

Report:  
TARGET INDUSTRY PROFILES



Presented to:  
SAN JOAQUIN PARTNERSHIP

[www.angeloueconomics.com](http://www.angeloueconomics.com)

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## Introduction

AngelouEconomics (AE) has conducted analysis of San Joaquin County's economic base to determine which industry sectors currently drive growth in the area. Additionally, we have examined and researched regional, national and global market and business trends for the purposes of making strategic recommendations for FUTURE Target Industries that the firm believes will work to produce economic prosperity and sustainable growth. The objective of this analysis is to determine those industries San Joaquin County should expand and should recruit based on its competitive advantages.

Traditionally, the economic growth of economies has been described in terms of the growth of a region's basic or primary industries. These industries typically export their goods or services outside the region, supporting ancillary industries such as retail, housing construction, and personal services. Increased competition and rapid gains in technology and productivity have altered the location requirements of many businesses. Any industry with growth potential is necessarily driven by cutting edge technology trends, and while an industry's ability to innovate will determine its future in the U.S., a community's ability to nurture that innovation will determine that community's success.

## Target Selection

Selection of target industries involves a combination of both quantitative and qualitative factors. The process begins by answering the following four questions:

- 1. Does the industry match community goals?** As mentioned above, innovation will be the key to a community's success in growing any industry. For that reason, the most important criterion is often whether or not the industry matches the stated economic goals of the community. Industries that seem to be a natural fit will struggle to succeed without the backing of the populace and its elected officials. Likewise, deficiencies in infrastructure can be overcome with zeal and a solid commitment by government to support businesses. Renewable energy, for example, is very popular in New Mexico. With support coming from residents, government, and industry, New Mexico can establish itself in this up-and-coming field.
- 2. Are there local assets that give industries a competitive edge?** Communities are as unique as people. Each one has strengths that companies can leverage to create competitive advantages. These strengths can include such things as workforce skills, tax structure, and climate. The challenge is to identify the key assets in the region. One of New Mexico's primary assets is its world-class reputation for research. Whole communities of scientists exist, creating a labor force unlike any other in the country. This is an obvious trait on which New Mexico can capitalize.
- 3. Is the industry growing locally or does it provide transitional opportunities?** Immediate and obvious candidates for targets are those that are experiencing growth within the community or surrounding communities. Food processing, for instance, was one of San Joaquin County's few growing manufacturing sectors over the past few years. However, there have been some changes in this industry, and will require an update for targeting purposes.

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4. **Does the region meet the minimum requirements for the industry?** When all is said and done, industries have minimum requirements that must be met in order to operate. With such a diverse state as California, there are bound to be regions of the state in which some industries work and some do not. In this case, food processing may actually be a poor fit for some areas of the state. Many manufacturing processes need massive amounts of water, and will not be viable in areas already experiencing water shortages.

Once criteria requirements are met for a target, the County was examined to see what might be their contribution to the industry. Contributions depend on factors such as workforce skills, infrastructure, and environmental assets. It should also be understood that as the target industries mature, industry roles might shift – which is to some degree what has happened with some of San Joaquin County's targets. Economic development is a fluid process.

## Cluster Analysis

Clusters are highly integrated groups of businesses with strong vertical and horizontal linkages. They categorize businesses by their final product and how these products are related to each other and integrated along the vertical supply chain.

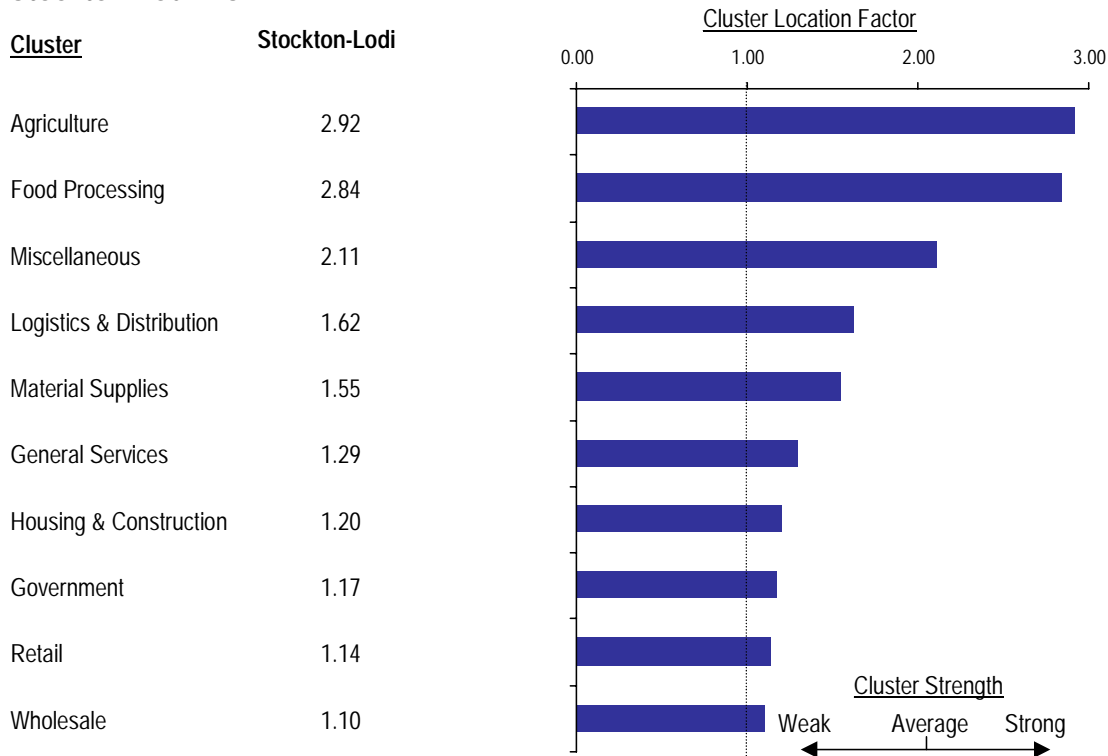
To assess the strength of a cluster in the regional economy, the location factors are calculated by comparing the cluster's share of total local employment to the cluster's national share. This location quotient will generally yield a value between 0 and 2, where 1.00 demonstrates an equal share percentage between the local and national economies. Cluster location factors greater than 2.00 indicate a strong cluster agglomeration, while those less than 0.50 indicate extremely weak clusters.

California and the San Joaquin County area have a relatively large labor force. For that reason, it is easy for a few clusters to dominate the cluster model's results. The following pages attempt to sort out that effect by analyzing industry development at the MSA and regional level as well as by looking at the industry's historical trends.

**San Joaquin's current strong clusters include (see below):**

- **Agriculture**
- **Food Processing**
- **Logistics & Distribution**
- **Materials Supplies**
- **General Services**
- **Housing & Construction**
- **Government**
- **Retail & Wholesale Trade**

## Cluster Distribution, 2003 Stockton-Lodi MSA



Source: Dun and Bradstreet; AngelouEconomics

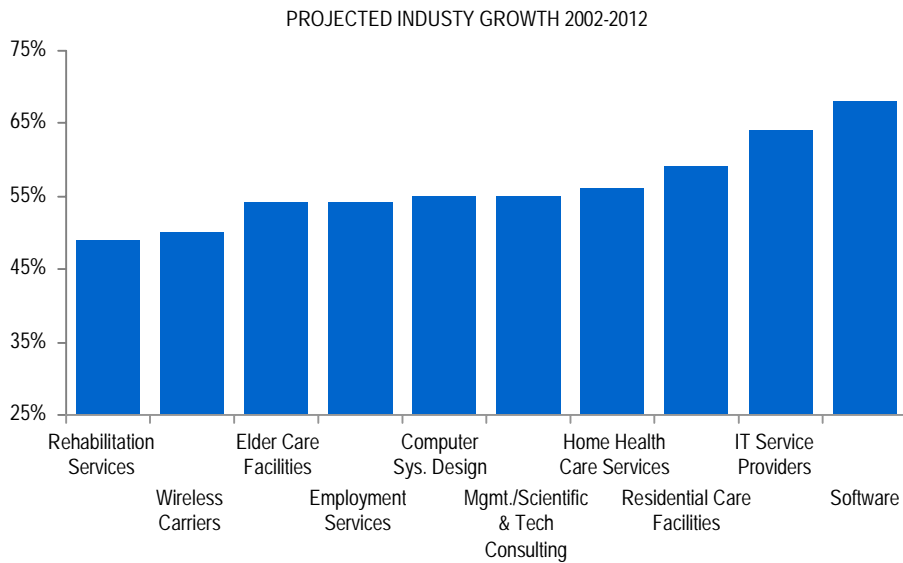
The Partnership has been working to secure businesses in some previously “defined” sectors; but there is a great deal of “combining” of industries into somewhat “ill-defined” target industries.

