

JOBs CREATION IN THE ENVIRONMENTAL INDUSTRY IN MINNESOTA AND THE UNITED STATES

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This report is a project of the Jobs and Environment Initiative, a pilot program of research, policy analysis and public education. The Minnesota report is part of a series of state-based and national reports on current jobs creation in the environmental industry, including in manufacturing, and further jobs potential inherent in environmental management and stewardship. Other reports completed examine jobs creation and the environmental industry in Ohio, Michigan, and Wisconsin and are available on the above websites.

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TABLE OF CONTENTS

LIST OF TABLES	iv
LIST OF FIGURES	iv
EXECUTIVE SUMMARY	v
I. INTRODUCTION	1
II. BACKGROUND: THE U.S. ENVIRONMENTAL PROTECTION INDUSTRY AND RELATED JOBS	3
II.A. Emergence of the Environmental Protection Industry	3
II.B. Environmental Protection as a Recession Proof Industry	5
II.C. The Current Size and Structure of the Industry	6
II.D. Prospects for the Future	7
III. DEFINING AND ESTIMATING ENVIRONMENTAL JOBS	10
III.A. What Constitutes an Environmental Job?	10
III.B. The Types of Jobs Created in the Environmental Industry	12
III.C. The Jobs Distribution in Typical Environmental Companies	15
IV. THE MINNESOTA ECONOMY IN 2003	19
V. THE ENVIRONMENTAL INDUSTRY AND JOBS IN MINNESOTA	22
V.A. Summary of the Environmental Industry and Jobs in Minnesota	22
V.B. Environmental Jobs in Minnesota by Industrial Sector	22
V.C. Environmental Jobs in Minnesota by Occupation and Skill	25
V.D. The Environmental Industry as an Economic Driver for Minnesota	30

TABLE OF CONTENTS
(Continued)

VI.	SUMMARY PROFILES OF SELECTED MINNESOTA ENVIRONMENTAL COMPANIES	<u>33</u>
VI.A.	BARR Engineering Co.	33
VI.B.	Braun Intertec	36
VI.C.	Ecolab	37
VI.D.	ECONAR	38
VI.E.	ECOsmarte	39
VI.F.	MTVL Laboratories, Inc.	39
VI.G.	Pace Analytical Services, Inc.	41
VI.H.	STS Consultants	41
VI.I.	Summit Enviroolutions	42
VI.J.	Terra-Therm	43
VI.K.	TSI, Inc.	44
VI.L.	West Central Environmental Consultants	44
VI.M.	Wind Turbine Industries Corporation	45
VII.	OPPORTUNITIES IN MINNESOTA STATE GOVERNMENT PROGRAMS FOR ENCOURAGING ENVIRONMENT-RELATED JOBS	<u>47</u>
VII.A.	Governor's Initiatives	47
VII.A.1.	The Minnesota Sustainable Development Initiative	47
VII.A.2.	MPCA Governor's Forums	47
VII.A.3.	Governor's council on Workforce Development	48
VII.B.	State Commissions	48
VII.B.1.	Minnesota Environmental Quality Board	48
VII.B.2.	MPCA Citizens' Board	49
VII.C.	Environment and Natural Resources Trust Fund	49
VII.D.	Minnesota Renewable Hydrogen Initiative	50
VII.E.	Office of Environmental Assistance	52
VII.F.	The Minnesota Pollution Control Agency	54
VII.G.	Minnesota Business Subsidies Law	54
VII.H.	Hubert H. Humphrey Institute	55

TABLE OF CONTENTS
(Continued)

VIII. SUMMARY OF MAJOR FINDINGS	56
BIBLIOGRAPHY	60
APPENDIX: U.S. COMMERCE DEPARTMENT ESTIMATES OF THE ENVIRONMENTAL INDUSTRY IN MINNESOTA	70
ABOUT THE JOBS AND ENVIRONMENT INITIATIVE	75
ABOUT MANAGEMENT INFORMATION SERVICES, INC.	75
ABOUT THE BUILDING DIAGNOSTICS RESEARCH INSTITUTE, INC.	75
BIOGRAPHICAL INFORMATION	76

LIST OF TABLES

1.	Environmental Protection Expenditures and Jobs in the U.S. Economy, 1970 - 2020	3
2.	Typical Employee Profile of a 100-person Environmental Remediation Services Company, 2003	17
3.	Typical Employee Profile of a 250-person Wind Turbine Manufacturing Company, 2003	18
4.	Earnings by Industry of Employment in Minnesota and the U.S. in 2003	21
5.	Jobs in Minnesota in 2003, by Industry, Including Environmental Employment	23
6.	Environmental Jobs Generated in Minnesota in 2003, by Selected Occupations	26
7.	Summary of the Select Minnesota Environmental Companies Profiled	34
A.1.	U.S. Department of Commerce Estimates of the U.S. and Minnesota Environmental Industries, 1999	71
A.2.	U.S. Department of Commerce Estimates of the Minnesota Environmental Industry by Metropolitan Statistical Areas, 1999	72
A.3.	Pollution Abatement Costs and Expenditures Estimates for Minnesota and the U.S. From the Census MA200 Survey, 1999	73

LIST OF FIGURES

1.	The Environmental Job Spectrum	13
2.	Selected U.S. Jobs Created in 2003 by Environmental Expenditures	14

EXECUTIVE SUMMARY

Objective of the Report

The objective of this report is to examine and describe the environmental industry and its jobs impact and jobs creation potential in the state of Minnesota, and to provide national context on the U.S. environmental industry as a whole.

The relationship between jobs and the environment is important to examine, in view of the size of the environmental industry and because the jobs impact of environmental management has been at times controversial. The report aims to examine the “trade-off” between jobs and environmental protection and highlight specific examples of how the environmental industry in Minnesota and nationally has had, and could have, jobs benefits. Therefore, this report:

- Assesses the current size of the environmental industry and related jobs in the U.S. and the prospects for the future
- Analyzes the concept and definition of an “environmental job”
- Estimates the size and the industrial sector composition of the environmental industry in Minnesota in 2003
- Estimates the jobs created in Minnesota in 2003 by environmental protection and their importance to the state economy
- Estimates the occupation and skill levels of these jobs
- Identifies a sample of typical environmental companies in Minnesota, the products and services they provide, their geographic location, and the number of jobs they create
- Identifies state government initiatives and policies that could facilitate further development of environmental industries in Minnesota
- Discusses how encouraging environmental and related industries in Minnesota could form an integral part of state economic development strategy
- Presents findings and conclusions

Findings -- The National Context

MISI has extensive experience analyzing the environmental industry. We have found that, over the past four decades, protection of the environment has grown rapidly to become a major sales-generating, profit-making, job-creating U.S. industry. Yet, we have also found that the importance of the environmental industry to the U.S. economy is still not fully understood by policy makers or the public at large.

MISI estimates that in 2003 protecting the environment generated \$301 billion in total industry sales, \$20 billion in corporate profits, 4.97 million jobs, and \$45 billion in Federal, state, and local government tax revenues. Moreover, the industry transcends traditional understanding of "green jobs," often wrongly assumed to be jobs for people to plan trees or clean up toxic waste sites or pollution accidents. (All estimates of the size of the environmental industry and jobs impact rely upon definitions used. MISI estimates rely upon the definitions in Chapter III.)

The environmental industry will continue to grow for the foreseeable future. MISI forecasts that in the U.S. real expenditures (2003 dollars) will increase from \$301 billion in 2003 to \$357 billion in 2010, \$398 billion in 2015, and \$442 billion in 2020; environmental employment will increase from 4.97 million jobs in 2003 to 5.39 million jobs in 2010, 5.76 million jobs in 2015, and 6.38 million jobs in 2020.

Environmental protection created nearly five million jobs in the U.S. in 2003, and these were distributed widely throughout all states and regions in the U.S. The vast majority of the jobs created by environmental protection are standard jobs for accountants, engineers, computer analysts, clerks, factory workers, truck drivers, mechanics, etc., and most of the persons employed in these jobs may not even realize that they owe their livelihood to protecting the environment.

Environmental protection is a large and growing industry in Minnesota, and MISI estimates that in 2003:

- Sales of the environmental industries in Minnesota totaled \$5.1 billion.
- The number of environment-related jobs totaled more than 92,000.
- The environmental industry in Minnesota comprised 2.6 percent of gross state product.
- Minnesota environmental industries accounted for 1.7 percent of the sales of the U.S. environmental industry.

- With 1.7 percent of the nation's population, employment earnings in the Minnesota manufacturing sector account for 2.4 percent of manufacturing earnings nationally.
- Environment-related jobs comprised 3.5 percent of Minnesota employment.
- Environment-related jobs in Minnesota comprised 1.8 percent of the total number of environment-related jobs in the U.S.
- Environment-related employment in the state has been increasing in recent years between one and two percent annually.

Most of the environmental jobs in Minnesota are in the private sector, and these are heavily concentrated in several sectors, including manufacturing, professional, scientific, and technical services, and educational services.

Types of Environmental Jobs in Minnesota

Environmental jobs in Minnesota are widely distributed through all occupations and skill levels, and requirements for virtually all occupations are generated by environmental expenditures. Thus, in Minnesota as in the U.S. generally, the vast majority of the jobs created by environmental protection are standard jobs for all occupations.

Nevertheless, we found that, in Minnesota, the importance of environmental expenditures for jobs in some occupations is greater than for others. For some occupations, such as environmental scientists and specialists, environmental engineers, hazardous materials workers, water and liquid waste treatment plant operators, environmental science protection technicians, refuse and recyclable material collectors, and environmental engineering technicians, virtually all of the demand in Minnesota is created by environmental protection activities.

