



# Industry Profiles

Part 2 of the  
Northern Kentucky New Economy  
Readiness Strategy

Presented to:  
Northern Kentucky Tri-ED

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## Northern Kentucky Industry Profiles

October 2003

AngelouEconomics is pleased to present Northern Kentucky Tri-ED with this *Industry Profiles* report, the second report in the four-part *Northern Kentucky New Economy Readiness Strategy*.

In August 2003, AngelouEconomics began a four-month process of assessing Northern Kentucky's preparedness as a location for high tech businesses. The intensive study focuses on revealing the region's most marketable high tech strengths and identifying actions that will improve its viability for high tech industry growth. We will help Northern Kentucky's leaders define "new economy" by identifying niche industry sectors best suited for the region. The final report will contain recommendations aimed at creating a more technology-rich environment, including improvements to quality of life amenities, workforce development programs, business inducements, marketing, and entrepreneurship.

The *Industry Profiles* report contains a snapshot of the new economy industries currently targeted for Northern Kentucky. Each profile contains a description of the trends affecting each industry, as well as their unique site selection requirements. This report is intended to provide a background to the local leadership on the key "needs" of these industries, and begin a discussion of how well they can be served by Northern Kentucky.

The third report, scheduled for review at the end of October, will contain a side-by-side comparison of Northern Kentucky's assets against target industries' needs. This analysis will help us more narrowly define the high tech niches around which the community's economic development program is focused. The fourth and final report, to be delivered in early December, will contain economic development strategies for growing targeted high tech companies in Northern Kentucky.

You can track our progress, find copies of final reports and presentations, and view an employer workforce survey on the project Web site, [www.ThinkNorthernKentuckyUSA.com](http://www.ThinkNorthernKentuckyUSA.com). Thank you in advance for contributing to the Northern Kentucky New Economy project.

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## ***REPORT OVERVIEW***

This report aims to describe the industries that are currently targeted by Northern Kentucky and begin to understand the unique requirements of each.

Target Industries identified in the 2001 Northern Kentucky New Economy Plan are:

- **Pharmaceuticals**
- **Communication services and equipment**
- **Special-industry machinery and apparatus**
- **Motor vehicles and parts**
- **Aircraft and parts**
- **Engineering and architectural services**
- **Research and testing services**
- **Financial services**
- **Environmental technology**
- **Healthcare services and equipment**

One additional New Economy industry has been added by AngelouEconomics for consideration: **Software and Internet**. In addition, the **Logistics and Distribution** industry has been included due to its increasing reliance on technology for greater efficiencies.

For the purposes of this report, we have grouped these targets into commonly accepted industry groups and offer niche sectors (or facility types) within each industry that we will focus our research on:

- **Biotechnology**
  - Pharmaceuticals research and manufacturing
  - Medical Devices research and manufacturing
  - Health services research
- **Telecommunications**
  - Network services and design
  - Data centers
  - Equipment research and manufacturing
- **Automotive**
  - Suppliers
  - Back office
- **Aircraft**
  - Manufacturing suppliers
  - Maintenance
- **Financial Services**
  - Processing/servicing
  - Call centers

- Back office support
- **Environmental Technologies**
  - Engineering
  - Conservation research and services
  - Clean Energy
- **Software and Internet**
  - Custom programming
  - Data centers
- **Logistics and Distribution**
  - Regional hub distribution
  - Back office logistics processing

We describe each of these industries from a global perspective and begin to address Northern Kentucky's readiness for each. We review the top location requirements for each industry, with a focus on:

1. **Economic conditions**: The overall characteristics of regions that support the business model or facility requirements of the industry, including location, size, demographics, and lifestyle.
2. **Structural Assets**: The infrastructure required by companies for their reliable and cost effective operation.
3. **Workforce**: The skills and job occupations that are required by companies in order to be successful.
4. **Research and development**: The role of universities and colleges in the support of new idea creation, technology commercialization, and the formation of workforce.
5. **Cost of doing business**: The cost factors that are most important to a company, which may include real estate, taxes, and incentives.

We discuss each of these 5 factors for each of the 8 major industries profiled in the report. This format is intended to provide a side-by-side comparison of each industry's needs and requirements. For some industries, certain factors play less of a role and are therefore given less attention and detail.

We present the following summary table of the location factors as an entry point to our discussion:

**Location Factors Summary**  
*Weights of Importance*

Target Industry	Type of Operation	Economic	Structural	Workforce	R&D	Costs
Biotechnology	R, m	Moderate	High	High	High	Low
Telecommunications	R, m, S	Moderate	Moderate	Moderate	Moderate	Moderate
Automotive	O	Low	High	High	Low	High
Aircraft	m, S	Low	Moderate	Moderate	Low	High
Financial Services	S, o	Moderate	Moderate	Moderate	Low	Moderate
Environmental Technologies	R, M	Low	Moderate	High	High	High
Software and Internet	S, o	Moderate	Moderate	High	High	Low
Logistics and Distribution	O, S	High	Low	Low	Low	High
R = Research M = Manufacturing                      Capitalized = Primary focus in this report S = Services                                Lower case = secondary focus O = Back Office / Admin						

Source: AngelouEconomics

The *Industry Profiles* report will serve as a prelude to our third report for this project, *New Economy Readiness Assessment*.

Finally, as Northern Kentucky's target industry list is revised, or additional niche sectors are identified, this report will be modified as required by the project.

## **BIOTECHNOLOGY: PHARMACEUTICAL & BIOMEDICAL RESEARCH AND MANUFACTURING**

### **Industry Overview**

Biotechnology, as its name implies, combines biology with technology. It applies knowledge of molecular, cellular, and genetic processes to real world products and services. It refers to scientific work related to genetic engineering for humans, animals and agriculture, environmental work, genetic data mining, and firms involved in the neurosciences and genome work. The area of biotechnology that is more closely linked with direct applications in health services is known as biomedical. Biomedical includes pharmaceutical manufacturing, medical equipment manufacturing, medical and dental laboratory services, and hospital applications. There are approximately 1,300 biomedical companies in the U.S.

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, an average annual growth rate of 2.2 percent, 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 throughout the current decade across the United States.

Major markets include: Agriculture, Energy, Environmental, Food Processing, Government, Manufacturing Process, Medical, Pharmaceuticals, Public Utilities and Research.

The U.S. government too, will demand biomedical products to support efforts to detect and protect against chemical and biological agents. Competition for biotech firms will be fierce, as almost every major metro includes it 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.

### **Biotechnology**

#### Cluster Definition

- 325411 Medicinals/Botanicals
- 325412 Pharmiceuticals
- 325413 Diagnosic Substances
- 345414 Biological Products
- 5417102 R&D in the Life Sciences

#### Industry Profile

- 300,000 employed - US

#### Wage Rates

- \$34 an hour in the US

#### Location Criteria

- Educated workforce
- Access to capital
- Research University

**Requirements:** Biotech firms have specific needs and have clustered around the few metros that can address those requirements. There is an acute shortage of research dollars and skilled life science workers. Locating near a large research university can allow start-ups to access to cheap lab space, technology transfer opportunities, and potential employees. Biotechnology companies will also desire established venture capital or angel networks they can tap for funding.