**At present, the San Joaquin Partnership is targeting:**

- **Electronics/Communication Technology (software, hardware manufacturing & assembly)**
- **Backroom Office/IT (incl: Call Centers & Fulfillment Centers)**
- **Food Processing**
- **Metals & Metal Fabrication**
- **Construction Materials**
- **Transportation/Logistics**

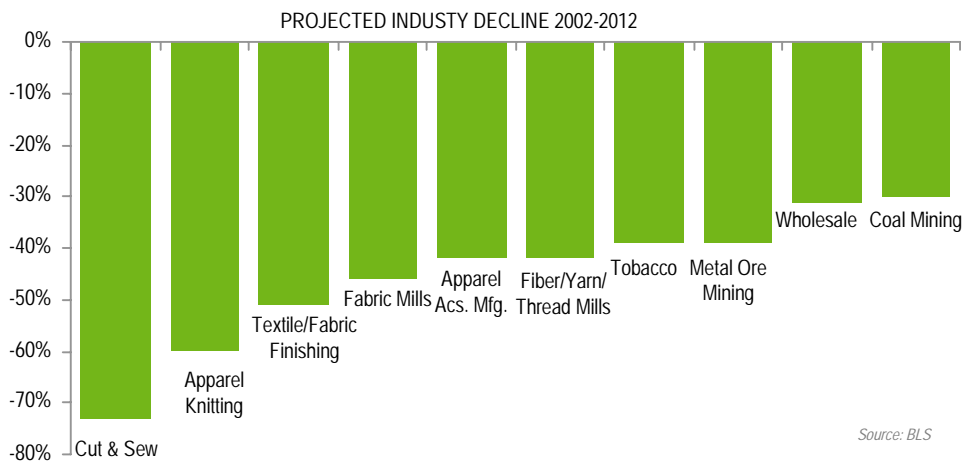
Several of these sectors have undergone enormous change in the last two years – several of these industries are, in fact, in declining industry segments – due to changing technologies, global implications, or consolidations, among other factors. The below graphic represents a “snapshot” of Growth & Declining Industries (only the first 12 industries per category). Future growth in the economy will be increasingly focused in the health and technology sectors, while traditional manufacturing will continue to see declines. This is important to the overall discussion as to strategy for moving a Target Industry marketing effort forward.

## U.S. INDUSTRY GROWTH



Source: BLS

## U.S. INDUSTRY DECLINE



Source: BLS

In this report, we profile the **new targets** that AngelouEconomics has determined offer new opportunities for growth and job creation for the county.

## Recommended Targets

After a general understanding is gained about local concentrations of San Joaquin County's industries, the industry list can be narrowed further to develop specific targets for the area. Besides being developed or developing locally, targets should also show national growth trends and fit the County's, as well as the State's, relative strengths.

$$\text{Target Potential} = \text{Developed Local Concentration} + \text{National Growth Trends} + \text{Complementary Strengths and Assets}$$

## Growth Potential

San Joaquin County has clusters with both strong and weak growth potential.

These industries, as well as several others, will be examined in more detail.

It will be important to identify not only those industries with projected prosperous and sustainable futures, but those that have strong futures in California and the County.

By way of example, the Semiconductor Industry provides thousands of jobs to California residents. However, much of the growth in the industry has been overseas. Additionally, Nanotechnology is a "replacement" technology to Semiconductors. This phenomenon coupled with China's growth as an industry leader, takes AE's focus away from this industry for San Joaquin County.

Biotech continues to be the hot topic in economic development circles these days. The "bio-speak" has actually increased in just the last six months due to VCs involvement again with the industry. However, they are adjusting their "interests" (i.e. funding) within the category. Biotech is also the most sought after target across the country. AE will examine and produce opportunities which will best fit San Joaquin County in this industry – we will work to create a "niche" for the County that is highly definable, and focused.



AE has selected targets for San Joaquin County taking into account: Existing Industry, Workforce Development, Education/Attainment, National & Global Market and Industry Trends, Forecasts for Growth & Declining Industries, Developing Technologies, as well as Regional and National Market & Consumer Demands.

### Target Industries

Target Industry	Role			Niches
	Mfg.	Prof Svcs	Research	
Value-Added Food Processing	x	x	x	Wine, Organics, Health/Snack, Nutritionals
Air Transportation	x	x	x	Avionics, Maintenance & Storage, MicroJets, Freight
Logistics & Distribution	x	x		Automotive OEM, Aftermarket
Medical Mfg & Supplies	x	x	x	Hospital, Home Care, Biometric/Laser
Agriculture Technologies	x	x	x	Fuels, Biotech, Horticulture, Fertilizers/Feeds
Clean Energy Technologies	x	x	x	Fuel Cell, Biomass, Waste, Solar, Wind

These targets do not preclude past targets, but rather create a list for go-forward marketing purposes. In review of the current target industries supported by SJP, it is noted that several are in a state of decline, or are in the process of realignment due to global trends in the marketplace. The recommendations herein are those for which efforts and resources should be targeted going forward. There will indeed continue to be opportunities in the current target industry sectors; but it is advised that these not be “pursued”, but rather managed per the outlook and recommendations presented.

Initial industry research has revealed a number of assets that make San Joaquin County a unique place for doing business. Many businesses continue to come to the area. And many production facilities throughout California are making use of cutting edge manufacturing techniques, increasing their longevity through the adoption of new technologies. However, there are numerous conditions creating difficulties for businesses and industry to compete on the West Coast. In review of these issues, and the assets of San Joaquin County, the target recommendations in this report are intended to be as specific as possible, while allowing for broad-based initiatives to be sustained by the Partnership. In other words, AngelouEconomics encourages the *local development of industry* through education and training-based initiatives, generated from research & development/entrepreneurial activity, for the creation of future jobs.

At this juncture, San Joaquin County cannot rely upon its existing assets and workforce for proliferation of business, industry and jobs. It must take its future into its own hands, with the focused and coordinated development of NEW industry through its own directive.

## TARGET ONE: LOGISTICS & DISTRIBUTION

### Industry Trends

Distribution includes all freight carriers (air, water, trucking, and intermodal) and warehousing. Until recently, most manufacturing firms took responsibility for the warehousing and coordination of their flow materials. More often now, these services are outsourced to develop an advanced just-in-time delivery system.

Virtually every product sold moves through the distribution industry, meaning that this industry touches roughly a third of the nation's GDP. The movement and storage of these goods is a \$260 billion industry and employs 4.2 million workers.

As the national economy slowed over the past few years, fewer goods were shipped throughout the country causing a sharp decline in demand for distribution services. Industry revenues and profits fell considerably during the downturn, but growth returned in 2003. Due to declining industry fortunes, national employment declined by 200,000 over the last three years. This cyclical effect has begun to reverse itself as U.S. producers increase their activity and consumer expenditures pick up.

### Distribution

**NAICS Definition**

- 484 Truck Transportation
- 4885 Freight Transportation Arrangement
- 488310 Port Facility Operation
- 488320 Marine Cargo Handling Services
- 493 Warehousing & Storage

**Industry Profile**

- \$260 billion in revenues
- 4.2 million employed - US

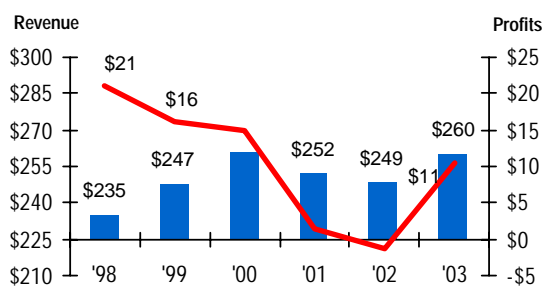
**Wage Rates**

- \$17 an hour in the US

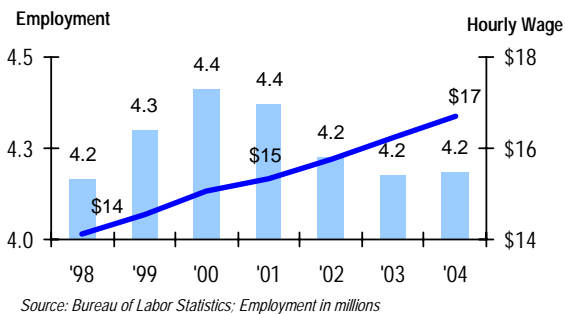
**Location Criteria**

- Transportation Infrastructure
- Affordable Land
- Large nearby market for goods
- No inventory tax

Transportation and Warehousing



Transportation and Warehousing



Another reason for the industry's recent decline is structural and is likely to be a long-term issue. The large traditional users of logistics and distribution are becoming an increasingly smaller part of the U.S. economy. Manufacturing, which uses almost a quarter of all transportation services, increased output by a mere 8% between

1996 and 2001. The two fastest growing sectors of the economy, construction and financial services, use relatively little transportation services. **These structural trends are expected to continue as the U.S. becomes more service-oriented. Growing a local distribution sector will be highly dependent on the health of local manufacturing or the market access to the greater region. As such, most goods are warehoused and shipped from their point of production or near the final destination.**

Share of Transportation Use and Growth in Output

Industry Title	% of Trans. Use	Growth in GDP '96-'01
All industries	100%	29%
Agriculture, forestry, and fishing	5%	8%
Mining	1%	23%
Construction	14%	52%
Manufacturing	24%	8%
Transportation	18%	26%
Communications and utilities	3%	36%
Wholesale and retail trade	14%	33%
Finance, insurance, and real estate	3%	45%
Services	17%	42%
Other	2%	10%

source: US Bureau of Economic Analysis

Overall revenues for the distribution industry are forecast to rise faster than GDP growth, and employment levels will as well grow faster than the overall economy. The fastest growing users of distribution services are expected to be aerospace and defense, industrial equipment, computer equipment, and consumer goods. As manufacturing becomes a smaller share of the national economy, the industry is expected to align more closely with the distribution of consumer goods at the regional destination.