However, in occupations not traditionally identified as environment-related, a significant share of the jobs is also generated by environmental protection. While, on average, environment-related employment in Minnesota comprises only 3.5 percent of total employment, in 2003 environmental protection generated jobs for a larger than average share of many professional, scientific, high-tech, and skilled workers in the state.

Our survey of existing environmental companies in Minnesota revealed a wide range of firms, and they are located throughout the state, in major urban centers, suburbs, small towns, and rural areas; they range in size from small firms of 10 employees to large firms employing thousands; they are engaged in a wide variety of activities, including remediation, manufacturing, testing, monitoring, analysis, etc.; and they include some of the most sophisticated, high-tech firms in the state. A number of

these firms have created significant numbers of new jobs over the past six months, including jobs in the manufacturing sector – at a time when Minnesota has been concerned about jobs, especially in manufacturing.

Salience of the Jobs-Environment Link in Minnesota at the Policy Level

We identified a number of existing state initiatives and interventions that could be used to assist the environmental industry and create jobs.

Key Points

First, contrary to common perception, most of the jobs created by environmental protection – both nationwide and in Minnesota -- are *not* for “environmental specialists.” The vast majority of the jobs created by environmental protection are standard jobs for a wide variety of occupations.

Second, as noted above, environmental jobs in Minnesota are concentrated within a number of sectors, including manufacturing and professional, scientific, and technical services. This is significant because Minnesota is one of the most manufacturing-intensive states in the nation and is currently very concerned with preserving, modernizing, and expanding its manufacturing base. Environmental protection offers a means of doing this, and investments in the environment can greatly assist Minnesota’s manufacturing sector.

Third, since the late 1960s, protection of the environment has grown rapidly to become a major U.S. industry. Protection of the environment and remediation of environmental problems will continue to be a growing and profitable industry in the U.S., and astute business and labor leaders, government officials, and policymakers in Minnesota – and in other states – should be cognizant of this.

Fourth, all regions and states benefit substantially from environmental expenditures. Many of the economic and employment benefits flow directly to states – such as Minnesota -- whose policymakers and government officials often see only costs and disadvantages from environmental protection. Yet, these policymakers and the public should welcome information that environmental protection offers substantial opportunities for economic development and job creation.

Fifth, investments in environmental protection will create large numbers of jobs for highly skilled, well-paid, technical workers, including college-educated professionals, many with advanced degrees, requiring advanced training and technical expertise, many of them in the manufacturing sector.

These are the kinds of jobs that states seek to attract and which provide the foundation for entrepreneurship and economic growth. These types of jobs are also a prerequisite for a prosperous, middle class society able to support state and local governments with tax revenues,

Sixth, but perhaps most important, this study demonstrates that environmental protection can form an important part of a strategy for Minnesota based on attracting and retaining professional, scientific, technical, high-skilled, well paying jobs, including manufacturing jobs. There is no inherent institutional impediment in Minnesota to using existing state economic assistance policies and incentives to facilitate and encourage development of the environmental industry in the state, especially given that industry's strong pre-existing economic traction.

Contents of the Report

- Chapter II -- History and current status of the U.S. environmental industry; provides industry and job forecasts through 2020
- Chapter III -- Definition of environmental jobs; illustrates the typical composition of occupational employment within environmental companies
- Chapter IV -- The current state of the Minnesota economy and labor market
- Chapter V -- Size, employment, and industrial and occupational composition of the environmental industry in Minnesota
- Chapter VI – Profiles of typical environmental firms in the state
- Chapter VII -- Minnesota Policy Context, Opportunities and Gaps; identifies state programs that could be used to assist environmental firms
- Chapter VIII – Summary of major findings

I. INTRODUCTION

The nexus between jobs and the environment will increase in importance in the future as the U.S. and other nations strive to meet pressing need for employment and income generation, while also confronting the challenges of multi-source pollution, energy waste and inefficiency, traffic congestion, climate change, scarcity of potable and usable water, electric grid reliability, etc. The prevailing view among economic development proponents has been that environmental protection is negative for jobs and employment. However, this view is not supported by empirical evidence. In addition, it is possible to estimate and document the overlooked size of the environmental industry in the U.S. as a whole, and at the state level, and the jobs this industry has protected and created.

The challenge -- and opportunity -- is to begin to shift the debate from "trade-offs" between jobs and environmental protection to a new level of congruent and integrated environmental and economic policy. This report provides information on jobs creation among individual environmentally-related companies as recently as May 2004, and we also note the results of prior research on the environmental industry over time.

Here we:

- Assess the current size of the environmental industry and related jobs in the U.S. and the prospects for the future
- Analyze the concept of an "environmental job"
- Estimate the size and the industrial sector composition of the environmental industry in Minnesota in 2003
- Estimate the jobs created in Minnesota in 2003 by environmental protection and their importance to the state economy
- Estimate the occupation and skill levels of these jobs
- Identify a sample of environmental companies in Minnesota, the products and services they provide, their geographic location, and the number of jobs created
- Identify state government programs that could be used to facilitate development of environmental industries in Minnesota

- Discuss how encouraging environment and related industries in Minnesota could form an integral part of state economic development strategy
- Summarize the major research findings

II. BACKGROUND: THE U.S. ENVIRONMENTAL PROTECTION INDUSTRY AND RELATED JOBS

II.A. Emergence of the Environmental Protection Industry

Contrary to general public perception and public policy understanding, since the late 1960s, protection of the environment has grown rapidly to become a major sales-generating, profit-making, job-creating industry. Expenditures in the U.S. for environmental protection (EP) have grown (in constant 2003 dollars) from \$39 billion per year in 1970 to \$301 billion per year by 2003 -- increasing more rapidly than GDP over the same period. As shown in Table 1:

- In 1970, environmental protection expenditures totaled \$39 billion (2003 dollars).
- In 1980, environmental protection expenditures totaled \$121 billion (2003 dollars).
- In 1990, environmental protection expenditures totaled \$204 billion (2003 dollars).
- In 2003, environmental protection expenditures totaled \$301 billion (2003 dollars).

**Table 1
Environmental Protection Expenditures and Jobs
In the U.S. Economy, 1970 - 2020**

	Expenditures (billions of 2003 dollars)	Jobs (thousands)
1970	\$39	704
1975	77	1,352
1980	121	2,117
1985	158	2,838
1990	204	3,517
1995	235	4,255
2003	301	4,974
2010	357	5,392
2015	398	5,756
2020	\$442	6,377

Source: Management Information Services, Inc., 2004.

For comparison, it is interesting to note that if "EP" were a corporation, it would rank higher than the top of the Fortune 500. Also, for comparison, MISI's estimate of 2003 EP expenditures (\$301 billion) ranks it higher than the sales of \$259 billion for Wal-Mart, the largest corporation in the U.S.

Many companies, whether they realize it or not, owe their profits -- and in some cases their existence -- to EP expenditures.¹ Many workers, whether they realize it or not, would be unemployed were it not for these expenditures: In 2003 environmental protection created nearly five million jobs distributed widely throughout the nation. To put this into perspective, the size of environment-related employment is:

- Over ten times larger than employment in the U.S. pharmaceuticals industry
- Nearly six times larger than the apparel industry
- Almost three times larger than the chemical industry
- Fifty percent greater than employment in religious organizations
- Nearly half the employment in hospitals
- Almost one-third the size of the entire construction industry

Further, while MISI forecasts that the rate of growth in expenditures for environmental protection will decline over the next decade, real expenditures will continue to increase substantially.²

Are Environmental Jobs “Productive?”

It is sometimes suggested that investments in environmental protection are "nonproductive," i.e., expenditures lots of money on anything -- for example, building pyramids in the desert – would stimulate industry and create jobs. However, environmental protection is hardly "make work." EP investments build tangible and intangible long-term assets, not the least among them is a healthier, safer, cleaner, and more livable environment nationwide and in Minnesota -- an important recruiting factor in attracting the new "high tech" firms strongly courted by all states, not to mention residents, tourists, high-visibility events, and investors.

Environmental protection is an exemplary public good, and according to the Harris pollsters this issue has consistently enjoyed wider and stronger public support

¹In this report, "expenditures" refers to all public and private spending in the environmental sector (EP spending) and is used interchangeably with "sales."

²The rate of growth declines because the total size of the industry continues to increase.

than virtually any other issue over the past three decades. Investments in plant and equipment which produce this strongly desired public good are as productive as those that produce automobiles, television sets, golf balls, or defense systems that we are willing to pay for directly in the prices of products or indirectly through the government.

It is also sometimes alleged that environmental standards penalize certain states and regions at the expense of others. While this can be sometimes true, the point has been overused. MISI's research does not support the contention that economic hardship in a given state or region can be blamed on "unreasonable" environmental laws. Further, MISI has found that the overall relationship between state environmental policies and economic/job growth is positive, not negative.

It is significant that many environmental economic and employment benefits flow directly to states whose policymakers and government officials often see only costs and disadvantages from environmental protection.³ Funds expended on pollution abatement and control programs are not wasted, but, rather, investments in environmental protection contribute as much to the well-being and labor markets of the nation and individual states as money spent on other goods competing for scarce private and public funds. All regions and states benefit substantially, and many states benefit at greater than proportionate rates from U.S. EP expenditures.

Over the past three decades protecting the environment has been a major public priority. The legislation enacted has significantly improved the nation's environment and has set in motion ongoing programs that will have significant effects on the nation's environment, economy, and job market well into the 21st century. Importantly, protection of the environment and remediation of environmental problems will continue to be a growing and profitable industry in the U.S. Astute businessmen, labor leaders, government officials, and policymakers should become more cognizant of opportunities inherent in the environmental industry.