**Economic Conditions.** Biotechnology firms seek locations in highly vibrant and well-educated communities. Firms also desire a growing population that is large enough to support workforce needs in a growing industry. Biotech companies also desire an amount of diversity in the community as many of the industry’s employees are from minority groups.

**Structural Assets.** Biotech firms have specific but feasible infrastructure needs, namely available “wet lab” space and reliable utilities. The typical biotech firm is relatively small and the majority of any capital investment will be tied up in equipment.

<b>Biotech Research Facility</b>		
<b>Typical Requirements</b>		
	<b>Input</b>	<b>Details</b>
Activity	<b>Biotech R&amp;D</b>	Biological, agriculture, or chemical research
Size	30,000 sf	1 story building
Acres	4-6 acres	
Employees	50 employees	2 shifts / 5 days per week
Water	2,500 gallons / day	250 gal/shift
Wastewater	2,250 gallons / day	does not need to be treated
Electricity	600 kw Demand	dual substations, possibly on separate grids
	324,000 kwh per month	70% average load factor
Natural Gas	150 mcf / month	
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$4-8 million	
Equipment	\$30 million	about \$1,000 per sf

**Source: AngelouEconomics**

More important are the financial needs of the industry. Biotechnology is an industry in its infancy, still relatively small even after a decade of substantial growth. Today, less than 50 industry companies have over 1,000 employees and none rank among the top 25 employers in the largest biotech metros. Biotech firms need an established venture capital base that is familiar with the industry. Less than 1 out of every 1,000 biotech related patents produces a successful commercial innovation and even when they do it can take more than a decade to come to market. Therefore biotech firms need financial backers that understand the industry and have long-term funds available for investment. Many of the industry’s largest firms including industry leader Amgen, were initially funded with venture capital.

**Workforce.** Attracting and retaining a quality workforce is more important in high-tech fields such as biotech. Workers tend to be highly mobile, meaning that they are willing to venture into a community, but

they are also easily swayed away. In an industry with high turnover, people tend to seek communities with numerous employment options. The typical biotech firm has less than 50 employees and most are very well educated. Biotech firms employ many life science PhDs, and will require an area research university with graduate life-sciences programs.

**SIC 873 - Research, Development, and Testing Services**

Source: Occupational Employment Statistics, Bureau of Labor Statistics 2000

SOC Code Number	Occupation Title	Employment Estimates		Wage Estimates	
		Employment	Percent of Total	Mean Hourly	Mean Annual
00-0000	Industry Total	669,700	100.00%	\$24.33	\$50,600
11-0000	Management Occupations	82,780	12.36%	\$42.39	\$88,170
15-0000	Computer and Mathematical Occupations	54,940	8.20%	\$31.13	\$64,750
17-0000	Architecture and Engineering Occupations	69,400	10.36%	\$29.91	\$62,210
17-2071	Electrical Engineers	5,640	0.84%	\$34.84	\$72,470
17-2141	Mechanical Engineers	5,760	0.86%	\$34.33	\$71,410
19-0000	Life, Physical, and Social Science Occupations	150,380	22.45%	\$23.55	\$48,990
19-1042	Medical Scientists, Except Epidemiologists	16,130	2.41%	\$31.88	\$66,300
19-2031	Chemists	19,820	2.96%	\$24.28	\$50,490
19-3021	Market Research Analysts	8,920	1.33%	\$26.41	\$54,940
19-4021	Biological Technicians	16,770	2.50%	\$17.42	\$36,230
19-4031	Chemical Technicians	13,740	2.05%	\$14.15	\$29,430
43-0000	Office and Administrative Support Occupations	151,880	22.68%	\$13.33	\$27,730

**Research & Development.** The large biotech firm is a rarity. Even in established markets, biotech firms are not considered large employers. Firms that specialize in research are generally no more than a small lab. These firms sell or license their marketable products to large vertically integrated powerhouses such as Merck and Pfizer. Thus it is important to have large research organizations in the area. Small biotech firm's benefit greatly from a research hospital or other large research institutions, they are able to use lab space and instrument they might not be able to afford, license technology, and gain invaluable intelligence from industry peers. All of the largest biotech metros in the U.S. have both a large research university and research hospital.

**Cost of Doing Business.** Firms usually have long and expensive Research and Development cycles that may prolong revenues for years. Due to large barriers to entry, a firm's success is highly dependent on entrepreneurial networks and long-term venture capital. Biotech firms and especially emerging ones face more competition for capital than in recent years. Time to market is critical. Marketable results generally take between 5 and 12 years. Many companies face enormous risks as they often are highly dependant upon a single drug or product that could fail or be tied up in a lengthy regulatory approval process by the F.D.A.

R&D tax credits, investment tax credits, and sales tax exemptions have been the most successful incentives. New York State committed \$60 million to biotech recruitment. The funds were distributed to state universities and hospitals for lab facilities, professional recruiting, and direct company incentives.

## **AUTOMOTIVE: SUPPLIERS BACK OFFICE**

### **Industry Overview**

The automotive industry's primary functions are to design, manufacture, and distribute transportation vehicles. Automotive suppliers provide engine parts, electrical systems, seats, and chassis components to auto assembly plants.

The automotive industry in the United States has over 1.3 million direct employees and is responsible for over \$240 billion in wages. Annual sales of automotive suppliers now top \$800 billion. Auto sales have surpassed 16 million new vehicles thanks to low interest rate financing and record rebates on new purchases. Domestic growth for the industry is projected to remain modest, closely following population growth levels.

The industry has experienced migration of domestic automotive factories from the Michigan area toward the Southeastern United States. To mitigate currency risks and bypass U.S. tariffs of up to 25%, foreign companies such as Honda, Toyota, Nissan, BMW, Mercedes, and Hyundai now have located factories in the U.S. The Southeast is attractive due to lower prevailing wages and low unionization rates. Another industry trend is for large automotive companies to use independent component companies as their suppliers. GM and Ford have both spun off their internal component groups into independent firms.

In an effort to boost profitability, automakers are looking for new revenue sources. GM is moving into service areas such as OnStar that provide monthly subscription revenues. Interior trim upgrades such as leather seats are also targeted as a revenue growth area as these upgrades command high margins for manufacturers.

The Intelligent Transportation Systems (ITS) technology market will be hot as demand grows for improved safety systems, sensors and new sensor technology for applications such as electronic toll collection, navigation, traffic management, highway construction, research activities, fleet management, commercial vehicle operations, and global positioning systems. Transportation authorities are installing automatic toll collection systems and surveillance cameras nationwide. Automakers are offering in-vehicle navigation and entertainment systems as well as collision warning and their improved control and warning devices. In addition, electrical systems are replacing mechanical systems in new automobiles.

Competition for automotive plants is fierce, due to the large number of quality blue collar and white-collar jobs associated with automotive manufacturing. Proximity to plant customers is vital to modern automotive supplier firms.