### Location Requirements

*Workforce:* Distribution firms need a blue-collar workforce and manufacturing workers have proved to be excellent fits for the industry.

*Cost of Doing Business:* Distributors work in a competitive industry and are very concerned about operating costs. Areas with low taxes, competitive wages, affordable utilities, and available land are ideal.

*Market/Geography:* For distribution companies, their customers are consumers and private industry, and location is key. As many industries shift to just in time manufacturing, more distribution operations will be required to be within a certain driving distance to avoid complications. Access to regional manufacturing operations and large metropolitan areas is important.

*Structural:* Highway infrastructure is extremely important to distribution firms. Distribution firms require well-maintained, uncongested roads, and often rail access; and airport and port facilities further support this industry. Overnight carrier hub proximity is viewed favorably. There should also be ample transportation capacity and no signs of bottlenecks in the future. Distribution centers will seek out areas with forward thinking transportation planning.

*Research and Development:* Local research institutions do not affect the relocation of distribution firms.

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### **Target Niche Focus: Automotive Aftermarket**

The size of the US motor vehicle aftermarket grew by 3% in 2003 to \$244.6 billion. “More registered vehicles, more licensed drivers, more miles traveled and an aging of the vehicle fleet all helped expand the domestic aftermarket,” say Kathleen Schmatz, AAIA president and CEO. There are 4400 member companies and affiliates in the AAIA – the association represents more than 45,000 repair shops and parts stores.

San Joaquin currently enjoys an excellent position for distribution of aftermarket parts to support automotive maintenance facilities in major cities. San Joaquin currently has a BMW parts distribution facility and should pursue other manufacturers or parts distributors.

## TARGET TWO: MEDICAL MANUFACTURING & SUPPLIES

### Industry Overview

Health services include the traditional industry segments involving health care: doctor and dentist offices, assisted living facilities, hospitals, and clinics. Health services have been one of the fastest-growing industries in the United States in recent years. The U.S. health care market is estimated to be worth \$1.3 trillion annually and employs 12 million, after adding 2 million jobs through the 90s. The industry's employment is expected to grow 26 percent by 2010 and employ over 14 million. Specific sectors will see even higher growth: the home-based health care market will grow more than 61 percent by 2010. The country's aging population and rising standards of living have increased demand for health care services. The health services industry is relatively immune to market fluctuations. The elderly population, a group with greater than average health care needs, will grow faster than the total population through 2008, increasing demand, especially for home health care, private practice, and personal care.

### Health Services

#### NAICS Definition

- 621 Ambulatory Health Care Services
- 622 Hospitals
- 6222 Psychiatric and Substance Abuse Hospitals
- 6223 Specialty Hospitals
- 623 Nursing and Residential Care Facilities

#### Industry Employment

- 12 million employed - US

#### Wage Rates

- \$18 an hour in the US

#### Location Criteria

- Educated workforce
- Local Nursing Program
- Regional Healthcare Cluster
- Established medical sector

California's aging population will require increasing amounts of health services. Strong health services can be beneficial to community as well as to economic development.

While the health service industry in the U.S. has outpaced population growth by 2-3 times, biotechnology has grown at an even faster rate. Global sales of prescription drugs currently top \$300 billion with the U.S., Japan, and Europe accounting for 80 percent of all sales. According to the Bureau of Labor Statistics, drug manufacturing will add 75,000 jobs through 2010, a 2.2 percent average annual growth rate, while output will grow even faster at an average annual rate of 5.6 percent (in real terms). Medical equipment is expected to add another 50,000 jobs in the same time period, a growth rate of 1.6 percent. Additionally, research and testing facilities are expected to net an additional 244,000 jobs during the period from 2000-2010, growing at an annual rate of 3.3 percent. All told, biotechnology should add nearly 400,000 jobs nationwide by the end of the current decade.

The U.S. government, too, will demand biomedical products to support efforts to detect and protect against chemical and biological agents. Competition for biotech and biomedical firms will be fierce, as almost every major metro includes biotechnology among its list of target industries. The Brookings Institute reports that out of 77 local and 36 state economic development agencies surveyed, 83 percent list biotechnology as one of their top two target industries. Biotech and health services, however, will likely experience growth in all markets, creating opportunities for those communities that have prepared themselves. Successful communities will be those that excel in research and are able to turn that research into marketable products. Currently, most biotechnology clusters are located in the Northeast (New Jersey and Boston), the Research Triangle, and California. New contenders in recent years include Central Texas and Salt Lake City.

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### Location Requirements

*Workforce.* Attracting and retaining a quality work force is very important in the health care field. Workers tend to be highly mobile, willing to venture into a new community, but they are also easily swayed to leave. In an industry with high turnover, people tend to seek communities with numerous employment options. Additionally, there is a nationwide shortage of health care workers, making recruiting even more difficult.

*Cost of Doing Business.* An area's recurring cost structure is not of primary importance to medical companies.

*Research & Development.* Access to area research universities and medical centers can be important.

*Economic Conditions.* Medical firms seek locations in vibrant, well-educated communities. Firms also desire a growing population that is large enough to support work force needs in a growing industry.

### **Target Niche Focus: Hospital & Home Care Equipment Manufacturing & Supplies**

The U.S. health care services market, the world's largest, is worth about \$1.7 trillion, while the European market is worth about \$700 billion. The industry's challenge (i.e. opportunity) is the rising demand for services. People are living longer and need more care.

The rise and fall of long-term care centers in the U.S. is an example of the current "peril". Major healthcare firms that once built and bought nursing homes and opened home care and other specialized care units are now hurting. Taking care of patients is expensive. However, the landscape for senior care services and prescription drug benefits, alongside all other healthcare services, is expected to improve in the U.S.

Coupled with the population growth is an increase in the use of innovative medical technology for intensive diagnosis and treatment.

San Joaquin is strategically positioned to serve the growing demand for medical devices and supplies from its central location in California. In addition, growing workforce capabilities in nursing and diagnostics will assist in the growth of medical companies in the county.

### **Target Niche Focus: Laser Research and Technologies**

Laser technology has application across numerous trades and industries; this is why it is a highly attractive target for San Joaquin County. The technology and products are already being utilized throughout many of the companies in the area. Additionally, it has vocational technology components for which educational programming is easily produced.

Laser technology grows daily. Its current applications include: cutting, drilling, welding, marking, micro-machining, and solar cell cutting. The mediums on which it works include: metals, non-metals, ceramics, composites, plastics,

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rubber, and glass. As examples of use, laser drilling has been used in jet engines and angioplasty; and, laser optics are now being used by the defense department for human identification.

AE believes San Joaquin County can work to develop this through a cross-over strategy – for both existing businesses (ex: construction – using laser technology for parylene ablation, i.e. surface coatings), and developing industries (ex: laser optics in ophthalmology).

There are research dollars to be accessed for this technology, as well as corporations looking for application labs, and research and development for their specific needs (the trucking industry is the most recent example).

### **Target Niche Focus: Biometrics**

Biometrics is an automated method of recognizing a person based on a physiological or behavioral characteristic. Among the features measured are face, fingerprints, hand geometry, handwriting, iris, retinal, vein, and voice. Biometric technologies are becoming the foundation of an extensive array of highly secure identification and personal verification solutions. As the level of security breaches and transaction fraud increases, the need for highly secure identification and personal verification technologies is becoming apparent.

Biometric-based solutions are able to provide for confidential financial transactions and personal data privacy. The need for biometrics can be found in federal, state, and local governments, in the military, and in commercial applications. Enterprise-wide network security infrastructures, government IDs, secure electronic banking, investing and other financial transactions, retail sales, law enforcement, and health and social services are already benefiting from these technologies.