II.B. Environmental Protection as a Recession Proof Industry

Expenditures to protect the environment has been one of the most rapidly and consistently growing "recession proof" industries in the economy for the past three decades, and real EP expenditures (2003 dollars) increased from \$39 billion in 1970 to \$301 billion in 2003. This represents nearly an eight-fold increase in expenditures in barely more than three decades -- a sustained real average rate of growth of about eight percent per year over the period. This compares with an average annual rate of

³For example, in 1989 MISI assessed the economic and jobs impacts of acid rain control legislation and found that, contrary to what was then widely believed, such legislation would actually create 4,400 more jobs in Minnesota than it would imperil. See Roger H. Bezdek and Robert M. Wendling, "Acid Rain Abatement Legislation – Costs and Benefits," *International Journal of Management Science*, Vol. 17, No. 3 (1989), pp. 251-261. More recently, in a study of vehicle fuel efficiency standards, MISI found that – contrary to the common perception -- enhanced CAFE standards would create a large number of jobs (6,400) in Minnesota. See Roger H. Bezdek and Robert M. Wendling, "Potential Long-term Impacts of Changes in U.S. Vehicle Fuel Efficiency Standards," *Energy Policy*, Vol. 33, No. 3, pp. 407-419.

growth of GDP that averaged between two and three percent over the same period. That is, since the late 1960s, expenditures for pollution abatement and control has been increasing at a rate nearly three times as large as that of GDP.

As might be expected, this rate of growth has not been consistent. In the early 1970s, EP expenditures were increasing nearly 15 percent per year, by the late 1980s they were increasing at about seven percent annually, and by the late 1990s were increasing at about four percent annually. This is to be anticipated as the industry grew and matured -- but even the most recent growth rates of four percent are higher than the growth rate of GDP. In 1970, EP expenditures accounted for 0.9 percent of GDP, whereas by 2003 the U.S. was devoting about three percent of GDP to pollution control and abatement and related environmental programs.

More interesting, perhaps, is the "recession-proof" nature of this industry:

- In the late 1970s the U.S. economy was reeling from inflationary shocks, record interest rates, energy crises, and anemic economic growth, but between 1975 and 1980 EP expenditures grew nearly 60 percent, from \$77 billion to \$121 billion.
- In the early 1980s the U.S. experienced the most severe economic recession in half a century, with many industries experiencing depression-level problems, but between 1980 and 1985 EP expenditures increased by \$37 billion -- 31 percent.
- During the early 1990s the U.S. experienced a relatively mild recession, with GDP declining one percent and unemployment increasing to 7.5 percent; nevertheless, between 1990 and 1995 EP expenditures increased from \$204 billion to \$235 billion -- 15 percent.
- Between 2000 and 2003, while U.S. economic and job growth was generally anemic, the EP industry expanded continuously, growing to \$301 billion.

However, MISI forecasts that the rate of growth of EP expenditures will gradually decline over the next decade, as the industry grows and matures.

II.C. The Current Size and Structure of the Environmental Industry and Jobs Created

As stated earlier, if "EP" were a corporation, it would rank higher than the top of the Fortune 500:

- MISI estimates that in 2003 EP expenditures totaled \$301 billion.
- In 2003, Wal-Mart, the largest U.S. corporation, had sales of \$259 billion.
- In 2003, the number two U.S. corporation, Exxon Mobil, had sales of \$213 billion, while the third-ranked corporation, General Motors, had sales of \$196 billion.

Clearly, providing the goods and services required for environmental protection has become a major U.S. industry with significant effects on the national economy and labor market and on those of individual states.⁴

MISI estimates that in 2003 protecting the environment generated:

- \$301 billion in total industry sales
- \$20 billion in corporate profits
- 4.97 million jobs
- \$45 billion in Federal, state, and local government tax revenues

II.D. Prospects for the Future

It is likely that the environmental industry will continue to grow for the foreseeable future:

- The environmental industry has grown and matured over the past four decades into a large, viable industry.
- Environmental processes and practices have been incorporated into most manufacturing and service industries.
- Pollution prevention is increasingly being utilized instead of “end of the pipe” pollution abatement remedies, and entire manufacturing process are being designed to limit environmental degradation from the beginning of the production process.

⁴All estimates of the size of the environmental industry rely critically on the exact definition of the industry. Since there is no official definition, estimates of the size of the environmental industry differ according to the source. In MISI's case, the definition of the industry includes human and environmental sustainability principles, and MISI's estimates thus include a broader range of environmental activities in the economy than some other definitions that have been developed.

- Over the years, a large number of environmental regulations have been enacted at the local, state, and Federal levels and will continue to generate requirements for environmental technology and services well into the future -- even in the unlikely event that no new environmental regulations are enacted.
- Environmental protection and regulation is strongly desired by the public, as verified in numerous public opinion polls conducted over the past 30 years.
- As the U.S. economy continues to grow, environmental problems resulting from urban sprawl, environmental degradation, energy consumption, increasing population, traffic congestion, mobile source pollution, and related problems will continue to increase the demand for environmental remediation.
- The public is increasingly being given the choice of purchasing environmentally benign products and “green” energy, and is responding favorably. Major corporations -- such as, for example, Ford and British Petroleum -- have noted this preference and are reorienting themselves as environmentally friendly companies.
- Problems that the U.S. and the rest of the world face in the future will likely increase the demand for environment-related technology, services, and labor. To cite the most obvious example, global warming presents a long-term challenge that is being addressed by various international and national legislative and mandatory regulatory initiatives such as the Kyoto protocol, the McCain-Lieberman bill in the U.S. Senate, and the Climate Stewardship Act in the U.S. House of Representatives. Also, individual states have begun to establish and institute climate action plans. Thus, mitigating climate change and reducing and managing greenhouse gas emissions will likely create demand for hundreds of billions of dollars of output from the environmental, energy efficiency, and renewable energy industries.

MISI anticipates that the environmental industry will continue to grow slightly faster than U.S. GDP over the coming decade, although this rate of growth will gradually diminish and will approach that of GDP. This is to be expected, since the industry has grown large and matured. Nevertheless, it will likely continue to be relatively “recession proof” because it is largely driven by statutes and regulations that must be complied with irrespective of the state of health of the nation’s economy.

Thus, Table 1 indicates that MISI forecasts EP to continue to be a growing, recession proof industry well into the 21st century, offering unique entrepreneurial, profit, and job opportunities for all types of businesses and workers. **MISI forecasts**

that in the U.S. real expenditures (2003 dollars) will increase from \$301 billion in 2003 to:

- \$357 billion in 2010
- \$398 billion in 2015
- \$442 billion in 2020

Environmental protection expenditures generate large numbers of jobs throughout all sectors of the economy and within many diverse occupations. As shown in Table 1, MISI forecasts that U.S. employment created directly and indirectly by EP expenditures will increase from 4.97 million jobs in 2003 to:

- 5.39 million jobs in 2010
- 5.76 million jobs in 2015
- 6.38 million jobs in 2020

Until the U.S. reaches a level of creating and managing a sustainable environment, the environmental protection industry will continue to outpace most other industries in the U.S. economy. Until then, the environmental industry is projected to grow at a rate 2-3 percent faster than many other industries.

These major economic opportunities have tended to go overlooked by economic development policymakers and government officials. Nevertheless, significant economic opportunities do exist and can be maximized and leveraged for broad social and environmental advantage.

III. DEFINING AND ESTIMATING ENVIRONMENTAL JOBS

III.A. What Constitutes an Environmental Job?

Ambiguities and Questions

As discussed in Chapter II, environmental protection created nearly five million jobs in the U.S. in 2003, and these were distributed widely throughout all states and regions within the U.S. But how many of these are “environmental jobs” or “green jobs?” More specifically, what constitutes an “environmental job?” While a definitive analysis of this important topic is outside the scope of this report, our review of the literature indicates that there is no rigorous, well-accepted definition of an environmental job. Rather, the definitions used are often loose and contradictory.

Clearly, an ecologist or an environmental engineer working in private industry or for an environmental advocacy organization would constitute an environmental job, as would an employee of the federal or a state environmental protection agency. However, there are ambiguities. For example, most people would agree that the positions in a firm that assembles and installs solar thermal collectors on residences and commercial office buildings for solar heating and solar hot water heating would be considered environmental jobs. But what about the jobs involved in producing those solar panels, especially if the factory involved used coal-based energy, one of the most controversial fossil fuels in terms of emissions, especially greenhouse gases? Here these manufacturing jobs are included as jobs created indirectly by environmental expenditures.

Most analysts would consider jobs in a recycling plant to be environmental jobs. But what if the recycling plant itself produces air pollution?

What about a factory in Minnesota that produces scrubbers for coal-fired power plants in Indiana? It seems clear that the jobs in the Minnesota factory should be considered green or environmental jobs, even though the user of the scrubbers in Indiana may cause pollution in Minnesota.

What about environmental engineers and environmental controls specialists working in a coal-fired power plant? What about the workers who produce environmental control equipment for the plant?

There are many manufacturing establishments throughout the United States that produce products for the automotive industry. Should those that produce components for fuel-efficient vehicles be considered part of the environmental industry, but not those that produce components for gas guzzlers? If so, is there any way to accurately distinguish between these? Should all factories producing catalytic converters be considered environmental jobs, even when some of these converters are used on low miles-per-gallon vehicles?