### **Automotive Suppliers**

#### NAICS Definition

- 32622 Rubber & Plastics Hoses & Belting
- 332 Fabricated Metals
- 3336 Engine & Turbine Mfg
- 333924 Truck, Tractor, Trailer Machinery Mfg
- 3353 Electrical Equipment
- 336 Transportation Equipment

#### Industry Employment

- 1.7 million employed - US

#### Wage Rates

- \$22 an hour in the US

#### Location Criteria

- Proximity to customer base
- Proximity to good technical training institutions
- Large affordable tracts of land
- Good affordable power supply

**Requirements:** Automotive suppliers operate in a low margin industry and are therefore most concerned with a communities recurring cost structure. They will also need excellent transportation infrastructure and a location within a reasonable distance of the final assembly line.

**Economic Conditions.** Increasingly, automotive firms are proponents of just-in time manufacturing. These firms prefer that suppliers locate within 200 miles of the main assembly plant, but not so close as to compete for the same workers. As of late, the industry has been gravitating towards more rural areas in the South where wages are lower, unions are less prevalent, and growth is occurring.

**Structural Assets.** Suppliers will be concerned about an area’s recurring cost structure more than many other industries. Auto suppliers use large amounts of electricity, natural gas, and water and need an affordable, reliable supply. Suppliers also need large, unencumbered land tracts and desire low property taxes due to the large amount of land and building space they use. Suppliers prefer to locate on major highways with direct access to the main assembly plant. Rail is often a key requirement for large component facilities.

<b>Automotive Supplier (Tier 2)</b>		
<b>Typical Requirements</b>		
	<b>Input</b>	<b>Details</b>
Activity	<b>Auto Supply Mftg</b>	Tier 2
Size	100,000 - 200,000 sf	1 story building, tall ceilings
Acres	15-50 acres	w/ separate entrance for trucks and employees
Employees	100-200 employees	10% Admin (\$40k), 90% production (\$12/hr) 3 shifts / 7 days per week
Water	up to 170,000 gallons / day	
Wastewater	up to 155,000 gallons / day	does not need to be treated
Electricity	1000-2000 kw Demand 1.4-1.8 mil kwh per month	dual substations, possibly on separate grids
Natural Gas	4,000 - 6,000 mcf / month	
Telecom	T-1 minimum	
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$5-10 million	
Equipment	\$15-20 million	
Other	5-10 miles of Interstate Rail is a plus, but not required Within 60 miles of commercial airport, 250 miles of port	

Source: AngelouEconomics

**Workforce.** Automotive suppliers require semi-skilled and skilled labor, preferably available at average to below average wages. A vast array of operators, machinists, welders, managers, and support staff are necessary to run an efficient factory. After production workers, engineering accounts for the largest share of positions in the transportation equipment industry. These jobs are primarily mechanical and industrial engineers that design the manufacturing equipment, coordinate processes, and maintain quality control.

### SIC 37 - Transportation Equipment

source: Occupational Employment Statistics, Bureau of Labor Statistics 2001

Occupation	Employment Estimate		Wage Estimate	
	US Employment	% of Total	Mean Hourly	Mean Annual
<b>TOTAL</b>	<b>1,714,420</b>	<b>100.00%</b>	<b>\$21.65</b>	<b>\$45,030.00</b>
Management occupations	83,380	4.86%	\$41.61	\$86,540.00
Business and financial operations	96,370	5.62%	\$29.09	\$60,510.00
Computer and mathematical	41,520	2.42%	\$30.46	\$63,360.00
<b>Architecture and engineering</b>	<b>216,580</b>	<b>12.63%</b>	<b>\$30.49</b>	<b>\$63,430.00</b>
Office support and administrative	119,120	6.95%	\$16.42	\$34,150.00
Construction and extraction	67,070	3.91%	\$20.22	\$42,070.00
Installation, maintenance, and repair	115,500	6.74%	\$20.44	\$42,520.00
<b>Production</b>	<b>848,750</b>	<b>49.51%</b>	<b>\$17.44</b>	<b>\$36,270.00</b>
Transportation and material moving	72,420	4.22%	\$17.07	\$35,510.00

Suppliers' need for technical employees forces them to look at communities that offer both a four- year engineering university and technical schools for production workers.

**Research & Development.** Research and development in the automotive supplier industry requires the coordination of mechanical, electrical, and material engineers. Automotive suppliers are also active in supply chain management. Automotive companies spend over \$18 billion on research and development. Due to the broad nature of inputs, research that affects the automotive industry is conducted by all level of firms and research institutions. Support for manufacturing process improvement is valuable to firms, but most research is conducted at headquarters offices.

**Cost of Doing Business.** Due to high quality standards and the use of just-in-time supply chain techniques, automotive supply firms require a high degree of trust with their partner assembly companies. Traffic bottlenecks at roads at airports can have a detrimental impact on OEMs. Factories are capital intensive and require a high number of semi-skilled laborers. Harmonious labor relations also have a significant impact on company performance. Outsourcing not only reduces wage expenses, but also lowers costs from pensions and provides added flexibility to adjust the workforce to meet changing market conditions. Because of their large impact of the communities in which they located auto firms and their suppliers have become adept at negotiating large incentive packages. Tax systems can affect plants greatly, and auto manufactures tend to look for areas with low property tax rates and sizable income tax credits. Many recent auto projects have also received significant workforce training credits in addition to sizable tax incentives. Few industries receive more financial incentives.

## ***TELECOMMUNICATIONS: NETWORK SERVICES AND DESIGN EQUIPMENT RESEARCH AND MANUFACTURING***

### **Industry Overview**

Today's telecommunications systems deliver voice, video, and data by means of a variety of wired and wireless methods. The telecommunications cluster includes manufacturers of network, switching and transmissions equipment, telephone and facsimile machines, fiber optic materials and cable, wireless communications equipment, and satellite communications systems.

Data centers are businesses that provide digital information storage for their customers usually in the form of websites and web servers. Data centers are composed of clusters of computers and network switching gear that allows efficient and highly reliable transfer of data over the Internet. Often these Data Centers are referred to as "Telecom Hotels" or "Server Farms".

According to the United States Telecom Association, the telecommunications industry employs nearly 1.3 million people with average salaries of \$56,400. These numbers are in a state of flux as the telecommunications industry was hit hard by the bursting of the tech bubble. Excess capacity was built in the late 1990s, and the bankruptcies of WorldCom (MCI), Exodus, and Global Crossing have stunted investment. The industry is currently consolidating, as the weaker companies can no longer compete. New Data Centers report occupancy rates of only 35%. However, many analysts believe that demand will catch up with supply by 2005. Future growth will be driven by increases in consumer bandwidth and expanding wireless networks.