Biometric-based authentication applications include workstation, network, and domain access, single sign-on, application logon, data protection, remote access to resources, transaction security, and Web security. Trust in these electronic transactions is essential to the healthy growth of the global economy. Utilized alone or integrated with other technologies such as smart cards, encryption keys and digital signatures, biometrics are set to pervade nearly all aspects of the economy and our daily lives.

Utilizing biometrics for personal authentication is becoming convenient and considerably more accurate than current methods (such as the utilization of passwords or PINs). This is because biometrics links the event to a particular individual (a password or token may be used by someone other than the authorized user), is convenient (nothing to carry or remember), accurate (it provides for positive authentication), can provide an audit trail and is becoming socially acceptable and inexpensive.

San Joaquin County has the space available for testing, development, applications, and manufacturing facilities – potentially under one roof. The highest demand for biometrics is through the Department of Defense, and increasingly in Asia where many of the actual products utilizing the technology and components are being manufactured.

To our knowledge, there is no comprehensive center on the West Coast for development of these technologies and components. Regardless, the demand for biometrics will only grow – and with the technology centers of the Bay Area, and the applications in Asia, San Joaquin County is well-situated for exploitation of this opportunity.

## TARGET THREE: AIR TRANSPORTATION

### Industry Trends

Aircraft suppliers provide parts and machinery for aircraft assembly and maintenance. These parts include engines, interior components, avionics, and aircraft hardware such as landing gear. These suppliers are important for both the assembly and maintenance of aircraft. The aerospace industry's customers include the military, commercial airlines, and general aviation.

The industry has suffered in recent years due to falling orders for new aircraft, but growth is expected to return in 2004. Aerospace industry employment fell for the fifth consecutive year shedding over 40,000 jobs in 2003 to end the year with 575,000 employees. A slight rebound in sales of 1% in 2004 will bring the civilian and military aircraft total to \$148 billion according to the Aerospace Industries Association (AIA). The government is the largest customer segment of the aerospace industry (about 60% of all sales), and increased sales to the Pentagon are offsetting declines in the commercial aircraft market. Civilian aircraft sales fell sharply following September 11, 2001. Pent up demand and a growing economy will lift civil aircraft sales over the next two years. From 1998-2003, Missiles was the fastest growing segment. The aerospace industry offers some of the highest salaries in the manufacturing sector. The Commission on the Future of the U.S. Aerospace Industry reports that aircraft and parts manufacturing workers earned an average annual salary of \$57,000 in 2002.

The leading geographic centers of aircraft and parts manufacturing in the U.S. are Washington, California, Kansas, Texas, and Connecticut.

*We focus on the civilian aircraft sector for San Joaquin's target industry.*

### Aircraft Manufacturing

#### Cluster Definition

- 336411 Aircraft manufacturing
- 336412 Aircraft Engine and Parts Manufacturing
- 336413 Parts and Auxiliary Equip. Manufacturing
- 488190 Aircraft maintenance and repair services
- 811219 Precision Equip. Maintenance
- 811310 Commercial Machinery Maintenance

#### Industry Profile

- \$148 billion sales
- 575,000 employed

#### Wage Rates

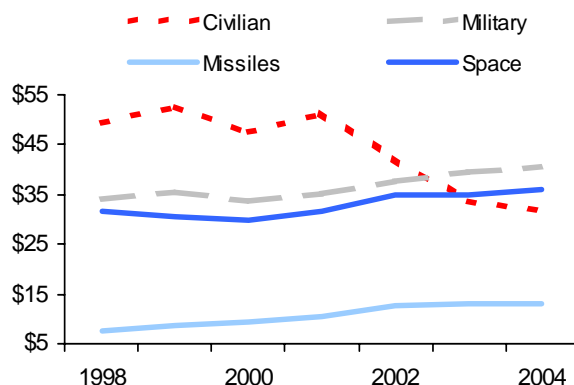
- \$57,000 avg. salary
- \$24 an hour in the US

#### Location Criteria

- Large area airport or military airbase
- Manufacturing non-union workforce
- Proximity to good technical training institutions
- Strong aircraft OEM and suppliers
- Temperate weather for testing

### Aerospace Industry Sales

In Billions of Dollars



Source: Dept. of Defense, NASA, Dept. of Commerce, Aerospace Industries Assn.

## Civilian Aircraft

Civilian Aircraft sales account for nearly one quarter of the U.S. aerospace industry. AIA President John Douglass predicts a recovery of civilian aviation by 2006. Commercial jetliner sales declined \$7 billion last year. The civilian jetliner market is split nearly 50-50 between Boeing and Europe's Airbus. Both companies expect to deliver a combined 570 aircraft in 2004. Meanwhile, Boeing is introducing its 200-seat **7E7**, its first new airliner in ten years. The 7E7 is expected to enter service in 2008. An emerging bright spot is civilian helicopters whose sales doubled to \$348 million.

Civilian Aircraft Growth Sectors
Light Jets
Helicopters
Maintenance Repair, and Overhaul (MRO)
Software
Cargo aircraft

Another bright spot in the industry is the **maintenance, repair, and overhaul (MRO)** segment. The nearly \$40 billion (MRO) landscape is also evolving rapidly, and is **expected to grow by \$11 billion** over the next 5 years. MRO consists of independent service providers; airline technical services departments, and OEMs. All are vying for market share, while commercial air travel levels are down. Airlines are striving to avoid large capital outlays for new aircraft purchases through improved maintenance and repair of their existing fleet. Civilian carriers and cargo companies are outsourcing their maintenance and repair. Revenues for MRO organizations are expected to grow over 5% per year over the next 3 years.

## Target Niche Focus: Avionics, Aircraft Maintenance & Storage, Microjets, Air Freight

AngelouEconomics recognizes the County as one ideal for transportation and logistics – this brings additional opportunities in this segment by delving into the equipment and technologies to support it, as well as grow it. Specifically, AE believes the County should focus on aviation, and related segments for aviation parts, manufacturing and technology.

### AVIONICS

Today's complex, high performance avionics systems require a variety of integrated circuits. Modern avionics systems may use common integrated processors to manage multiple avionics functions including mission management, sensor control, sensor tasking, track fusion, fire control, integrated navigation, flight-path management, diagnostics management and pilot-vehicle interface. Avionics technicians install, inspect, test, adjust, or repair avionics equipment, such as radar, radio, navigation, and missile control systems in aircraft or space vehicles.

### MICROJETS

There is an increase in demand for "personal" jets, or "micro" jets, as well – this is being driven by dissatisfaction among business travelers with large airports, increased security concerns and the need for efficient, affordable travel.

Regional jets, particularly their engines and components, are emerging as a major growth driver in the commercial transport MRO market. According to the fleet database compiled by New Haven, Conn.-based BACK Aviation Solutions, regional jets accounted for just 4% of the world commercial jet fleet in January

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1994, with 338 units. This grew to 2,058, or 13%, by January 2004. BACK predicts that by 2014, the number of regional jets will reach 3,847, or 24% of a total worldwide jet fleet of 16,030. In fact, some 70% of that growth is expected to happen between now and 2009, when the regional jet share of the world fleet will have reached 23%.

Projecting a \$4.8 billion expansion of the worldwide MRO market to \$41.8 billion by 2009, BACK believes that regional jets will account for \$2.62 billion, or 55% of the market growth. This will surpass conventional narrowbody and widebody transports, which will respectively account for 34% (\$1.64 billion) and 11% (\$540 million).

All of this points to potential opportunities for operators of both independent and airline-owned MRO facilities willing to invest in the tooling and expertise needed to maintain the growing fleet of regional jets, not to mention the remaining turboprops, which will continue to operate in some niche markets.

## MAINTENANCE/STORAGE

The global MRO business is showing signs of strengthening with airlines slowly adding capacity as maintenance providers seek strategic partnerships with carriers and original equipment manufacturers to position themselves for long-term viability.

According to an MRO forecast recently compiled by BACK Aviation Solutions and Strand Associates Inc., during the next five years the value of the commercial jet transport MRO market will increase nearly 13% to \$41 billion from \$37 billion this year. During the next 10 years, the two MRO consulting companies project an overall growth gain of more than 32%, or about 2.9% annually for the period.

Despite entering the third year of an airline downturn that has adversely affected the MRO business, a number of MRO company officials are optimistic that the worst may be over. August W. Henningsen, chairman of the executive board at Lufthansa Technik, says global demand for MRO is still suppressed, but conditions in 2004 could improve compared with 2003. "There are positive signs in the marketplace," and demand is rising slightly, but Henningsen does not see any significant changes in the near future.

According to PAMA, the U.S. aviation industry must do more to attract young people to consider a career as a mechanic, but little is being done to present aircraft maintenance as a career choice, and the industry has a poor track record of supporting and evangelizing its cause

Two business aviation industry forecasts – Honeywell Aerospace's 12th Annual Business Aviation Outlook and Rolls-Royce's The Market for Business Jets, 2003-2022 – project continuing demand for new business aircraft. The Honeywell forecast predicts that customers will accept approximately 7,700 units valued at \$115 billion between 2003 and 2013, while Rolls-Royce forecasts that 13,948 new aircraft will be delivered between 2003 and 2022.