These relevant questions have, in fact, been generated by shifts in environmental policy itself. The early stages of the environmental movement in the 1970s and 1980s focused primarily on "end-of-the pipe" solutions. That is, the remedies and controls focused on cleaning or minimizing air, water, or solid waste pollutants after they had been produced. However, more recently during the 1980s and 1990s, environmental protection has gradually evolved to include entire processes, so, rather than cleaning up at the end of the pipe, the entire manufacturing and servicing processes are being designed to minimize the production of pollutants. Therefore, it is possible that very efficient processes designed to produce relatively little waste output could actually result in a decrease in the number of environmental jobs if these are defined strictly as "end of the pipe" jobs. A widespread program of energy efficiency, energy conservation, and demand-side management could ultimately result in less need for electric power to begin with and could result in the shutting down of a coal-fired electric power plant. While some may view such a shutdown as an environmental plus, many environmental jobs in that power plant involving pollution abatement and control would be in this case lost. Is this jobs loss desirable?

There is also the issue of how to take account of indirect job creation and how broadly or narrowly to define an indirect environmental job. For example, what of ancillary jobs created across the street from a factory producing solar collectors shortly after it opens, such as a doughnut shop, fast food restaurant, dry cleaner, etc. whose customers are primarily the workers at the renewable energy factory. Are these latter jobs also considered to be "indirect" green jobs or environmental jobs? We include such indirect jobs in this report, though we also conclude they are not "as green" as the direct jobs created.

While solid waste abatement and control is a major area of environmental concern, does this imply that all persons engaged in trash collection business are performing environmental jobs?

What part of the tourism industry constitutes "ecotourism," and are all jobs associated with ecotourism green jobs? Are then all the environmental externalities and costs produced by tourists, such as water use or waste, to be forgiven if these tourists are engaged in ecotourism?

Are all land management programs and all forms of alternative energy green industries, with all jobs counting as environmental jobs?

Definitions and Concepts Used in This Report

MISI considers that jobs can be considered to be "green" relative to the way the job was performed previously, i.e., in a production process, a change in technology that reduces waste emissions or energy consumption makes the jobs in that process "greener" than before. Still, can these jobs continue to be counted as environmental

jobs when newer technology makes available ways of furthering green production, e.g., further reducing energy consumption?

Two approaches can be used to address the relativity cited. The first approach targets environmental jobs, which could be new jobs or the greening of existing jobs, and defines a green job as one that emphasizes activities that contribute to environmentally sustainable development. A second approach focuses on the economy as a whole, defining a green economy as an economy that is environmentally sustainable, and environmental jobs as those jobs required to make an economy environmentally sustainable. Similarly, the term “environmental sector” is used to collectively describe companies involved in businesses designed to limit negative environmental impacts. However, this definition of green jobs as employment opportunities arising from expenditures on activities that support environmentally sustainable development, or which reduce negative impacts on the environment, also presents ambiguities.

Therefore, based on extensive research and literature review, MISI considers that environmental jobs are perhaps best understood when viewed in a continuum across a spectrum, with jobs that generate obvious environmental resource degradation or extraction at one end; a range of greener jobs involving clean production measures and technologies to reduce environmental impacts in the center, and the other end of the spectrum where jobs have a positive environmental impact (see Figure 1).

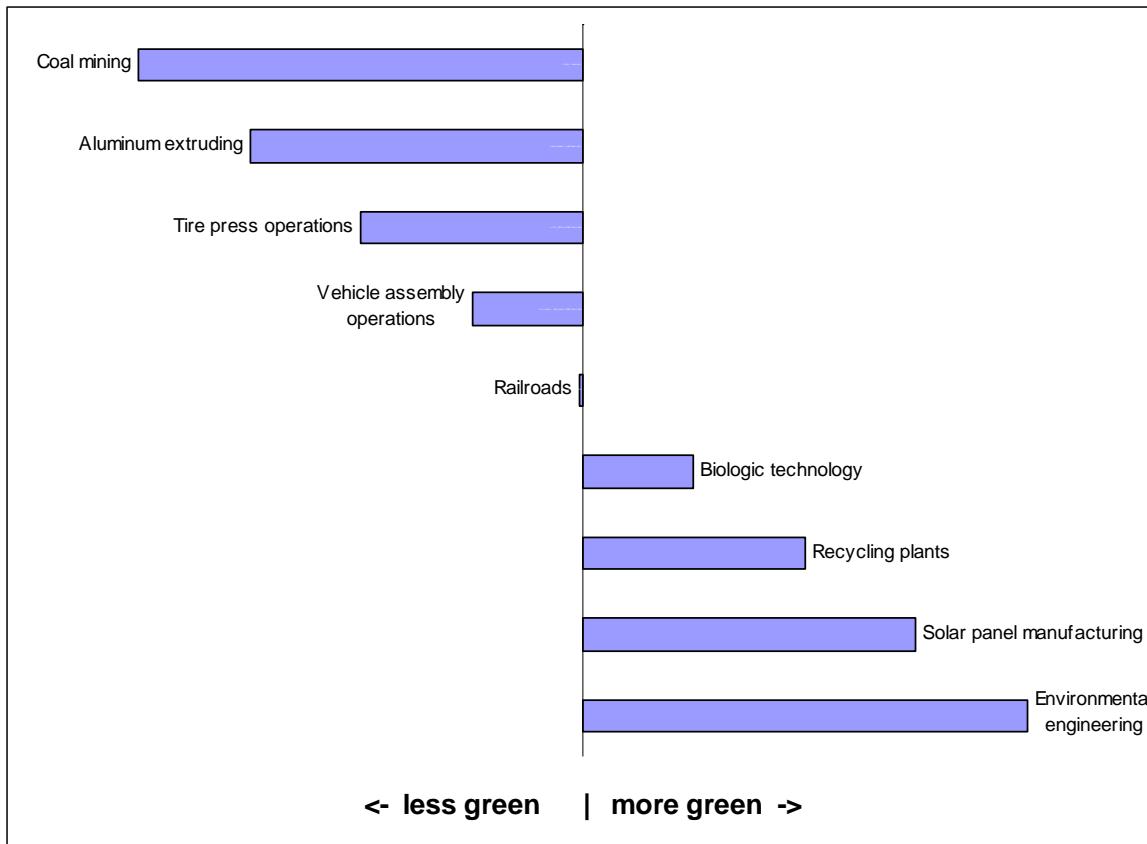
Using the spectrum concept, MISI defines environmental industries and green jobs as those which, as a result of environmental pressures and concerns, have produced the development of numerous products, processes, and services, which specifically target the reduction of environmental impact. Environment-related jobs include those created both directly and indirectly by environmental protection expenditures.

III.B. Types of Jobs Created in the Environmental Industry

There exists relatively little rigorous and comprehensive research addressing the practical relationship between environmental protection and existing jobs or future job creation. Even some research in this area sponsored by environmental organizations is off the mark, in that it has tended to emphasize jobs creation in classically green activities, such as environmental lawyers or workers in recycling plants.

However, while these jobs certainly count as jobs related to the environment, MISI's data suggests that the classic environmental job constitutes only a small portion of the jobs created by environmental protection. The vast majority of the jobs created by environmental protection are standard jobs for accountants, engineers, computer analysts, clerks, factory workers, truck drivers, mechanics, etc. In fact, most of the persons employed in these jobs may not even realize that they owe their livelihood to protecting the environment.

Figure 1
The Environmental Job Spectrum

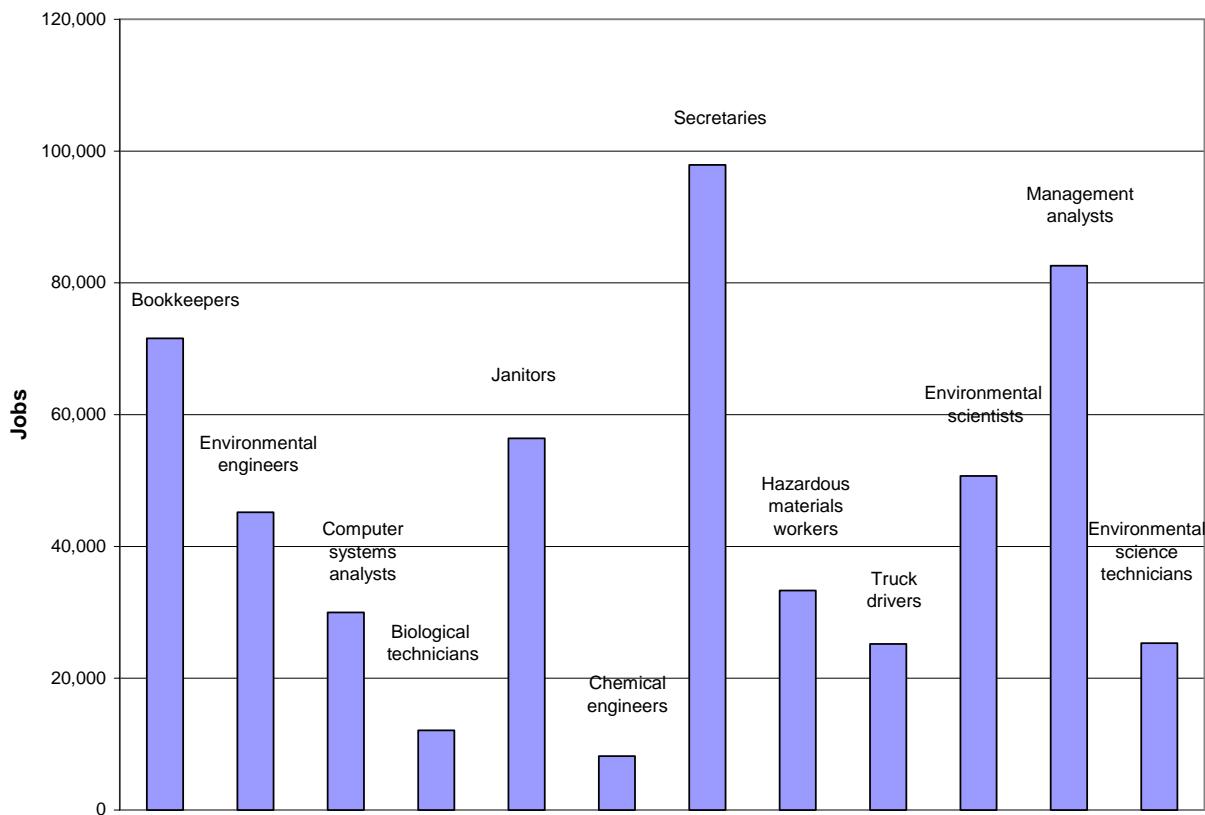


Source: Management Information Services, Inc., 2004.