The global trend toward privatization of telecommunication networks has sparked tremendous competition and innovation. Consumers have benefited as prices have fallen while quality has improved. Wireless networks are now cheaper to install in developing countries than traditional wired infrastructure. As more data is carried wirelessly, the need for security will increase. Companies specializing in data integrity are expected to benefit from this increasing demand for security. Blue Tooth wireless standard links mobile PCs, phones and other digital devices. Another major trend is the convergence of the Internet, cellular, PCS, satellite, wireless and fiber optics will lead to growth as many new products and services will provide any time access everywhere in the world.

Major centers for telecommunications research and services are Dallas/Ft. Worth, San Jose, Northern Virginia, and Boston. Worldwide leaders in telecommunications research can also be found in Finland, Sweden, Germany, Japan, and South Korea. Manufacturing for telecommunications equipment is growing rapidly in China and the countries of Southeast Asia. In addition, increased concerns for security and backup capabilities by Fortune 500 companies will help to drive the data operations to mid-tier more remote cities.

**Requirements:** Telecom firms live and die according to their reliability. Power reliability and cost are of supreme concern for telecom firms. Available space can be a concern in smaller markets as well as finding qualified workers.

### **Electronics & Instrumentation**

#### **Cluster Definition**

- 3353 Electrical Equipment Mfg
- 3345 Navigation, Measuring, Control Instruments
- 3359 Other Electrical Equipment Mfg
- Industry specific instruments are often classified under that industry

#### **Industry Profile**

- 1.3 million employed - US

#### **Wage Rates**

- \$15 an hour in the US

#### **Location Criteria**

- Proximity to industry
- Proximity to university engineering programs
- Proximity to good technical training institutions
- Reliable power supply

**Economic Conditions.** Telecommunication firms seek locations in “connected” and well-educated communities. Data Centers also require significant telecommunications and electricity infrastructure and their success usually depends on the demand for service by local companies. Telecom firms will locate near growing economies.

**Structural Assets.** Data centers house mission critical data for their customers and shutdown can cost millions. Electronics manufacturing involves detailed, precision work and fluctuations on power can lead to poor consumer products. For these reasons power infrastructure is paramount in any site selection process. Low cost power is second only to reliability, consistency, and redundancy. If not constructing their own space firms will need an available supply of class A office space.

Electronics Mftg		
	Input	Details
Manufactures	<b>Electronics</b>	PCBs, cell phones, consumer electronics
Size	120,000 sf	10% office, 15% warehouse, 75% production 15-20 production lines
Acres	10-15 acres developable	
Employees	400-500 employees	24 hours / 2 shift
Water	80-100,000 gallons per day	200 gal/day per employee
Wastewater	90,000 gallons per day	does not need to be treated
Electricity	1600 - 2000 KW (Max Demand) 1,150,000 - 1,450,000 KWH/mo	dual substations, possibly on separate grids 70% average load factor
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$8-10 million	
Equipment	\$15-25 million	\$1 - \$1.5 million per line
Improvements	\$4 million	\$2 - \$4 million

Source: AngelouEconomics

**Workforce.** Attracting and retaining a quality workforce is more important in high-tech fields such as telecommunications. As in biotech, workers tend to be highly mobile, meaning that they are willing to venture into a community, but they are also easily swayed away. In an industry with high turnover, people tend to seek communities with ample employment options.

**SIC 481 - Telephone Communications**

Source: Occupational Employment Statistics, Bureau of Labor Statistics 2000

SOC Code Number	Occupation Title	Employment Estimates		Wage Estimates	
		Employment	Percent of Total	Mean Hourly	Mean Annual
00-0000	<b>Industry Total</b>	1,139,730	100.00%	\$23.09	\$48,030
13-0000	<b>Business and Financial Operations Occupations</b>	94,070	8.25%	\$26.91	\$55,970
13-1111	Management Analysts	15,670	1.37%	\$26.07	\$54,220
15-0000	<b>Computer and Mathematical Occupations</b>	85,950	7.54%	\$29.04	\$60,400
15-1031	Computer Software Engineers, Applications	9,500	0.83%	\$32.68	\$67,980
15-1032	Computer Software Engineers, Systems Software	19,040	1.67%	\$33.61	\$69,900
15-1071	Network and Computer Systems Administrators	12,660	1.11%	\$28.29	\$58,850
41-0000	<b>Sales and Related Occupations</b>	144,380	12.67%	\$19.93	\$41,460
43-0000	Office and Administrative Support Occupations	344,000	30.18%	\$17.09	\$35,540
49-0000	<b>Installation, Maintenance, and Repair Occupations</b>	287,320	25.21%	\$22.89	\$47,620

Telecom firms require highly skilled engineers and computer software programmers. Telecom is also a fairly mature industry with many large firms directing the market. As such the industry has clustered around large metros with well-educated workforces.

**Research & Development.** R&D in telecommunications requires large amounts of capital and highly skilled scientists and engineers. This industry is highly innovative, leading to small firms who need access to venture capital. The distinction between telecom, computer, and semiconductor is fading ever faster, and telecom companies prefer to locate in close proximity to companies and research universities with programs in these areas of expertise.

**Cost of Doing Business.** The telecommunications industry is not as concerned with recurring costs as many traditional industries. Labor costs are any telecom firms' largest expenditure, sometimes accounting for as much as 90% of a firm's expenditures, much more than traditional manufacturing industries. As such, traditional recurring costs such as tax rates, electricity costs, and transportation costs are not as important to telecom firms. Many of the national's largest telecoms are located in high operating cost environments such as New Jersey, New York, and California. Even though telecom firms do not pay large amounts of taxes to local municipalities, their high wage rates ensure large incentive packages.

## ***AIRCRAFT: MANUFACTURING SUPPLIERS MAINTENANCE***

### **Industry Overview**

Aircraft suppliers provide parts and machinery for aircraft assembly and maintenance. These parts include engines, interior components, electronics, and aircraft hardware such as landing gear. These suppliers are important for both the assembly of new aircraft, and the maintenance of currently operating aircraft. The aerospace industry's main customers include the military, commercial airlines, and general aviation. Suppliers in the United States and Europe dominate the aircraft parts industry, although Asian firms are quickly increasing their competitiveness.

The aircraft industry has been greatly affected by the recent economic slowdown. Terrorist activity, declining business travel budgets, and SARS fears have cut air travel by 10%, and many airlines are either in bankruptcy or near bankruptcy. Subsequently, employment in the aircraft parts industry has dropped over 10% to 408,000. According to the Aerospace Research Center, domestic aerospace sales are projected to fall below \$140 billion in 2003, down from \$153 billion in 2001. The industry seems to have turned the corner towards growth as air travel levels are slowly recovering. The industry expects a boost from any improvement in the macro economic environment.

One bright spot in the aerospace industry is the maintenance, repair, and overhaul (MRO) segment. The nearly \$40 billion maintenance, repair, and overhaul (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 vying for profitable market positions, while commercial air travel levels are down. Airlines are striving to avoid costly new aircraft purchases through improved maintenance and repair of currently operating aircraft. As such, they are increasing their reliance on independent companies for aircraft maintenance. Revenues for MRO organizations are expected to grow over 5% per year over the next 3 years.