Both Honeywell and Rolls-Royce believe that the market will begin a sustained expansion in 2005. Honeywell's 2003 survey revealed that more operators plan to purchase new aircraft over the next five years than the company's 2002 poll indicated. The key drivers in the growth of business aviation include:

- A growing economy – rising stock markets and corporate profits.
- A deteriorating airline environment – fewer commercial flights and first-class seats.

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- New aircraft models – new-generation designs will offer capabilities and efficiencies previously unavailable, including very light jets, a whole new class of airplane.
  - Regulations and retirement of aging aircraft – more stringent operating rules will make older aircraft obsolete.
  - The continuing popularity of fractional aircraft ownership programs.

The popularity of business aircraft has increased as more companies realize the efficiency and productivity of this powerful business tool. The number of companies operating business aircraft in the United States has grown more than 60 percent from 6,584 companies operating 9,504 aircraft in 1991 to 10,661 companies operating 15,879 aircraft in 2003. During 2003, 14,555 operators flew 23,121 turbine-powered business aircraft worldwide. More than 75 percent of the operators (10,982) and 72 percent of the aircraft (16,650) were located in North America. Europe was home to the second largest concentration of operators (1,255) and aircraft (2,378), while South America ranked third in both categories, with 979 operators and 1,533 aircraft. The remaining 9 percent of the operators and 11 percent of the aircraft were scattered throughout Africa, Asia, Central America, the Middle East and Oceania (which includes Australia and the Pacific islands).

A growing option for business aircraft operators is fractional ownership, in which companies or individuals own a fraction of an aircraft and receive management and pilot services associated with the aircraft's operation. Fractional ownership continues to be a major contributor to the growth of business aviation because it extends the benefits of business flying to new customers. Fractional aircraft programs have grown dramatically in less than 20 years since the concept was introduced. In 1986, there were three owners of fractionally held aircraft. By 1993, there were 110. From 2000 to 2004, the number of companies and individuals using fractional ownership grew by 62 percent, from 3,834 to 6,217 shares.

The ability to use smaller, less-congested airports located closer to one's final destination is a vital part of the utility and flexibility of general aviation aircraft. In fact, most operators of business aircraft prefer to use these so-called "reliever airports" in major metropolitan areas instead of airline hubs whenever possible. That is why general aviation operations at the busiest U.S. air carrier airports are usually a single-digit percentage of total operations at those aviation facilities.

Business aircraft operations in the New York City area are a good example of this phenomenon. At New York's major commercial service airports – Newark, LaGuardia and Kennedy – general aviation comprises only about 3 percent of the total operations because most business aircraft operators utilize alternative airports – Teterboro or Morristown in New Jersey or Westchester County and Islip in New York.

A closer examination of 32 S&P 500 companies commencing business aircraft operations after 1995's brief economic slowdown revealed that, on a return to shareholder basis, new business aircraft operators returned 343 percent to their shareholders between 1995 and 1999, versus 177 percent for nonoperators. Moreover, the new operator group, which lagged behind nonoperator return on equity (ROE) growth prior to 1995, surpassed nonoperators thereafter, increasing ROE by 3.6 percent overall.

Interviews of CFOs and other financial executives of the S&P 500 peer groups found a strong correlation between benefits and success drivers. Senior executives in operator organizations can visit hundreds of locations (their own facilities or those of customers/ suppliers) in a year because of the flexibility inherent in being able to control aircraft schedules and routes. In some cases, executives said they visit four or five

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sites in one day, reviewing operations, efficiency, quality and customer service. Also, the use of employee shuttles can help a company save time and reduce costs, while enabling cost-effective growth.

## **AFTERMARKET**

There is an “aftermarket” in aviation, as well as automotive. Several companies have recently announced expansions in working to service the needs in maintenance, modification, and modernization of existing, aging fleets.

There is an increase in demand for “personal” jets, or “micro” jets, as well – this is being driven by dissatisfaction among business travelers with large airports, increased security concerns and the need for efficient, affordable travel.

## **Review of San Joaquin Local Assets for Aviation**

San Joaquin offers four big assets important to distribution: The Port, The Stockton Airport, transportation access, low cost land, and a competitive workforce.

- The Port is a key economic driver. The Port of Stockton connects San Joaquin with international trade.
- Geographic location is one of the region’s strongest assets for distribution. Located on the west coast with access to the Pacific Rim and South America, the Port of Stockton is in an ideal location for international trade. A strong intermodal system allows quick and easy transportation to the western U.S. and beyond.
- The region is surrounded by a wide variety of industries including: automotive, agricultural equipment, machinery, food processing, metalworking, and electrical equipment. Numerous local, regional, and national freight carriers ensure a wide selection of less-than-truckload carriers. This centralized location coupled with excellent highway access gives potential suppliers a competitive advantage in lead times crucial for just-in-time manufacturing.
- Transportation access into San Joaquin is excellent. A highly accessible highway transportation system links San Joaquin County to the major California urban markets. San Joaquin County is a major Northern California distribution point where two primary north-south highways, Interstate 5 and Highway 99, meet and are joined by the Stockton Cross-town Freeway and Highway 120 through Manteca. Interstate 5 is the main north-south route for freight movement along the west coast from Canada to Mexico. Highway 99 is the main inland route through California connecting major cities in the San Joaquin Valley.
- Stockton Airport has one of the longest runways in the region and the largest refrigerated warehouse on airport property in North America. It is an ideal facility for specialized crops and horticulture that are temperature sensitive and need quick distribution.
- The workforce is also a plus for the region. There is an ample pool of workers that when trained, will be a huge asset for the community.

## TARGET FOUR: VALUE ADDED FOOD PROCESSING

### Industry Trends

The food processing industry includes establishments that manufacture or process food and beverages as well as related products such as chewing gum, manufactured ice, and vegetable and animal fats and oils. The food processing industry is the link between the agricultural and retail sectors. Raw fruits, vegetables, grains, meats, and dairy products are processed in the plants and then sold to retailers or wholesalers, who then pass these finished products along to the consumer.

Production and distribution of food and beverages account for over **one-sixth of the nation's industrial output**. The largest concentration of food processing employment in the U.S. is in meat production, employing 30 percent of the total workforce. Bakery goods and preserved fruits production employ an additional 25 percent.

Industry revenue growth slowed considerably during the economic downturn and in order to maintain profitability firms slashed payrolls. Employment fell 3.8% from 2000 to 2004, and the job losses continue albeit at a slower pace.

Demand for food products is expected to grow as niches such as specialty foods, ethnic foods, and pre-packaged foods make their way to the dinner table more frequently. New plants are more automated, transforming a traditionally labor intensive industry to a more automated one. Jobs will be lost but will be offset by an increase in higher skilled, higher wage jobs.

Employment is expected to stabilize as **two-thirds of companies surveyed by Food Processing Magazine expect to increase hiring this year**. While the food processing industry will continue to experience growth as the U.S. population expands, changes in preferences and technologies will affect the shape of the industry.

**Hispanic, Asian and other ethnic foods should provide growth opportunities** for food producers, as the U.S. Hispanic population is expected to swell to 43 million by 2010 and ethnic foods are gaining widespread acceptance. Nationally, tortilla sales have grown steadily by just under 10 percent a year and are expected to hit \$6.1 billion in 2004 according to the Tortilla Industry Association. Tortillas account for 32% of the market for all types of bread

### Food Processing

#### NAICS Definition

- 311 Food Manufacturing
- 3111 Animal Food Manufacturing
- 311211 Corn Manufacturing
- 31191 Snack Food Manufacturing
- 31141 Frozen Food Manufacturing

#### Industry Profile

- \$260 billion in revenues
- 1.4 million employed - US

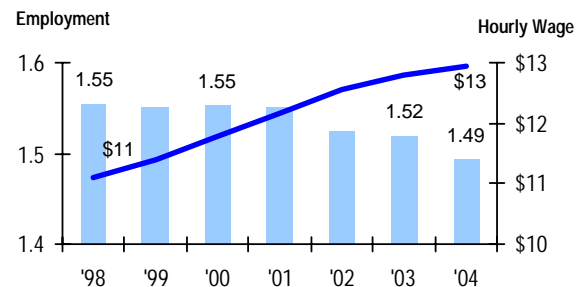
#### Wage Rates

- \$13 an hour in the US

#### Location Criteria

- Transportation infrastructure
- Low cost of doing business
- Large nearby market for goods
- Agriculture base

### Food Processing



Source: Bureau of Labor Statistics: Employment in millions

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compared to 34% for white bread. Wrap sandwiches are an example of the cross over of ethnic foods to the mainstream.