For example, as illustrated in Figure 2, in the U.S. in 2003, environmental protection created:

- More jobs for secretaries (97,900,) than for environmental scientists (50,700).
- More jobs for management analysts (82,600) than for environmental engineers (45,200).
- More jobs for bookkeepers (71,600) than for hazardous materials workers (33,300).
- More jobs for janitors (56,400) than for environmental science technicians (25,000).

Figure 2
Selected U.S. Jobs Created in 2003 by Environmental Expenditures



Source: Management Information Services, Inc., 2004.

- More jobs for computer systems analysts (30,000) than for chemical engineers (8,200)
- More jobs for truck drivers (25,200) than for biological technicians (12,100)

More generally, arguments stressing the economic benefits and job creation resulting from environmental protection and clean energy initiatives are not currently being made in a rigorous manner which disaggregates these benefits to a level of detail that is meaningful to policymakers. The level of detail required is at the sector, industry, state, city, and county level, and the jobs created have to be identified by industry, category, skill, and specific occupation at the state and local level. This report provides data at such levels of detail.

III.C. The Jobs Distribution in Typical Environmental Companies

There are many thousands of environmental companies located throughout the United States and they generate jobs for nearly five million workers in virtually every community. These firms:

- Range from the very small one or two person “mom and pop” shops to very large firms employing thousands of workers.
- Employ workers at all levels of skills, from the most basic and rudimentary to the very high skilled technical and professional
- Include environmental service firms and manufacturing firms
- Include those whose market is local, those whose market is state and regional, those whose market is national, and those whose market is international.
- Face the same problems, challenges, and opportunities as other companies

Given the wide diversity in the size, function, and technologies of environmental companies, it is impossible to estimate the job profile of the “average” environmental firm. However, it is possible to identify the jobs and earnings profiles of typical types of firms involved in environment-related areas of work. Tables 2 and 3 illustrate this:

- Table 2 shows the 2003 occupational job distribution and employee earnings of a typical environmental remediation services company.
- Table 3 shows the 2003 occupational job distribution and employee earnings of a typical wind turbine manufacturing company.

These tables illustrate the points made above.

First, firms working in the environmental and related areas employ a wide range of workers at all educational and skills levels and at widely differing earnings levels.

Second, in environmental companies, many of the employees are not classified as “environmental specialists.” For example, even in the environmental remediation services firm profiled in Table 2, most of the workers are in occupations such as laborers, clerks, bookkeepers, accountants, maintenance workers, cost estimators, etc. All of these employees owe their jobs and livelihoods to environmental protection, but, in general, they perform the same types of activities at work as employees in firms that have little or nothing to do with the environment.

This is illustrated even more forcefully in Table 3. The occupational job distribution of a typical wind turbine manufacturing company differs relatively little from that of a company that manufactures other products. Thus, the production of wind turbines and wind turbine components requires large numbers of engine assemblers, machinists, machine tool operators, mechanical and industrial engineers, welders, tool and die makers, mechanics, managers, purchasing agents, etc. These are “environmental” workers only because the company they work for is manufacturing a renewable energy product. Importantly, with the current national angst concerning the erosion of the U.S. manufacturing sector and the loss of U.S. manufacturing jobs, it is relevant to note that many environmental and renewable energy technologies are growing rapidly.⁵ In at least some states, these types of firms can help revitalize the manufacturing sector and provide the types of diversified, high-wage jobs that all states seek to attract.

⁵For example, windpower is the most rapidly growing source of electrical power in the world.

Table 2
Typical Employee Profile of a 100-person
Environmental Remediation Services Company, 2003

Occupation	Employees	Earnings
Hazardous Materials Removal Workers	22	\$36,204
Septic Tank Servicers and Sewer Pipe Cleaners	8	30,419
Construction Laborers	7	32,382
First-Line Supervisors/Managers of Construction/Extraction	5	50,673
Truck Drivers, Heavy and Tractor-Trailer	5	33,044
General and Operations Managers	3	86,258
Laborers and Freight, Stock, and Material Movers	2	21,620
Truck Drivers, Light Or Delivery Services	2	27,437
Office Clerks	2	23,384
Refuse and Recyclable Material Collectors	2	26,796
Insulation Workers	2	32,256
Secretaries (except Legal, Medical, and Executive)	2	25,998
Bookkeeping, Accounting, and Auditing Clerks	2	31,217
Plumbers, Pipefitters, and Steamfitters	1	41,202
Executive Secretaries and Administrative Assistants	1	36,729
Maintenance and Repair Workers	1	30,849
Environmental Engineering Technicians	1	36,939
Operating Engineers and Other Const. Equip. Operators	1	40,520
First-Line Supervisors/Managers of Office/Administrative	1	47,576
Chief Executives	1	116,435
Construction Managers	1	73,994
Cleaners of Vehicles and Equipment	1	21,704
Cost Estimators	1	56,753
Janitors and Cleaners	1	25,746
Environmental Engineers	1	69,930
Industrial Truck and Tractor Operators	1	27,741
Carpenters	1	38,588
Construction and Maintenance Painters	1	33,296
Accountants and Auditors	1	53,865
Dispatchers (except Police, Fire, and Ambulance)	1	29,537
Water and Liquid Waste Treatment Plant and System Operators	1	31,049
First-Line Supervisors/Managers of Transportation Operators	1	46,914
Sales Representatives, Wholesale and Manufacturing	1	42,683
Customer Service Representatives	1	30,366
First-Line Supervisors/Managers of Mechanics and Repairers	1	49,088
Environmental Scientists and Specialists	1	62,003
Receptionists and Information Clerks	1	22,775
Environmental Science and Protection Technicians	1	44,867
Other employees	12	47,422
Employee Total	100	\$39,621

Source: Management Information Services, Inc., 2004.

Table 3
Typical Employee Profile of a 250-person
Wind Turbine Manufacturing Company, 2003

Occupation	Employees	Earnings
Engine and Other Machine Assemblers	31	\$33,359
Machinists	27	37,191
Team Assemblers	16	27,668
Computer-Controlled Machine Tool Operators	12	37,254
Mechanical Engineers	10	65,772
First-Line Supervisors/Managers of Production/Operating	10	54,705
Inspectors, Testers, Sorters, Samplers, and Weighers	8	37,202
Lathe and Turning Machine Tool Setters/Operators/Tenders	6	36,729
Drilling and Boring Machine Tool Setters/Operators/Tenders	4	36,509
Welders, Cutters, Solderers, and Brazers	4	36,530
Laborers and Freight, Stock, and Material Movers	4	28,466
Maintenance and Repair Workers	4	41,318
Tool and Die Makers	4	40,047
Grinding/Lapping/Polishing/Buffing Machine Tool Operators	4	31,899
Multiple Machine Tool Setters/Operators/Tenders	4	37,517
Industrial Engineers	3	64,659
Industrial Machinery Mechanics	3	42,315
Engineering Managers	3	99,404
Shipping, Receiving, and Traffic Clerks	3	29,516
General and Operations Managers	3	110,702
Industrial Production Managers	3	85,512
Industrial Truck and Tractor Operators	3	31,416
Purchasing Agents	3	51,702
Cutting/Punching/Press Machine Setters/Operators/Tenders	3	28,907
Production, Planning, and Expediting Clerks	3	41,601
Milling and Planing Machine Setters/Operators/Tenders	3	37,380
Mechanical Drafters	2	44,090
Customer Service Representatives	2	36,036
Bookkeeping, Accounting, and Auditing Clerks	2	32,760
Office Clerks, General	2	27,227
Sales Representatives, Wholesale and Manufacturing	2	50,757
Janitors and Cleaners	2	28,476
Sales Engineers	2	66,591
Accountants and Auditors	2	54,873
Tool Grinders, Filers, and Sharpeners	2	40,520
Executive Secretaries and Administrative Assistants	2	39,638
Mechanical Engineering Technicians	2	46,767
Electricians	2	45,570
Other employees	48	45,969
Employee Total	250	\$42,726

Source: Management Information Services, Inc., 2004.

IV. THE MINNESOTA ECONOMY IN 2003

The Minnesota economy remained strong in 2003 despite some setbacks with employment. Personal income rose at least 3.0 percent annually from 2001 to 2003, exceeding the U.S. average in each year. Gross state product increased steadily over the period, surpassing \$200 billion for the first time in 2003, and the state's contribution to national GDP continues to increase and reached 1.9%. Population is estimated to have grown steadily since the 2000 census, increasing 2.5 percent over the period, slightly lower than the 3.0-percent national increase. Minnesota passed the 5-million mark in population in 2001 and is now the 21st largest state based on population.

The civilian labor force grew by around 10,000 from 2002 to 2003, reaching an all-time monthly high of 2,929,000 by the end of 2003. However, state employment did not keep pace with the growth in the civilian labor force throughout the year and unemployment reached 151,500. The state unemployment rate increased from 4.8 percent to 5.2 percent during 2003, but by year's end the rate still remained a half-percentage point lower than the national average of 5.7 percent.