Military spending has acted as a buffer against a weak economic environment. Hardware procurements have increased rapidly since 2000, including a possible \$22 billion lease of 100 Boeing 767 tankers that will help shore up industry revenues. Spending on defense related maintenance has steadily increased for the last 5 years. The military has also embraced outsourcing as a way to save money and lower overhead and increase the amount of work available to contractors.

### **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**

- 551,000 employed

#### **Wage Rates**

- \$24 an hour in the US

#### **Location Criteria**

- Large area airport or military airbase
- Manufacturing non-union workforce
- Proximity to good technical training institutions

**Requirements:** Aircraft suppliers need to locate in an area with excellent transportation infrastructure, qualified workers, and available land. The industry also desires a large, international airport in the area.

**Economic Conditions.** Aircraft part suppliers require close proximity to a major airfield or military airbase. A significant local logistics and distribution industry is necessary to support the aircraft industry. Technical and trade schools are needed to educate and train workers. Maintenance facilities can draw aircraft across large regions due to relative short flight times.

**Structural Assets.** Aircraft and aircraft parts manufacturers are typically large-scale operations requiring a sizable tract of land. Facilities range in size from a few hundred thousand sq. ft. to the millions. Any facility will require ample access to electricity, natural gas, water, and wastewater. An excellent transportation system including both interstate and rail access, in addition to a commercial airport, will also be required. Port access is required to ship large subassemblies.

<b>Aircraft Manufacturing Facility</b>		
<b>Typical Requirements</b>		
	<b>Input</b>	<b>Details</b>
Activity	<b>Aircraft Manufacturing</b>	
Size	250,000 to 400,000 sq. ft.	
Acres	40-75 acres	
Employees	600 employees	25% Admin (\$60k), 75% production (\$35k) 3 shifts / 7 days per week
Water	600,000 gallons / day	
Wastewater	450,000 gallons / day	does not need to be treated
Electricity	26,000 kw Demand	dual substations, possibly on separate grids
Natural Gas	13 mil to 16 mil kwh per month	
Telecom	1 mil Therms a year	
	T-1 minimum	
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$25 million	
Equipment	\$125 million	
Other	15 miles of Interstate Rail is required Within 60 miles of commercial airport	
<b>Source: AngelouEconomics</b>		

**Workforce.** Semi-skilled and skilled workers are required for aircraft parts manufacturing, including many engineers and drafters. Mechanics and aircraft technicians will be needed for any maintenance facility. Skilled machinists are required to make parts that are not massed produced.

**SIC 372 - Aircraft and Parts**

Source: Occupational Employment Statistics, Bureau of Labor Statistics 2000

SOC Code Number	Occupation Title	Employment Estimates		Wage Estimates	
		Employment	Percent of Total	Mean Hourly	Mean Annual
00-0000	<b>Industry Total</b>	450,470	100.00%	\$23.82	\$49,540
13-0000	<b>Business and Financial Operations Occupations</b>	40,030	8.89%	\$27.29	\$56,760
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	6,680	1.48%	\$25.33	\$52,680
13-1111	Management Analysts	9,640	2.14%	\$28.76	\$59,820
17-0000	<b>Architecture and Engineering Occupations</b>	82,300	18.27%	\$30.98	\$64,450
17-2011	Aerospace Engineers	34,840	7.73%	\$33.97	\$70,660
17-2141	Mechanical Engineers	7,450	1.65%	\$31.04	\$64,570
43-0000	<b>Office and Administrative Support Occupations</b>	41,080	9.12%	\$17.34	\$36,070
49-0000	<b>Installation, Maintenance, and Repair Occupations</b>	37,320	8.28%	\$20.43	\$42,490
49-3011	Aircraft Mechanics and Service Technicians	15,000	3.33%	\$19.78	\$41,140
51-0000	<b>Production Occupations</b>	159,680	35.45%	\$17.69	\$36,800
51-1011	First-Line Supervisors/Managers of Production and Operating Workers	11,880	2.64%	\$26.37	\$54,850
51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	27,400	6.08%	\$18.44	\$38,360
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	15,430	3.43%	\$18.02	\$37,480

As with automotive suppliers, an aircraft manufacturing facility will desire both a four-year engineering university as well as a good technical college. A joint training program between the technical college and the manufacturer would be highly beneficial.

**Research & Development.** R&D activity in the aircraft manufacturing industry abounds, though it generally focuses on product development rather than later staged manufacturing processes. Major funding sources are often military in nature as most underlying aerospace technologies come out of the Department of Defense and NASA. The majority of industry research is conducted in house at private research and design facilities.

**Cost of Doing Business.** Aircraft parts manufacturing are large-scale, low margin operations whose profitability is greatly influenced by recurring costs. They are large users of electricity and natural gas and pay large amounts of property taxes. Any location decision will be heavily influenced by tax rates, utility costs, and prevailing wage rates. Due to the number and diversity of employees these operations are fiercely sought after and command large amounts of incentives. Typical incentives are similar to the automotive industry and have included tax abatements, tax credits, worker-training grants, and infrastructure improvements.

***FINANCIAL SERVICES:  
PROCESSING/SERVICING  
CALL CENTERS  
BACK OFFICE SUPPORT***

### Industry Overview

The Financial Services industry is comprised of commercial banks, savings institutions, financial leasing firms, and insurance companies. Financial service providers include equipment leasing companies, stockbrokers and investment banking firms, and back-office credit operations.

Today nearly 50% of all U.S. households hold stock, generating greater public interest than ever before in the financial services industry, which has a total U.S. output valued at \$1.5 trillion. Merger and acquisition activity led by the idea of "convergence" and the 1999 repeal of the Glass-Steagall act has allowed for the unification of banking, insurance, and securities services under on corporate roof. Globalization is also contributing to mergers and acquisition activity as U.S. companies have begun to compete with many foreign companies, which often operate under radically different rules.

Support staffs for the Financial Services industry perform a variety of record keeping duties. They track revenues coming into and leaving organizations as well as provide customer support. They provide payroll, procurement, and auditing services for their clients. The growing number of retirees will require higher levels of financial services. However, productivity improvements from information technology will limit job growth for some financial professions.

Although the domestic call center industry struggled in 2002 and continues to struggle in 2003 financial services call centers have been a bright spot. Many call centers have closed as companies outsource or merge their call center services. Increasingly companies are outsourcing their call center services to offshore entities in countries with large English speaking populations. India is the most popular destination for call center outsourcing. Strong competition for call centers also comes from Canada, South Africa, Costa Rica, and the Philippines. The recent creation of the National Do Not Call List is also a threat to the outbound call center industry, as fewer sales calls can be placed from within the United States.

Financial service call centers have been less affected by these changes than the industry. They have a higher value add and have moved operations overseas with much more caution.

## Financial Services

### Cluster Definition

- 52 Finance and Insurance
- 522320 Financial Transactions Processing
- 518210 Data Processing
- 522210 Credit Card Issuing
- 56142 Telephone Call Centers

### Industry Profile

- 5 million employed - US

### Wage Rates

- \$18 an hour in the US

### Location Criteria

- Educated workforce
- Quality office space
- Affordable Utilities

**Requirements:** Financial service support centers require low recurring costs, reliable utilities, and available office space. They therefore tend to locate in small metros and suburban areas of larger metros.