The popularity of **low-carbohydrate diets** is changing the content and marketing of **packaged foods**. Pushed by the popular Atkins' diet, an estimated 17 million Americans are on a formal low-carbohydrate diet, and another 42 million are reported to be reducing the intake of carbs. This trend is increasing demand for low-carb packaged snacks and foods. **Pastas, prepared foods, sauces and seasonings are other high growth segments.**

**Health foods are gaining ground**, as new food products such as nutraceuticals blend herbs and natural compounds to treat ailments such as high cholesterol. According to the GAO, Americans spend over \$16 billion per year on functional foods or under 4% of total annual expenditures on foods eaten at home, slightly more than expenditures on dietary supplements (\$14.7 billion) and over twice as much as expenditures on organic foods (\$7.7 billion).

**Technology is increasingly important to the food industry.** Traceability systems provide efficient ways to produce, assemble, warehouse, and distribute products. Examples include electronic coding systems and radio-frequency identification systems, which help streamline distribution. New tagging technologies will soon be able to ensure that products are untampered, delivered on time, and temperature-maintained throughout distribution.

**Efficient distribution of food products has grown in importance**, as more food is being manufactured far from where it is ultimately consumed. During 2000, American companies spent an estimated \$1.6 trillion on supply-related activities, including the movement, storage, and control of products. Food processors typically face thin profit margins so cutting costs throughout the supply chain is important.

#### Location Requirements

*Workforce:* Food processors require a well-trained blue-collar workforce with significant amounts of degreed engineers and food scientists. Labor is a large component of the cost of production, and food producers generally seek locations with a low cost workforce.

*Cost of Doing Business:* Food processing is a very low margin industry and profits are being squeezed from many directions, so area costs are very important. Much of the industry is migrating from high cost areas in the Northeast to the Midwest and South to increase profitability. In addition to wage rates, local tax structures, cost of real estate, cost of natural gas, and cost of electricity will be top concerns.

*Market/Geography:* For food processing companies, their customers are households and location is important. Access to regional distribution networks, agricultural inputs, and a large population base is important. Packaged food producers are less constrained by geography.

*Structural:* Infrastructure is extremely important to food processors. The industry requires well maintained, uncongested roads, rail access, and airport and port facilities are desired. There should also be ample water and wastewater capacity, as many industry firms will require extremely large amounts of meet FDA requirements for facility cleanliness.

*Research and Development:* Local research capabilities generally do not affect established food producers. Some new entrants can create foods or use agricultural products that rely on university research.

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### **Target Niche Focus: Organics, Health/Snack Foods, Nutritional Supplements**

This is a growing industry – as the population grows so too does food consumption. The “specialty” and “health” segments are the fastest growing segments and also represent high-dollar opportunities in this other commodity-driven industry.

Furthermore, the health foods segment works well with the major industry target for San Joaquin: Medical. There are potentially a number of cross-over opportunities for research and development, meeting the needs of general consumers, and the aging population – all health-based.

San Joaquin County should embrace its agricultural heritage and its vast amount of assets in the food processing industry, and take it to its “next level”, particularly in the “health” segment. This growth is not a “fad”, it is a trend.

### **Target Niche Focus: Wine**

Clearly this is a growing opportunity for the area. Lodi has truly begun to “come into its own”, including increased recognition of it as being a “destination” for wine lovers. The growth of this industry lends itself to opportunities in: packaging, printing, bottling/glass, corrugated, packing/warehousing/distribution, and other such segments of a consumer products economy.

Consideration should be given to the other added-value foods and targets for the development of suppliers and manufacturers that will meet cross-over needs in the consumer goods/packaged foods industry segment (as above).

The immediate focus and emphasis should be with tourism. SJP should work diligently to support and build this industry.

### **Target Niche Focus: Goat Dairy**

Preliminary research has indicated that the conversion of Cattle Dairy farms to Goat Dairy farms is not an expensive process. The Goat Dairy products today have significantly higher “return”, as they are perceived to be high-end products: chevre, goat milk, butters, etc. This is something to explore with the state – they have helped two (known) area farmers with this process.

### **Review of San Joaquin Local Assets in Food Processing**

San Joaquin is a large agriculture center and currently has the largest refrigerated warehouse on airport property in North America. With its strategic location, San Joaquin provides good access to both agricultural inputs and consumer markets. The region has a strong and diverse transportation system with excellent highway and rail access as well as air and waterways. San Joaquin can take specific steps to enhance its Food Processing cluster:

- Convey key selling points through targeted marketing campaign.
- Establish an organic food incubator. Organized as a cooperative venture in specialty foods by farmers’ cooperatives or local colleges, the incubator could help provide the training necessary to begin a specialty food enterprise.
- Coordinate closely with the universities and agriculture extension offices.
- Explore healthy food niches. Assistance is available in solving problems of technology, quality control, and marketing through research and technical testing agreements.

## TARGET FIVE: AGRICULTURE TECHNOLOGIES

### Industry Overview

Agricultural technologies include high value added components of the agriculture industry, such as farm equipment manufacturing and research, ancillary manufacturing industries, agricultural biotech, and production of agriculture-based products.

In 2001, factory shipments of farm equipment from original equipment manufacturers totaled \$6.2 billion. Of that total, harvest machinery and parts accounted for \$2.1 billion; planting, seeding, and fertilizing machinery, \$986.2 million; haying machinery, \$804.8 million; farm dairy machines, sprayers, dusters, elevators, and farm blowers, \$787.9 million; and plows, harrows, rollers, pulverizers, cultivators, and weeders, \$515.9 million. Commercial equipment for grounds and turf care generated \$2.0 billion.

After suffering through ups and downs in the market during the 1990s, the new decade brought its own set of challenges for the industry. Factors affecting the overall U.S. economy also play a significant role in the organization of this industry. Globalization and consolidation have allowed industry leaders to maintain growth or minimize losses in a poor domestic market.

Forecasting to 2005, the U.S. Department of Labor saw positive signs for the agricultural equipment industry, noting that farmers had generally recovered from the losses and excessive debts incurred during the 1980s and 1990s. Farmers were expected to replace machinery that they had been unable to replace when times were hardest, and to invest in new machinery, taking advantage of improvements brought about by advanced technology.

### Agricultural Technologies

**NAICS Definition**

- 325190 Ethanol Manufacturing - Wet Mill
- 33311 Agricultural Implement Manufacturing
- 333111 Farm Equipment Manufacturing
- 33312 Construction Machinery Manufacturing
- 333294 Food Product Machinery Manufacturing

**Industry Profile**

- \$18 billion in revenues
- 200,000 employed - US

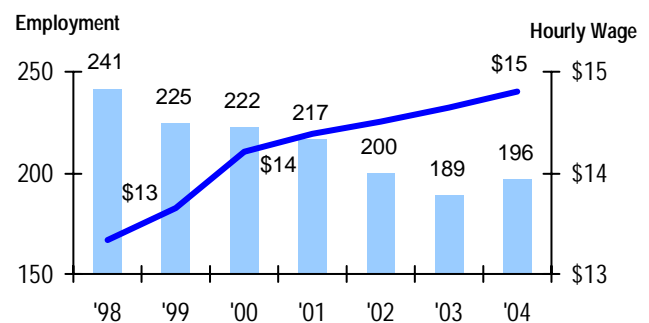
**Wage Rates**

- \$15 an hour in the US

**Location Criteria**

- Transportation infrastructure
- Low cost of doing business
- Existing manufacturing base
- Agriculture base

### Agricultural Machinery Manufacturing



Source: Bureau of Labor Statistics; Employment in thousands

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## **Niche Target Focus: AgBiotech**

There is a great deal of national and international attention being placed on this segment – there is also a great deal of money being invested in technologies and products related. AngelouEconomics believes strongly that this will be a good target Industry for San Joaquin – with development of specific strategies in several sectors:

1. **Renewable fuels** – San Joaquin should attempt to develop a large-scale alternative fuel production facility. A 40-million gallon ethanol plant (new plants range from 40 million to 100 million) would only employ 40 workers, but could have a much larger local economic impact according to the Renewable Fuels Association. Plant construction is typically in the \$150 million range and corn prices typically increase 10 cents a bushel in the region surrounding a new plant. State and local tax receipts will increase by over \$1 million annually.

Other types of renewable fuel plants may be possibilities as well. Soy diesel and bio diesel will continue to grow in importance as the U.S. seeks to reduce dependency on foreign oil and reduce fossil fuel emissions. More than 400 major fleets use bio diesel commercially nationwide. About 300 retail filling stations make bio diesel available to the public, and more than 1,000 petroleum distributors carry it nationwide. Biomass or agricultural waste is also capable of being converted into fuels, electricity, and fertilizers.