The Minnesota economy is strongly grounded in manufacturing and knowledge-based high-tech industries; for example:

- Minnesota is ranked as one of the nation's top seven technology states.⁶
- Minneapolis-St. Paul has been ranked as the world's most "knowledge-competitive" region.⁷
- Minnesota is one of the most manufacturing-intensive states in the nation, and over the past decade manufacturing employment increased in the state by four percent, compared to a decrease of nine percent nationwide.
- Minnesota's exports of manufactured products total \$10 billion annually, and have increased 12 percent since 1997.
- The state is a major exporter of computers and electronics, machinery, medical products, transportation equipment, chemicals, electrical equipment, and fabricated metal products.
- The University of Minnesota ranks among the top three public research universities in the U.S.

⁶Minnesota Department of Employment and Economic Development, *Positively Minnesota*, 2004.

⁷Ibid.

- The state has the highest labor force participation rate in the nation.
- Minnesota has the nation's highest percentage of high school graduates and ranks eighth highest in college graduates.

Table 4 shows the earnings by industry of employment in Minnesota and how these compare to the U.S. averages. This table shows that Minnesota ranks relatively low with respect to sectors such as mining, information, finance, insurance, and real estate. However, the salient feature illustrated in this table is the continuing importance in Minnesota of manufacturing. Specifically:

- With 1.7 percent of the nation's population, employment earnings in the Minnesota manufacturing sector account for 2.4 percent of manufacturing earnings nationally.
- More important, more than 15 percent of every dollar earned in the state is earned by employees in the manufacturing sector – compared to 12.7 percent nationally.
- In terms of earnings, manufacturing is the largest sector in the Minnesota economy
- The Minnesota/U.S. index for manufacturing is 119, higher than for any other sector except wholesale trade.

Manufacturing is thus a linchpin of the Minnesota economy, and Minnesota has a large manufacturing sector.

The second-largest sector based on employment earnings is the public administration sector comprised of state, local and federal government employees, accounting for 14 percent. The third largest sector is health care and social assistance.

Table 4
Earnings by Industry of Employment in Minnesota and the U.S. in 2003

	Minnesota (mill.\$)	Minnesota Share of U.S.	Minnesota Share of Earnings	U.S. Share of Earnings	Minnesota Index
Personal Income	174,449	1.9%	-	-	-
Agriculture, Forestry, Fishing and Hunting	1,305	1.6%	0.9%	1.1%	82
Mining	415	0.7%	0.3%	0.8%	36
Utilities	1,313	1.8%	0.9%	1.0%	93
Construction	8,728	2.0%	6.3%	6.1%	103
Manufacturing	21,091	2.4%	15.2%	12.7%	119
Wholesale Trade	9,128	2.5%	6.6%	5.2%	126
Retail Trade	8,905	1.9%	6.4%	6.8%	94
Transportation and Warehousing	4,916	2.1%	3.5%	3.3%	107
Information	3,734	1.5%	2.7%	3.6%	74
Finance and Insurance	11,909	2.2%	8.6%	7.6%	112
Real Estate and Rental and Leasing	3,027	1.6%	2.2%	2.7%	80
Professional, Scientific, and Technical Services	10,942	1.7%	7.9%	9.2%	85
Management of Companies and Enterprises	5,880	4.0%	4.2%	2.1%	202
Administrative/Support/Waste Management/Remediation Services	3,852	1.5%	2.8%	3.5%	78
Educational Services	1,509	1.6%	1.1%	1.3%	83
Health Care and Social Assistance	14,510	2.2%	10.5%	9.4%	111
Arts, Entertainment, and Recreation	1,295	1.7%	0.9%	1.1%	87
Accommodation and Food Services	3,030	1.6%	2.2%	2.7%	81
Other Services	4,296	2.0%	3.1%	3.0%	102
Public Administration	19,041	1.6%	13.7%	16.5%	83

Source: Management Information Services, Inc., 2004.

V. THE ENVIRONMENTAL INDUSTRY AND JOBS IN Minnesota

V.A. Summary of the Environmental Industry and Jobs in Minnesota

MISI estimates that in 2003:

- Sales of the environmental industries in Minnesota totaled \$5.1 billion.
- The number of environment-related jobs totaled more than 92,000.
- The environmental industry in Minnesota comprised 2.6 percent of gross state product.
- Minnesota environmental industries accounted for 1.7 percent of the sales of the U.S. environmental industry.
- Environment-related jobs comprised 3.5 percent of Minnesota employment.
- Environment-related jobs in Minnesota comprised 1.8 percent of the total number of environment-related jobs in the U.S.
- Environment-related employment in the state has been increasing in recent years between one and two percent annually.

V.B. Environmental Jobs in Minnesota by Industrial Sector

Table 5 shows the industrial distribution of total employment and of environmental employment in Minnesota in 2003.

Comparison of the industrial sector distribution of environment-related jobs in Minnesota with that of total employment in the state is instructive. A significant portion of the environmental jobs is in the public administration sector which, given the public nature of environmental protection, is to be expected. However, most of the environmental jobs in Minnesota are in the private sector, and focusing on these reveals that they are heavily concentrated in several sectors. Of particular note is that the private sector environmental industry in Minnesota is more manufacturing intensive than other average private sector activity in the state:

Table 5
Environmental-Related Jobs in Minnesota in 2003, by Industry

Industry	Establishments	Total Employment	Environmental Employment	Environmental Jobs (percent)
Agriculture, Forestry, Fishing and Hunting	500	800	86	10.7
Mining	149	5,200	515	9.9
Utilities	289	12,000	2,902	24.2
Construction	15,835	125,200	4,497	3.6
Manufacturing	7,492	344,300	11,974	3.5
Wholesale Trade	9,076	127,800	2,151	1.7
Retail Trade	21,033	301,700	1,778	0.6
Transportation and Warehousing	3,706	80,100	507	0.6
Information	2,596	62,600	1,751	2.8
Finance and Insurance	9,186	138,100	1,062	0.8
Real Estate and Rental and Leasing	5,774	37,900	527	1.4
Professional, Scientific, and Technical Services	14,449	118,200	12,922	10.9
Management of Companies and Enterprises	953	59,000	1,385	2.3
Administrative/Support/Waste Management/Remediation Services	6,866	117,300	7,622	6.5
Educational Services	1,489	48,400	1,676	3.5
Health Care and Social Assistance	12,820	318,300	2,099	0.7
Arts, Entertainment, and Recreation	2,570	36,900	247	0.7
Accommodation and Food Services	10,250	196,200	1,525	0.8
Other Services	15,284	118,900	1,330	1.1
Public Administration	-	402,400	35,545	8.8
State Total	140,319	2,651,300	92,100	3.5

Source: Management Information Services, Inc., 2004.

- 21 percent of private sector jobs in the environmental industry are in manufacturing, compared to 15 percent in manufacturing among all private sector industrial activities in Minnesota.
- 23 percent of private sector environmental jobs are in professional, scientific, and technical services, compared to five percent of all private sector jobs in the state.
- 14 percent of private sector environmental jobs are in administrative, support, and waste management services, compared to five percent of all private sector jobs in the state.
- Three percent of private sector environmental jobs are in educational services, compared to two percent of all private sector jobs in the state.

Conversely, there are relatively few private sector environmental jobs in other parts of the Minnesota economy:

- Three percent of private sector environmental jobs are in the retail trade sector, compared to 13 percent in retail trade among all private sector jobs in the state.
- Two percent of environmental jobs are in the finance and insurance sector, compared to six percent among all private sector jobs in the state.
- 3.7 percent of environmental jobs are in the health care and social service sector, compared to 14 percent among all private sector jobs in the state.
- One percent of environmental jobs are in the transportation and warehousing sector, compared to six percent among all private sector jobs in the state.

Assessing the portion of total state employment in each industrial sector accounted for by environmental jobs indicates that the 92,100 environmental jobs account for about 3.5 percent of the total 2.7 million jobs in Minnesota. However, this distribution is uneven among industry sectors:

- 24 percent of employment in the utilities sector consists of environmental jobs, primarily water, waste treatment, sanitation, and related facilities.
- Nearly nine percent of public administration employment in the state consists of environmental jobs.
- About 11 percent of Minnesota jobs in the professional, scientific, and technical services are environmental jobs.
- **About 3.5 percent of the state's manufacturing employment is environment-related** – equal to the 3.5 percent average for environmental jobs of total state employment.
- Only very small portions of total state employment in sectors such as food services, entertainment, real estate, finance, insurance, and retail trade are comprised of environmental jobs.

Key Observations on Jobs Distribution

The concentration of environmental jobs within certain industrial sectors is instructive and interesting.

While accounting for 3.5 percent of total state employment, the industrial sector composition of environmental employment is highly skewed in favor of certain sectors. For example, more than one-fifth of private sector environmental jobs are in manufacturing, compared to 15 percent of all private sector employment, and nearly one-fifth of private sector environmental jobs are in professional, scientific, and technical services, compared to only five percent of all private sector jobs in the state.

This indicates that investments in the environment will provide a greater than proportionate assist to Minnesota's manufacturing sector. As noted in Chapter IV, Minnesota is one of the most manufacturing-intensive states in the nation and is currently very concerned with preserving, modernizing, and expanding its manufacturing base. Table 5 indicates that the environmental industry can aid in this objective.

Similarly, **environmental investments generate, proportionately, nearly five times as many jobs in professional, scientific, and technical services as the state average.** Jobs in this sector are the high-skilled, high-wage, technical and professional jobs that Minnesota – and other states – seeks to attract and retain. Table 5 indicates that investments in environmental protection can be of considerable assistance here.