**Economic Conditions.** Financial service support organizations often look for non-metro and suburban communities for many reasons: competition for labor is low, wages are more competitive, housing costs are low and a large stock is available, and large campus tracts are available.

**Structural Assets.** Back office operations serve as hubs for many other vital functions. Thus, it is important that power, telecom, and other ISP services be reliable and affordable. Other than power these operations are light users of other utilities making it a good fit where other industries are excluded by water and wastewater constraints.

<b>Call Center Typical Requirements</b>		
	<b>Input</b>	<b>Details</b>
Activity	<b>Call Center</b>	
Size	150,000 sq. ft.	
Acres	20 acres	
Employees	900 employees	10% Admin (\$45k), 90% production (\$10 hr) 3 shifts / 7 days per week
Water	10,000 gallons / day	
Wastewater	10,000 gallons / day	does not need to be treated
Electricity	1350 kw Demand 750,000 kwh per month	dual substations, possibly on separate grids
Natural Gas	100,000 Therms a year	
Telecom	SONET ring access	
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$20 million	
Equipment	\$20 million	
Other	Redundant Utilites Within 60 miles of commercial airport	

**Source: AngelouEconomics**

**Workforce.** Financial service support centers require workers with high school diplomas and employees with some specialized accounting knowledge. Many mutual funds and brokerage call centers require college degrees and specific industry certifications. Others seeking to lower their costs look to student populations.

**SIC 61 - Non-Depository Credit Institutions***Source: Occupational Employment Statistics, Bureau of Labor Statistics 2000*

SOC Code Number	Occupation Title	Employment Estimates		Wage Estimates	
		Employment	Percent of Total	Mean Hourly	Mean Annual
00-0000	<b>Industry Total</b>	730,220	100.00%	\$20.11	\$41,830
11-0000	<b>Management Occupations</b>	71,180	9.75%	\$39.74	\$82,650
13-2011	<b>Accountants and Auditors</b>	9,530	1.31%	\$22.57	\$46,950
13-2041	Credit Analysts	17,610	2.41%	\$21.38	\$44,460
13-2051	Financial Analysts	10,400	1.42%	\$28.20	\$58,650
13-2071	Loan Counselors	16,220	2.22%	\$17.72	\$36,860
13-2072	Loan Officers	95,060	13.02%	\$24.86	\$51,710
41-0000	<b>Sales and Related Occupations</b>	58,940	8.07%	\$21.74	\$45,220
41-1012	First-Line Supervisors/Managers of Non-Retail Sales Workers	4,830	0.66%	\$27.69	\$57,590
41-3031	Securities, Commodities, and Financial Services Sales Agents	21,530	2.95%	\$27.35	\$56,890
43-0000	Office and Administrative Support Occupations	375,220	51.38%	\$13.77	\$28,650

**Cost of Doing Business.** Major expenses for the financial service industry include employee training and establishing communications infrastructure. Turnover is common amongst the back office support staff. Low cost real estate is important, as the cost of telecom is high. Firms within the industry receive a large amount of job based incentive packages including new job tax credits and community run training programs. Local laws are often an important aspect of the site selection process. South Dakota become a home to the credit card processing and call center industry in part by passing legislation allowing for higher usury rates.

## ***LOGISTICS AND DISTRIBUTION:***

### **Industry Overview**

Logistics is the process of planning, implementing, and controlling the efficient flow of goods and services through the supply chain from producer to consumer. Distribution includes all freight carriers (air, water, trucking, and intermodal) and warehousing. These companies warehouse and store goods that have been transported by air, water, freight, and rail. Until recently, most manufacturing firms took responsibility for the warehousing and coordination of their flow of materials. More often 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 of these goods, a \$264 billion industry, is increasingly coordinated by high-tech means such as global positioning satellites, real-time Internet tracking and just-in-time inventory systems.

And so, the industry has two distinct sides. The distribution of goods will continue to be serviced by "low-tech" suppliers – trucks, airplanes, and ships. The logistical coordination, on the other hand, is a high value-added service that will differentiate companies and drive industry growth in coming years. Technical workers dominate employment in this field. Federal Express clearly pioneered the service side of distribution and more established companies have been racing in to catch up including the United States Postal Service.

Logistics and distribution is highly dependent upon trends in the general economy. Employment in distribution-related occupations is expected to grow by 22 percent between 2000 and 2010, compared to an average growth rate of 16 percent over all occupations. Job opportunities will abound for qualified truck drivers and service technicians.

### **Logistics & Distribution**

#### **NAICS Definition**

- 484 Truck Transportation
- 482 Rail Transportation
- 4885 Freight Transportation Arrangement
- 4884 Support Activities for Road Transportation
- 4882 Support Activities for Rail Transportation
- 493 Warehousing & Storage

#### **Industry Profile**

- 640k employed - US

#### **Wage Rates**

- \$11 an hour in the US

#### **Location Criteria**

- Excellent Transportation Infrastructure
- Affordable Land
- Large nearby market for goods

**Requirements:** The logistics and distribution industry is location specific. Firms need large tracts of land with excellent transportation infrastructure near end use market, whether that is the consumer or the final assembly line.

**Economic Conditions.** Logistics and distribution companies seek excellent highway access, affordable land on which to build their warehouses, a large market nearby, and no inventory tax. Economic growth is important as well. Much of a distributors revenue can come from area firms and regional consumer needs. In either case distributors desire a growing regional economy expand their potential client base. Large distribution firms locate near mid-size to large metros with a hub airport.

**Structural Assets.** Logistics and distribution firms require large tracts of unencumbered land, cheap utilities, and an excellent transportation infrastructure. Affordable utilities are desired.

<b>Regional Distribution Center</b>		
<b>Typical Requirements</b>		
	<b>Input</b>	<b>Details</b>
Activity	<b>Warehouse and Distribution</b>	
Size	250,000 to 500,000 sq. ft.	1 story building, tall ceilings (25-35 ft.)
Acres	15-50 acres	w/ separate entrance for trucks and employees
Employees	600 employees	10% Admin (\$40k), 90% production (\$9/hr) 3 shifts / 7 days per week
Water	6,000 gallons / day	
Wastewater	5,400 gallons / day	does not need to be treated
Electricity	1,350 kw Demand	dual substations, possibly on separate grids
	1+ mil kwh per month	
Natural Gas	175,000 Therms a year	
Telecom	T-1 minimum	
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$25 million	
Equipment	\$12 million	
Other	Within 5 miles of Interstate Rail is a plus, but not required Within 60 miles of commercial airport, 250 miles of port No history of flooding in area or on typical route to facility	
<b>Source: AngelouEconomics</b>		

**Workforce.** Occupations in logistics and distribution use varied skill sets. Entry-level positions are available as laborers and materials handlers. Truck drivers are also vital to the industry. A limited number of IT professionals are needed to support supply chain companies as well. The industry has high turnover so areas need to have a sizable available workforce. Many distribution facilities employ college students part-time, making a young population a key concern.