2. **Renewable materials** -- The Federal Government as well as private industry are pushing for increased use of renewable materials such as plant-derived plastics. Companies, under pressure from consumers to demonstrate a commitment to the environment while seeking innovative methods to improve performance and cut costs are turning to “Green products.” Renewable products benefit from the rapidly rising price of steel and petroleum and need to reduce environmental impact.

The United Soybean Board has identified five primary target areas that hold great potential for soy-based products: adhesives, which primarily involves wood adhesives; coatings and printing inks, including solvent and water-based products; lubricants, from engine oils to railway lubricants; plastics, particularly rigid and flexible polyurethanes; and specialty products, which can include paint strippers, cosmetics, industrial cleaners and hand lotions. Corn and soybean resin adds strength, flexibility, corrosion resistance, and endurance to the panels, while weighing 25 percent less than steel. Soybean-based resin performance has improved and is able to partially replace petroleum chemicals in industrial grade resins.

Other renewable materials are also available. Switch grass for example, is now being used as fiber reinforcement for plastics as well as boiler fuel. In Europe, switch grass is used in injection molding. Kenaf is a natural fiber that is an alternative to fiberglass. It is safer to produce and biodegradable. As construction continues to boom and traditional building materials become scarce, renewable building materials will continue to grow in acceptance and will eventually become mainstream.

Bio-based polymers have become attractive to manufacturers recently due to their environmental profile. Unlike plastics made from petroleum, biopolymers made from fermented cornstarch are biodegradable and do not emit toxic fumes when incinerated. Biopolymer products also can be recycled.

3. **Agricultural technologies** -- Agricultural technologies improve productivity for producing, harvesting, storing, processing and distributing basic food, feed, and fiber supplies. Increasingly companies will add precision and “intelligence” to these technologies by combining sensors (including biosensors) with

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computers, controllers, artificial intelligence, GPS, and vision systems. These technologies will optimize efficiency, sustainability, and reliability of the food supply while assuring the safety and health of workers, the public, and the environment. Some other productivity enhancing technologies include: environmental controllers, precision agriculture utilizing GPS, yield monitors, remote sensing and variable-rate technology and computerized field equipment. Services such as sales, customer service, technical support, training, management, planning, market and product research will also be needed.

4. **Horticulture** – This industry segment continues to grow each year. A great opportunity for San Joaquin County was developed due to an existing asset: the largest refrigerated facility on the West Coast. While this particular unit is near capacity, the need for refrigeration on the West Coast is substantial.

One of the industries with this primary need, is horticulture. The floral business is big business, as is its importation. A great number of floral imports come from Hawaii and South America. The largest import areas for floral are in Southern California, and until recently, Florida. However, the Florida importer and distributor has recently filed bankruptcy, as has the private air carrier for those goods. There is a perceived “hole” in the industry at this moment, and San Joaquin County should approach the possible opportunity.

5. **Fertilizer/Feed** – This is currently one of the largest product categories being exported at the Stockton Port. It is anticipated that the demand for such product will only grow, particularly to the Pacific Rim. Additionally, the agbiotech efforts – both in the County and otherwise – will continue to create new products for these purposes, with a rebound in agriculture through technological improvements.

San Joaquin can do several things to assist the development of its agriculture technologies cluster. Strong relations with the California Department of Food and Agriculture will be required. Investigate applications for alternate uses for farm product refusals. Some of these products will be valuable in building materials. San Joaquin should coordinate with research efforts at UC campuses and offer its central, agriculture location as one opportunity for pilot projects. Help local growers find new value added opportunities for existing products. Explore whether products are sent elsewhere for further processing, and work to relocate those operations back. Attend trade shows both domestically and overseas to understand the industry and build networking contacts for your local businesses.

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### Location Requirements for BioFuel Facilities

*Market:* Bio fuel facilities need to be near agriculture inputs and tend to locate in rural areas. Ag tech companies need to be close to farms.

*Structural Assets:* Bio fuel producers will locate near the industry's base of production. Firms will need excellent distribution assets including specialized train and barge distribution centers.

*Work force:* Bio fuel and biomaterial plants do not employ large amounts of people and the local labor force is not typically an issue. Employees will include engineers and production workers.

*Cost of Doing Business:* New facilities need large, affordable land tracts, typically at least 100 acres, and desire low property taxes.

*R&D:* Local or regional research can be important to fostering industry development. The manufacturing process is still maturing but new techniques are needed to advance the profitability of the industry.

## TARGET FIVE: CLEAN ENERGY TECHNOLOGIES

### Industry Trends

Clean energy is defined as technologies that reduce the environmental impact of energy generation. AngelouEconomics considers solar, geothermal, wind, clean coal, biomass, and fuel cells all to be clean energy technologies.

The energy industry is undergoing rapid change and has become truly multi-faceted. Traditional fossil fuel extraction and production is as important as ever and new technologies are changing the way natural resources are utilized. At the same time, dwindling domestic resources, rising consumption, uncertain international energy supplies, and environmental concerns have forced the United States and others to develop sources of renewable energy production. The entire U.S. economy depends on having reliable, affordable energy. Clean energy generation can help meet domestic needs in a responsible manner.

Total energy industry revenues (traditional and clean) were \$148 billion in 2004 and clean energy made up 9% of total energy revenues. Clean energy is the fastest growing segment of the energy industry, with revenues in its three main segments (solar, wind, and fuel cells) expected to increase from \$13 billion to \$92 billion over the next decade.

Much of the industry's research is extremely high-risk and could take decades to reach commercialization. The majority of this research takes place in federal labs tasked with clean energy research. These labs are located in a handful of states, including California, Colorado, and New Mexico. Industry firms in need of outside expertise, access to research facilities, and a potential workforce will cluster around these labs.

Energy is a long-term growth industry. As the American economy continues to grow, energy consumption will rise. The U.S. population expansion is contributing to increased energy use as well; energy consumption per capita is expected to rise 13.6% by 2013. Unfortunately, the U.S. lacks the domestic resources to meet projected demand. Therefore, the country's energy needs are increasingly met by imports. As demand outgrows supply, prices will rise for both oil and natural gas, in turn leading to increases in energy prices.

Fossil fuels currently account for 81% of domestic production and all of the country's imports. Nuclear generation accounts for 11% and renewable/clean sources of energy account for

### Clean Energy

#### NAICS Definition

22111 Electric Power Generation  
 334413 Semiconductor related Mftg  
 3355999 Electrical Equipment Mftg  
 541380 Testing Laboratories  
 5417 Scientific R&D

#### Industry Employment

575,000 employed - US

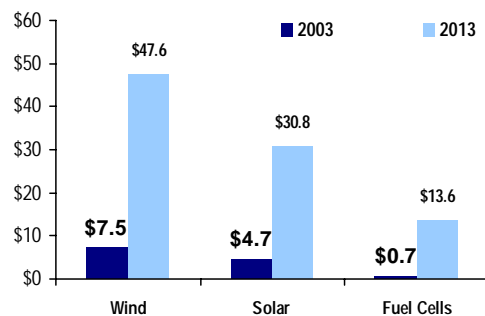
#### Wage Rates

High

#### Location Criteria

Educated workforce  
 Access to capital  
 Research institutions  
 Temperate weather for testing

### CLEAN ENERGY PROJECTED GROWTH



Source: Clean Edge; In billions

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8% of U.S. production. Hydroelectric power accounts for the bulk of this U.S. clean energy production. Fractional amounts come from solar, wind, and geothermal generation.

Renewable or clean energy has risen as a solution to many of our energy supply problems. Clean energy is widely available domestically and falling costs have made many technologies feasible today. True to its name, clean energy has a negligible environmental impact when compared to coal and other fossil fuels.

Clean energy products increase energy and natural resource efficiency while reducing the environmental impact of further development. Clean technologies such as energy-efficient appliances, alternative fuel cars, and advanced steel production reduce energy and natural resource consumption. These technologies also lessen the energy needs of companies and dependence on foreign sources of energy. Additional benefits of these technologies are improved environmental quality, better quality of life, and long-term economic growth.

The most promising clean energy applications include fuel cells, biomass, wind power, and solar energy.

**Fuel Cell** technology began with its use in the Apollo Space Program. Fuel Cells are electrochemical devices that combine hydrogen and oxygen to generate electricity, heat, and water without combustion or harmful emissions.

The current U.S. market for fuel cells is estimated to be over a \$700 million and is expected to grow to nearly \$14 billion by the next decade. The advantages of fuel cells are near zero emissions, few moving parts, and the ability to generate electricity at remote locations without transmission lines.

Applications for fuels cells are classified in three categories: stationary power, transportation, and portable applications. Stationary power applications include power for residential and commercial buildings. Fuel cells can provide power on site without the need for transmission lines, which is important for remote sites. Transportation applications vary from wheel chairs, golf carts, cars, vans, to buses. Fuel cell technology is being tested by every major automaker worldwide. The technology will first be introduced by large fleet vehicles such as buses and will spread to smaller vehicles as the fueling infrastructure further develops. Portable applications include electronic devices such as laptop computers, cell phones, cameras, and generators.