V.C. Environmental Jobs in Minnesota by Occupation and Skill

Environmental employment in Minnesota can be disaggregated by specific occupations and skills, and this information for 2003 for selected occupations is given in Table 6. This table illustrates that environmental jobs in Minnesota are widely distributed through all occupations and skill levels and, while the number of jobs created in different occupations differs substantially, employment in virtually all occupations is generated by environmental spending.

As noted in Chapter III, the vast majority of the jobs created by environmental protection are standard jobs for accountants, engineers, computer analysts, clerks, factory workers, truck drivers, mechanics, etc. and most of the persons employed in these jobs may not even realize that they owe their livelihood to protecting the environment. This is borne out in Table 6, which lists the jobs created by environmental protection in Minnesota in 2003 within selected occupations. This table shows that in 2003 environmental protection generated in Minnesota generated:

Table 6
Environmental Jobs Generated in Minnesota in 2003, by Selected Occupations

Occupation	Jobs
Accountants and Auditors	728
Biological Technicians	293
Bookkeeping and Accounting Clerks	847
Cashiers	1,545
Chemists	243
Computer and Information Systems Engineers	1,839
Conservation Scientists	382
Customer Service Representative	997
Electricians	303
Electronics Engineers	408
Environmental Engineers	427
Environmental Scientists and Specialists	1,324
Executive Secretaries and Administrative Assistants	771
Financial Managers	365
Foresters	283
Geoscientists	127
Graphic Designers	171
Hazardous Material Removal Workers	718
Industrial Engineers	151
Inspectors, Testers, and Sorters	246
Janitors and Cleaners	1,035
Machinists	265
Management Analysts	829
Marketing Managers	246
Mechanical Engineering Technicians	131
Medical Scientists, Except Epidemiologists	516
Occupational Health and Safety Specialists	112
Office Clerks	2,550
Refuse and Recyclable Material Collectors	2,323
Sales Representatives, Technical and Scientific Products	254
Stock Clerks	1,038
Security Guards	443
Training and Development Specialists	227
Truck Drivers	1,452
Water and Liquid Waste Treatment Plant Operators	1,538
Welders and Solderers	289

Source: Management Information Services, Inc., 2004.

- More jobs for machinists (265) than for geoscientists (127)
- More jobs for management analysts (829) than for environmental engineers (408)
- More jobs for executive secretaries (771) than for biological technicians (293)
- More jobs for truck drivers (1,452) than for environmental scientists and specialists (1,324)
- More jobs for office clerks (2,559) than for refuse and recyclable material collectors (2,323)
- More jobs for electricians (303) than for occupational health and safety specialists (112)
- More jobs for customer service representatives (997) than for medical scientists (516)
- More jobs for security guards (443) than for chemists (243)
- More jobs for financial managers (365) than for conservation scientists (382)
- More jobs for computer and information systems engineers (1,839) than for Hazardous material removal workers (718)

Thus, many workers in Minnesota are dependent on environmental protection for their employment, although they often would have no way of recognizing that connection unless it is brought to their attention.

The importance of environmental spending for jobs in some occupations is much greater than in others. For some occupations, such as environmental scientists and specialists, environmental engineers, hazardous materials workers, water and liquid waste treatment plant operators, environmental science protection technicians, refuse and recyclable material collectors, and environmental engineering technicians, virtually all of the demand in Minnesota is created by environmental protection activities. This is hardly surprising, for most of these jobs are clearly identifiable as "environmental" jobs.

However, in many occupations not traditionally identified as environment-related, a greater than proportionate share of the jobs is also generated by environmental protection. Recalling that, on average, environment-related employment in Minnesota comprises only ... percent of total employment, in 2003 environmental protection expenditures generated jobs for a greater than proportionate share – as much as ten percent or more -- of many professional occupations in the state, including:

- Architects
- Chemists
- Civil engineers
- Computer software engineers
- Electronics engineers
- Geoscientists
- Medical scientists
- Natural sciences managers
- Occupational health and safety specialists
- Surveyors

For many other occupations, also not traditionally identified as environment-related, a greater than proportionate share of the jobs is also generated by environmental protection. Again recalling that, on average, environment-related employment in Minnesota comprises only 3.5 percent of total employment, in 2003 environmental protection generated jobs for as much as ten percent or more of many highly skilled, technical occupations in the state, including:

- Architectural and civil drafters
- Biological technicians
- Chemical technicians
- Civil engineering technicians
- Electrical and electronics engineering technicians
- Electrical and electronics equipment assemblers
- Electrical and electronics drafters
- Forest and conservation technicians

- Industrial engineering technicians
- Sheet metal workers
- Surveying and mapping technicians

The above findings are significant for they indicate that state investments in environmental protection will create jobs in greater than proportionate share in two categories that Minnesota -- and other states -- are eager to attract:

- College-educated professional workers, many with advanced degrees
- Highly skilled, technical workers, with advanced training and technical expertise, many of them in the manufacturing sector

Environmental protection thus generates jobs that are disproportionately for highly skilled, well-paid, technical and professional workers, who in turn underpin and provide foundation for entrepreneurship and economic growth.

Finally, there are many occupations for which requirements in Minnesota generated by environmental protection are close to the average of 3.5 percent of total employment; including in the following occupations:

- Accountants and auditors
- Brickmasons
- Truck mechanics
- Construction laborers
- Electricians
- Financial managers
- General and operations managers
- Health information specialists
- Human resource managers

- Industrial machinery mechanics
- Industrial production managers
- Machinists
- Network and Computer systems Administrators
- Payroll clerks
- Plumbers and Pipefitters
- Purchasing agents
- Security guards
- Shipping and receiving clerks
- Stock clerks
- Training and development specialists
- Truck drivers
- Welders

V.D. The Environmental Industry as an Economic Driver for Minnesota

This study demonstrates that environmental protection can form an important part of a strategy for Minnesota based on attracting and retaining professional, scientific, technical, high-skilled, well paying jobs, including manufacturing jobs. While a successful strategy must have other components as well, rarely has any state recognized the economic and jobs benefits that could flow from specifically encouraging the development of environmental and environment-related industries as an economic development initiative. Indeed, usually the opposite is the case: States tend to view environmental economic costs as economically negative.

While designing such a development strategy is outside the scope of this report, there are concrete examples of environment-related initiatives that could create substantial numbers of jobs in Minnesota. For example:

- This study demonstrates that, at present in Minnesota, environmental protection is creating more than 92,000 jobs in the state, and these are disproportionately high-skilled, professional, scientific, technical, well paying jobs – many of them in manufacturing.
- A 2002 joint study by MISI and 20/20 Vision for the Energy Foundation estimated that an aggressive strengthening of U.S. Federal Corporate Average Fuel Economy (CAFE) standards would create nearly 6,400 jobs in Minnesota. Thus, contrary to what many believe, the production of more fuel-efficient vehicles would create substantial numbers of jobs in Minnesota, not reduce them.⁸
- A 2002 study by the University of Illinois estimated that investments in renewable energy and energy efficiency would create 4,000 jobs in Minnesota.⁹
- A 2001 MISI study of environment-related jobs policies in the Midwestern states identified a number of opportunities and initiatives for job creation in Minnesota.¹⁰
- A 1999 study sponsored by the World Wildlife Fund and the Energy Foundation estimated that a strategy to address global warming in the U.S. would create more than 14,000 jobs in Minnesota.¹¹

Given the multiplier effect of environmental spending and investment, it is likely that substantial numbers of jobs could be created through a systematic program to develop the environmental industry. Our findings show this is especially true in Minnesota, which currently has a thriving, job creating environmental industry, currently generating more than 92,000 jobs in the state, to a large extent unbeknownst to most state residents and probably to most policymakers. Such a systematic program of investment could have significant positive and potentially transformational impact. It is a

⁸Management Information Services, Inc. and 20/20 Vision Education Fund, *Fuel Standards and Jobs: Economic, Employment, Energy, and Environmental Impacts of Revised CAFE Standards Through 2030*, Washington, D.C., 2002. See also Bezdek and Wendling "Potential Long-term Impacts of Changes in U.S. Vehicle Fuel Efficiency Standards," op. cit.

⁹Regional Economics Applications Laboratory, *Job Jolt: The Economic Impacts of Repowering the Midwest*, University of Illinois, Chicago, 2002.

¹⁰Management Information Services, Inc., *Survey of Jobs and the Environment Issues in Six Midwestern States: Identifying Policy Challenges and Opportunities*, report prepared for the Joyce Foundation, Chicago, July 2001.

¹¹Tellus Institute and Stockholm Environment Institute, *America's Global Warming Solutions*, Boston, August 1999.

matter of more fully linking classic economic development approaches with a better understanding of the role and reach of environmental programs and expenditures as a factor contributing to that development.

VI. SUMMARY PROFILES OF SELECTED MINNESOTA ENVIRONMENTAL COMPANIES

We conducted a survey of existing environmental companies in Minnesota, examining a functional, technological and geographic mix of companies. Our research revealed a wide range of firms, and they:

- Are located throughout the state, in major urban centers, suburbs, small towns, and rural areas.
- Range in size from small firms of 10 employees to large firms employing thousands
- Are engaged a wide variety of activities, including manufacturing, remediation, testing, monitoring, analysis, etc.
- Include some of the most sophisticated, high-tech firms in the state

Summary descriptions of a representative sample of these firms are given in Table 7 and are discussed below. Information presented is current as of July 2004.

VI.A. BARR Engineering Company

Barr Engineering has offices in Minneapolis, Hibbing, and Duluth, and provides environmental, engineering, and information technology services to clients throughout the United States and the world. The firm has 300 employees, including 275 in Minnesota, and has hired 15 new staff in the past six months. Barr's employees are primarily engineers, scientists, degreed technologists, and technical support staff. About half of its clients are state and local governments and half are private industrial and commercial companies, and 95 percent of its business is domestic.