**SIC 473 - Arrangement of Transportation of Freight and Cargo**

Source: Occupational Employment Statistics, Bureau of Labor Statistics 2000

SOC Code Number	Occupation Title	Employment Estimates		Wage Estimates	
		Employment	Percent of Total	Mean Hourly	Mean Annual
00-0000	<b>Industry Total</b>	190,430	100.00%	\$18.11	\$37,670
11-0000	<b>Management Occupations</b>	17,270	9.07%	\$38.12	\$79,290
41-0000	<b>Sales and Related Occupations</b>	12,190	6.40%	\$24.14	\$50,200
41-1012	First-Line Supervisors/Managers of Non-Retail Sales Workers	1,260	0.66%	\$29.00	\$60,320
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical	3,250	1.71%	\$24.70	\$51,370
43-0000	<b>Office and Administrative Support Occupations</b>	90,880	47.72%	\$15.27	\$31,760
53-0000	<b>Transportation and Material Moving Occupations</b>	53,930	28.32%	\$14.26	\$29,660
53-3032	Truck Drivers, Heavy and Tractor-Trailer	11,980	6.29%	\$16.45	\$34,220
53-3033	Truck Drivers, Light Or Delivery Services	12,380	6.50%	\$16.35	\$34,010
53-7051	Industrial Truck and Tractor Operators	5,230	2.75%	\$11.52	\$23,960
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	15,990	8.40%	\$11.22	\$23,330

**Research & Development.** Supply Chain research is conducted by many universities and companies such as Wal-mart and FedEx. Mathematicians, computer scientists, an operations experts conduct this research. Research and development is less important than in most industries.

**Cost of Doing Business.** Logistics and Distribution companies invest primarily in warehouses, trucks, moving equipment, and IT infrastructure. Inventory taxes are avoided at all costs and many distributors look for special incentives such as reduced taxes on fuels. Those large operations require massive land tracts at low prices, and generally make low-end building improvements. Recent expansions have received tax abatements, tax credits, infrastructure improvements, and industrial revenue bonds.

## ***SOFTWARE AND INTERNET: DATA CENTERS***

### **Industry Overview**

The software industry is comprised of computer programming services, prepackaged software, data processing, and information retrieval services. Software is a group of instructions, understood by computers, which allow computers to complete desired tasks. Demand for software is driven by efficiencies derived through computer automation or in the case of the gaming industry, through entertainment value.

Software firms now have worldwide revenues in excess of \$200 billion. Approximately half of these sales come from software applications, development tools and infrastructure software splitting the remaining market. Major areas of growth are in data security and business intelligence. Due to the low start-up costs associated with a software firm, many small software companies exist. However, the industry is quickly maturing and many analysts forecast consolidation of these firms. Large software companies such as Microsoft, IBM, and Oracle have already bought many smaller companies. Other major trends in the software industry include outsourcing programming duties to low cost regions and the “open source” movement. China, India, and Russia have low cost computer scientists, ensuring further investment in these regions. The “open source” movement has gained momentum behind the Linux operating system. Open source refers to the practice of allowing free access to the building blocks of a computer program, which in turn multiplies the number of programmers who can work on building solutions around that program.

As discussed earlier, data centers are businesses that provide digital information storage for their customers usually in the form of websites. Data centers are composed of clusters of computers and network switching gear that allows efficient transfer of data over the Internet. These computers store the software programs and databases needed to run an Internet website. Often these Data Centers are referred to as “Telecom Hotels”.

Software firms are located in nearly every city in the United States. Major centers for the software and Internet industry are Seattle, San Jose, Washington D.C., Boston, Austin, New York, Raleigh, and Boulder.

### **Software Development**

#### **NAICS Definition**

- 511210 Software Publishers
- 541511 Computer Programming Services
- 541512 Computer Systems Design Services
- 541519 Computer Related Services

#### **Industry Employment**

- 2.8 million employed - US

#### **Wage Rates**

- \$29 an hour in the US

#### **Location Criteria**

- Educated workforce
- Access to capital
- Research incubator

**Requirements:** The software industry requires affordable office space, a well-trained workforce, and reliable utilities.

**Economic Conditions.** Software companies seek communities with a well-educated and creative workforce. Datacenters require significant telecommunications and energy infrastructure. Software employees are highly mobile. Quality of life is especially important to attracting and retaining experienced technical workers especially during periods of growth.

**Structural Assets.** Software firms require reliable utility service at affordable rates. Many industry firms will require access to a SONET ring and numerous T-1 lines. Software companies will also require high-end office space.

<b>Data Center</b>		
<b>Typical Requirements</b>		
	<b>Input</b>	<b>Details</b>
Activity	<b>Data Center</b>	
Size	125,000 sq. ft.	
Acres	15 acres	
Employees	60-80 employees	100% Admin (\$75k) 3 shifts / 7 days per week
Water	10,000 gallons / day	
Wastewater	10,000 gallons / day	
Electricity	2000 kw Demand 1.6 mil kwh per month	does not need to be treated dual substations, separate grids/loops, redundant
Natural Gas	10,000 Therms a year	
Telecom	SONET ring access	
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$20 million	
Equipment	\$20 million	
Other	Redundant Utilites Minimal natural disaster risk	
<b>Source: AngelouEconomics</b>		

**Workforce.** Software and Internet companies require computer scientists, computer engineers, and technicians. Software firms need for well-trained workers will drive them to areas where they can meet recruitment needs.

**SIC 737 - Computer Programming, Data Processing, and Other Computer Related Services**

Source: Occupational Employment Statistics, Bureau of Labor Statistics 2000

SOC Code Number	Occupation Title	Employment Estimates		Wage Estimates	
		Employment	Percent of Total	Mean Hourly	Mean Annual
00-0000	<b>Industry Total</b>	1,987,460	100.00%	\$28.72	\$59,740
11-0000	<b>Management Occupations</b>	223,520	11.25%	\$44.55	\$92,660
15-0000	<b>Computer and Mathematical Occupations</b>	968,950	48.75%	\$31.59	\$65,710
15-1021	Computer Programmers	207,680	10.45%	\$32.24	\$67,060
15-1031	Computer Software Engineers, Applications	183,620	9.24%	\$36.15	\$75,190
15-1032	Computer Software Engineers, Systems Software	104,130	5.24%	\$36.23	\$75,350
15-1041	Computer Support Specialists	146,940	7.39%	\$21.41	\$44,520
15-1051	Computer Systems Analysts	144,330	7.26%	\$33.11	\$68,880
15-1061	Database Administrators	26,140	1.32%	\$32.57	\$67,750
15-1071	Network and Computer Systems Administrators	58,800	2.96%	\$29.02	\$60,360
15-1081	Network Systems and Data Communications Analysts	35,200	1.77%	\$31.08	\$64,640
43-0000	Office and Administrative Support Occupations	364,860	18.36%	\$14.10	\$29,330

**Research & Development.** Due to the relatively low cost of computers, computer science development can occur nearly anywhere. Many significant developments are produced by hobbyists and entrepreneurs as well as by universities and corporations. Due to the large amount of proprietary information involved software firms keep all R&D in house. Microsoft, for example, has never revealed the source code for its Windows operating system effectively suppressing any outside research.