The outlook for fuel cells is bright. Presently, the barrier to commercialization is the manufacturing costs. It is estimated that some 4,000 companies worldwide are developing fuel cell applications. Automakers, governments, and other industries have invested at least \$7 billion over the last decade in fuel cell applications. The U.S. Department of Energy estimates that fuel cell development could add up to 750,000 jobs to the U.S. economy by 2030.

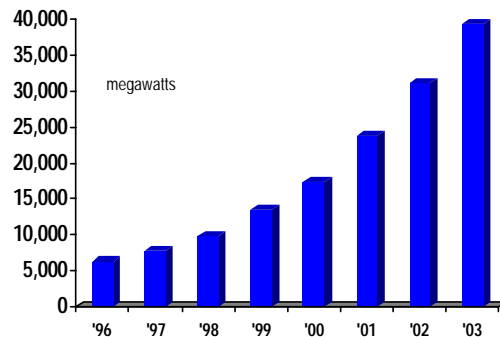
**Biomass** technology uses organic matter such as plants to generate power or process into fuels. Biomass currently ranks second to hydropower in renewable primary energy production in the U.S. Electricity generation by biomass is forecasted to grow by more than 115% by 2025.

A widely known application of biomass power generation is the use of Biodiesel. Biodiesel is a fuel made from vegetable oil that runs in any unmodified diesel engine. Biodiesel can be made from any vegetable oil including oils pressed straight from the seed (virgin oils) such as soy, sunflower, canola, and coconut. Biodiesel can also be made from recycled cooking oils from fast food restaurants. The benefits of biodiesel are many: 1) it runs in any conventional, unmodified diesel engine, 2) it reduces carbon dioxide emissions by up to 100%, 3) it can be used alone or mixed in any amount with petroleum diesel fuel, and 4) it is safe to handle and transport because it is biodegradable and non-toxic.

**Wind** generated energy is expected to be the second largest source of renewable electricity by 2025, growing over 400% through 2025. Globally, the industry added over 7,000 megawatts of capacity in 2003 and now generates nearly 40,000 megawatts of energy. The wind energy industry recorded 2003 revenues of \$7.5 billion. Wind energy is forecasted to increase annual revenue to \$48 billion by 2013.

2003 came close to being a record-breaking year in the U.S., with 1,687 MW of wind energy capacity installed. Current capacity stood at 6,374 MW at the end of the year, with utility-scale turbines operating in 30 states. The United States is now the second largest wind energy user in the world after Germany. Leading wind energy states are California (2,043MW), Texas (1,293 MW), Minnesota (563 MW), Iowa (472 MW), and Wyoming (285 MW). More than half of the new capacity installed consisted of GE Wind turbines. Spanish manufacturer Gamesa and Indian manufacturer Suzlon installed their first turbines in the U.S. in 2003.

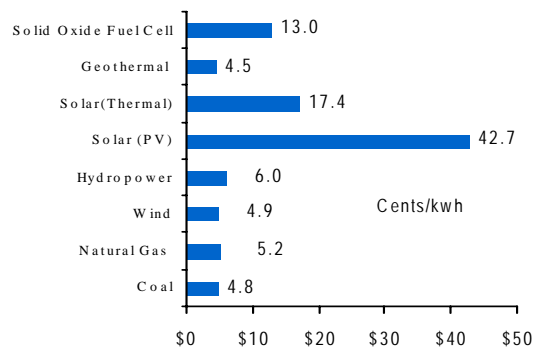
### WIND ENERGY CAPACITY



Source: American Wind Energy Association

**Solar** energy has the greatest potential of all clean energy applications, but is decades away from large-scale development. About one percent of the surface of the Sahara desert would be sufficient to supply the entire worldwide electricity demand using solar thermal power plants. The solar power industry is comprised of two competing technologies, photovoltaic and thermal. Both photovoltaic and solar thermal power plants have proven their feasibility in many operating environments at a large number of locations. There are relevant megawatt-size systems for both technologies.

### LEVELIZED COSTS BY TECHNOLOGY



Source: California Energy Commission

Photovoltaic devices use semiconducting materials to convert solar radiation directly into electricity. In contrast to photovoltaic plants, solar thermal power plants are not based on collecting direct sunlight, but generate electricity from the heat produced by sunlight. Solar thermal is more cost effective than photovoltaic, but during cloud cover can produce no electricity while photovoltaic can produce some energy. Currently, the cost of solar is still too high for mass adoption. Nanotechnologies offer new hope in driving down these costs.

**Municipal solid waste (MSW)** describes the stream of solid waste generated by households, industry, and commercial establishments. MSW consists of everyday items such as product packaging, grass clippings, and newspapers. It can also include wastewater generated by these same entities. MSW is burned, which not only creates energy, but removes the need to dispose of the waste. Burning waste does produce an environmental impact, but the process is still cleaner than fossil fuel fired plants.

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**Geothermal energy** technologies use the heat of the earth for energy generation and heating applications. Geothermal energy can be produced from the shallow ground to extremely high temperatures of molten rock called magma found far beneath the Earth's surface.

The upper 10 feet of the Earth's surface maintains a steady temperature between 50° and 60°F. Geothermal heat pumps use this resource to heat and cool buildings. A geothermal heat pump system consists of a heat pump, an air delivery system, and a heat exchanger (a system of pipes buried in the shallow ground near the building). In the winter, the heat pump removes heat from the heat exchanger and pumps it into the building. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger. The heat removed from the indoor air during the summer can also be used to provide hot water.

As odd as it sounds, coal could become a clean energy source over the next two decades through **Clean Coal** technologies. "Clean Coal" refers to a collection of technologies designed to increase the energy efficiency of coal use while reducing its traditionally large environmental impact. Clean coal technologies in current operation include pollution controls for new and existing coal plants, advanced combustion technologies, and coal gasification-based systems. These and almost two-dozen more technologies, developed in a joint effort between the Department of Energy, private industry, and state governments in the late 1980s and early 1990s, have achieved commercial success.

Federal funding for the next generation of "clean coal" technologies has begun. President Bush committed \$1.2 billion over five years to a comprehensive Hydrogen Fuel Initiative. The Bush Administration also unveiled FutureGen, a \$1 billion, 10-year public-private demonstration project to create the world's first coal-based, zero-emissions electricity and hydrogen power plant.

#### Location Requirements for Clean Energy Facilities

*Economic Conditions.* Research and production firms locate near metropolitan area with large high tech clusters and a growing economy, and often use the local market to test their new products. They often locate near a university or research institution to access a talent pool of engineers and scientists. Start-up firms in this industry tend to locate in progressive communities that support their endeavors.

*Research & Development.* Outside firms such as GE Wind Power and Vestas, industry firms are typically very small (averaging between 10-20 employees) and have limited resources. Companies face significant hurdles to design, test and deploy products that meet a variety of governmental standards. Because of these demanding research needs and lack of funds, having available lab space within an area university or incubator is increasingly important. Firms will also want to be near areas that work as testing ranges. For example, a solar firm wants to be located in an area with abundant sunlight.

*Cost of Doing Business.* Companies look for areas with a low overall recurring cost base. Due to the high salaries of scientists and technical workers and extensive research and testing, general operating costs must be low. Clean energy firms closely analyze state and local energy policies. Large-scale generators look to states with renewable energy portfolio standards and other renewable incentives. More generally, companies prefer states that have an active retail market for electricity, giving consumers the choice to use renewable sources of energy.

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*Workforce.* The industry requires highly paid scientists, technicians, and professionals with a range of skills from chemistry, biology, physics, engineering, management, and other technical and scientific backgrounds. Due to the nature of the industry, an entrepreneurial spirit is necessary as many employees may be transferred from high tech companies who are familiar with a start-up environment.

The opportunities for development technologies, as well as products and services are large and growing. AE believes this will be a good area for San Joaquin County to be a part. The recommendation is to center the efforts in Clean and Renewable Energy at the Port. There is adequate space for such an industry endeavor; it would also bring prestige and notoriety to the Port for “innovation”, and it is the location for import/export of related goods – examples: rotors and blades for wind energy turbines, panels and materials for solar energy, fuel cells and products containing fuel cells (GPS systems to motorcycles), reclamation facilities for biomass, among others.

It is also recommended that the County work with the Universities and Colleges to develop research facilities, test-site facilities, technology centers and training facilities for these industries at the Port. Many of the private and public companies that are utilizing the Port today are companies which are increasingly spending dollars on research for product development – this includes a number of companies in the energy industries.

There is funding for clean and renewable energy, federal and state, as well as through those private companies engaged in the industry. This is a clear opportunity for San Joaquin County to take a leadership role in developing out an industry, and related technologies that will bring a high-profile to the communities, as well as a reason to make the area home.