**Cost of Doing Business.** Software and Internet companies' primary costs are computer and networking equipment, and employee salaries. Electricity and rental space are also a primary concern of datacenters. The Internet makes software distribution very cheap and efficient so transportation costs are not an issue. Software firms pay high wages, employ highly skilled workers, and are extremely low impact operations and as such they are highly coveted by communities.

## ENVIRONMENTAL TECHNOLOGIES

### Industry Overview

Environmental Technologies, also called conservation technologies, increase energy and natural resource efficiency; promote long-term economic growth, while reducing the environmental impact of development. Clean technologies such as energy-efficient appliances and motors, alternative fuel cars, and advanced steel production reduce energy and natural resource consumption while reducing pollution. These technologies also reduce the energy needs of companies and dependence on foreign oil. Additional benefits of these technologies are improved environmental quality, better quality of life and long-term economic growth.

The industry is primarily focused on water & wastewater treatment, air & noise pollution control, solid waste management, and environmental clean up. Environmental Technology Markets include: Manufacturing, Auto Industry, Utilities, Waste-to-energy Industries, and government.

The environmental technology industry is a dynamic industry with annual global sales of environmental goods and services estimated between \$400 and \$500 billion. The industry is reported to be growing at a rate of 6 percent annually. Major international corporations and world leaders agreed at the 2000 World Economic Forum in Switzerland that sustainable development is the most significant policy issue facing corporations worldwide and represents the greatest opportunity for growth. Conservation technology creates jobs in direct manufacturing of related technologies, research and development, system design, installation and maintenance, education and training, energy auditing and management, and consulting.

Over the next decade, developing nations will expand their economies fivefold, and the global population will double. Limited capital and rising world demand for environmentally responsible production and resource usage will stimulate demand for environmental technology products and services.

The global market for environmental products and services now exceeds the U.S. market in annual dollar value and is growing rapidly. This market is made up of two distinct parts: industrial markets where demand may be as sophisticated as in the U.S. and rapidly developing markets where environmental infrastructure for potable water, wastewater treatment, and solid waste disposal dominates.

Several sectors promise future growth. As populations rise, consumption and pollution of ground and surface water increases. The American Waster Water Works Association estimates the \$325 Billion will be needed over the next 20 years to meet U.S. water infrastructure needs. To meet this demand, much of the infrastructure will be privatized.

### Conservation Technologies

#### NAICS Definition

- 334413 Semiconductor related Manufacturing
- 3355999 Electrical Equipment Mnaufacturing
- 541380 Testing Laboratories
- 5417 Scientific Research and Development

#### Industry Profile

- 40k employed - US

#### Location Criteria

- Educated workforce
- Access to capital
- Research incubator
- High tech clusterr

The export markets for environmental technologies and services are promising. Eastern European nations struggle to meet EU standards and large increases in industrial output in China and India should further increase demand.

Rising growth in world population, consumption and the environmental impact, makes for Clean Energy to be another conservation technology with a promising future. Clean Energy is any technology that reduces the environmental impact per unit of emission or reduces the impact per output unit of any product or service that requires energy. Renewable energy is naturally regenerated and derived directly from the sun or indirectly for example by wind and organic matter.

Biomass technology uses organic matter such as plants that stores energy from the sun, to generate power, process into fuels or convert it into other chemicals or materials. Bioenergy ranks second to hydropower in renewable primary energy production in the U.S.

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, coconut and hemp. Biodiesel can also be made from recycled cooking oils from fast food restaurants. The Benefits of biodiesel are many including: it runs in any conventional, unmodified diesel engine, reduces Carbon Dioxide emissions by up to 100%, can be used alone or mixed in any amount with petroleum diesel fuel, is safe to handle and transport because it is biodegradable and non-toxic.

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. The current U.S. market for fuel cells is estimated to be over a \$1.2 billion and is expected to grow to nearly \$7 billion by the end of the decade. The advantage of fuels cells are: near zero emissions, few moving parts, and they can be used 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, important for remote sites. Transportation applications vary from wheel chairs, golf carts, cars, vans and busses. Fuel cell technology is being tested by every major automaker worldwide. The technology will first be introduced by large fleet vehicles such as busses and will spread to smaller vehicles as the fueling infrastructure 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 job for the U.S. economy by 2030.

**Requirements:** Conservation technology firms tend to locate in areas with both high tech employees and a manufacturing base. The industry employs many engineers and designers and has traditionally recruited them from more established industries.

**Economic Conditions.** Firms locate near metropolitan area with large high tech clusters. They often locate near a university to access to a talent pool of engineers and scientists. Start-up firms tend to locate in progressive communities that support their endeavors.

**Structural Assets.** These companies are little more than small labs that typically require flex industrial space with an office component. Access to area research facilities can be important to firms with the clean energy industry.

<b>Clean Energy Research Facility</b>		
<b>Typical Requirements</b>		
	<b>Input</b>	<b>Details</b>
Activity	<b>Conservation R&amp;D</b>	Conservation or clean energy research
Size	15,000 sf	1 story building
Acres	2-10 acres	
Employees	10-20 employees	
Water	1,500 gallons / day	
Wastewater	1,250 gallons / day	does not need to be treated
Electricity	500 kw Demand 250,000 kwh per month	dual substations, possibly on separate grids 70% average load factor
Investment (\$) (for a typical U.S. facility)		
Building/Land	\$2 million	
Equipment	\$5 million	
<b>Source: AngelouEconomics</b>		

**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 such many employees may be transfers from high tech companies who are familiar with a start-up environment.

**Selected Conservation Technology Occupations**

source: Occupational Employment Statistics, Bureau of Labor Statistics 2001

<b>Occupation</b>	<b>US Employment</b>	<b>Wage Estimate</b>	
		<b>Mean Hourly</b>	<b>Mean Annual</b>
Engineering Managers	214,760	\$42.74	\$88,900
Civil Engineers	205,370	\$28.09	\$61,000
Mechanical Engineers	204,310	\$29.54	\$63,530
Electrical and Electronics Drafters	39,300	\$19.27	\$43,200
Electro-Mechanical Technicians	42,130	\$18.34	\$39,890
Geoscientists	23,030	\$28.01	\$64,120
Materials Scientists	8,360	\$30.17	\$64,850

**Research & Development.** Industry firms are typically very small, averaging between 10-20 employees, and have limited resources. And 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.

**Cost of Doing Business.** High expenditures are required for salaries of scientists and highly skilled technical workers. Extensive research and development and testing are required. Companies must be keenly aware of domestic and international regulations. Many communities have attracted industry firms through environmental grants and tax credits that allow firms to operate with little incoming revenue.