Barr was incorporated as an employee-owned firm in 1966 and traces its origins to the early 1900s. It has been helping balance the needs of people, plants, and animals for four decades and has found that working with nature instead of against it often proves the most successful and economical strategy. Barr's win-win environmental work includes:

- Using landscape ecology to reduce erosion and enhance water quality and natural aesthetics -- as well as property values
- Demonstrating that natural attenuation is often the best way to both protect citizens and the environment and to minimize cleanup costs

Table 7
Summary of the Select Minnesota Environmental Companies Profiled

Company	Location	Products/Services	Jobs
BARR Engineering Co.	Minneapolis, Hibbing, Duluth	Environmental engineering and technology services	US: 300 MN: 275
Braun Intertec	Minneapolis, Albertville, Blaine, Hibbing, Lakeville, Rochester, St. Cloud, St. Paul	Environmental and engineering consulting and testing services	US: 60 MN: 50
Ecolab	St. Paul	The leading global developer of premium cleaning, sanitizing, and pest elimination products and services	US: 20,000 MN: 2,800
ECONAR	Elk River, Appleton	Manufactures geothermal heat pumps	US: 50 MN: 50
ECOsmarte	Richfield, Maple Grove, Plymouth, Prior Lake	Non-chemical water technology	US: 15 MN: 15
MTVL Laboratories, Inc.	New Ulm	Environmental and energy analytical and testing laboratories	US: 120 MN: 95
Pace Analytical Services, Inc.	Minneapolis	Environmental analytical and testing laboratories	US: 600 MN: 225
STS Consultants	Minneapolis	Environmental, engineering, and geo-environmental consulting, design, and construction	US: 500 MN: 50
Summit EnviroSolutions	St. Paul	Environmental engineering and services	US: 40 MN: 40
Terra-Therm	New Richland	Midwest's largest distributor of geothermal heat pump systems	US: 13 MN: 13
TSI, Inc.	Shoreview	Designs and manufactures flow and particulate measurement instruments	US: 800 MN: 350
West Central Environmental Consultants	Morris, Fridley, Perham	Pollution detection, assessment, and remediation services	US: 50 MN: 50
Wind Turbine Industries Corporation	Prior Lake	Manufacturing and sales of wind turbines	US: 11 MN: 11

Source: Management Information Services, Inc., 2004.

- Redeveloping a former dump site into a recreational park, whose wetland area not only offers scenic value but naturally filters impurities from water

Barr is committed to providing pragmatic solutions to various problems, and has contributed significantly to reducing project costs through efficient use of resources. Its primary environmental business areas include:

- *Remediation Design.* Barr has experience with a broad spectrum of risk management and remediation techniques, including combining institutional controls and engineered systems to create one-of-a-kind solutions. It implements conventional technologies and assists in determining whether natural solutions will work with long-term plans for the site and help limit future liability.
- *Site Development.* From site investigations to grading plans to storm sewer design, Barr offers a full range of site development services. The firm has turned landfills into parks, converted sites choked with invasive plants into aesthetically pleasing stormwater wetlands, and designed the infrastructure for large-scale commercial, retail, and residential developments.
- *Waste Management.* Waste management projects combine environmental, regulatory, and engineering expertise, and Barr develops and executes integrated solutions for its clients' waste management problems. The firm's four decades of experience has been gained on projects involving both municipal and industrial hazardous wastes and wastes from environmental cleanups. Barr's experience ranges from basic landfill design to preparation of management tools such as educational videos.
- *Geotechnical (Soils).* Barr's geotechnical engineers and engineering geologists establish what site conditions are and, working closely with the firm's structural engineers, design solutions that meet the individual needs of clients. The firm has worked with industrial clients for nearly half a century to provide comprehensive solutions related to processing, handling, and the infrastructure that supports industrial operations.
- *Water.* Over the last four decades, Barr has solved water resources problems for clients such as municipalities and counties, watershed management organizations, lake associations, developers, industries, and state and federal agencies.
- *Dams.* Barr has completed more than 200 dam projects and has the experience to keep projects on schedule and within budget.

- *Structures.* Barr offers a full range of structural engineering services, from initial investigations to construction observation. Using the best in technology from finite element analysis to steel optimization software, the firm's structural engineers can design, evaluate, and rehabilitate a wide range of structures.

VI.B. Braun Intertec

Braun Intertec provides environmental and engineering consulting and testing services and is headquartered in Minneapolis. The firm has 60 employees, including 50 in Minnesota, and has hired five new staff in the past six months. State and local governments comprise 20 percent of Braun's clients and commercial and industrial comprise the remaining 80 percent; all of its business is domestic.

From its early geotechnical work in 1957 to the extensive consulting and testing services provided for the Mall of America, Braun Intertec has provided thousands of engineering and environmental solutions. Over the years, the company has developed a comprehensive scope of services in engineering and environmental consulting, materials, analytical laboratories, and testing services. It assists clients with site selection and planning, design, construction, operations, and property management. Braun Intertec offers reliable, cost effective solutions for clients in the development and management of their assets in the built and natural environments and has extensive expertise in a wide range of industries, including:

- *Retail* -- Braun Intertec has worked with some of the world's largest retailers, from Wal Mart, McDonalds, and Home Depot to the Mall of America.
- *Transportation* – Braun provides transportation client services such as environmental assessments, right of way due diligence, pavement design and testing, acceptance testing for roadways, railroads, light rail systems, airports, bridges, and tunnels.
- *Utility* -- Braun Intertec has broad experience in the utility and energy sectors, including work on power plants, refineries, pipelines, power boilers and co-generator systems. It provides clients with environmental assessments, industrial hygiene services (including health and safety monitoring), and environmental storage testing.
- *Manufacturing* -- From working with manufacturing giants such as 3M, Medtronic, and Cargill to helping small businesses like St. James Automotive, Braun Intertec has partnered with dozens of clients in the manufacturing sector. Its work is often on the cutting

edge of new technology, like providing testing services for a new angioplasty stent coating technology. In some cases, Braun Intertec works with manufacturing clients to provide on-site expertise, such as providing chemical, civil, and electrical consultants to 3M.

- *Institutional* -- Braun has extensive experience helping institutional clients, including hospitals, libraries, museums, schools, and universities, with services such as pre- and post-construction surveys, environmental site assessments, hazardous materials testing, and abatement and property assessment.
- *Government* – Braun’s work, with all levels of government, involves hundreds of projects over the past three decades and includes environmental site assessments, environmental impact studies, sanitation system assessments, and right of way acquisition evaluation.
- *Professional Services* -- Braun Intertec has served the professional services sectors such as financial institutions, insurers, and health maintenance organizations.
- *Real Estate* -- Since its inception in 1957, Braun has partnered with contractors, developers, property managers, architects, engineers and other consultants in developing real estate solutions. The firm has worked on single-family housing, multi-family housing, planned communities, campuses, commercial real estate, office buildings, warehouse developments, and office parks.

VI.C. Ecolab

Ecolab is a \$3 billion St. Paul company that is the leading global developer and marketer of premium cleaning, sanitizing, pest elimination, maintenance, and repair products and services for the world's hospitality, institutional, and industrial markets. It has 20,000 employees, including 2,800 in Minnesota, and has hired 300 new employees in the past six months. Its staff consists of engineers, administrators, IT personnel, marketing staff, and distributors. Its clientele is comprised of distributors selling to industrial and commercial customers and distributors selling to residential customers. It has sales in most of the nations of the world.

Ecolab was founded in 1923 to serve the burgeoning restaurant and lodging industries. Over the years, it has expanded its offerings to serve hospitals, food and beverage plants, laundries, schools, retail and commercial property, and other clients.

In the United States, Ecolab provides its customers with value-added cleaning, sanitation, and service solutions through nine complementary business units: Institutional, Food & Beverage, Pest Elimination, Kay Professional Products, GCS Service, Textile Care, Vehicle Care, and Water Care Services. Each of these businesses is dedicated to providing customers with the highest-quality, most highly effective products, systems, and services.

Internationally, Ecolab operates directly in nearly 70 countries, employing approximately 20,000 associates. In addition, Ecolab reaches customers in more than 100 other countries through distributors, licensees, and export operations. To meet the global demand for its products, Ecolab operates more than 50 state-of-the-art manufacturing and distribution facilities worldwide.

Ecolab's core institutional and food and beverage offerings are available in all markets and it is globally expanding the full array of services offered in the United States, as demand dictates. Many international offerings are essentially the same as their U.S. counterparts, though tailored as necessary to meet unique local and regional needs.

VI.D. ECONAR

ECONAR manufactures geothermal heat pumps and is located in Elk River and Appleton. It has 50 employees, who are primarily manufacturing workers and technicians. About half of the firm's business is industrial/commercial and half is residential.

ECONAR has been producing geothermal heat pumps in Minnesota for over 15 years, and the state's cold winter climate has driven the design of ECONAR's heating and cooling equipment to what is known as a "Cold Climate" geothermal heat pump. This cold climate technology focuses on maximizing the energy savings available in heating dominated regions without sacrificing comfort, thus making ECONAR the leader in cold climate heat pump technology and North America's only Cold Climate heat pump manufacturer. Extremely efficient cooling, dehumidification, and optional domestic hot water heating are also provided in one packaged system.

Safety and comfort are both inherent to and designed into ECONAR's geothermal heat pumps and, in addition, ECONAR, through installation of its heat pumps, has contributed to the reduction of global warming through the elimination of fossil fuels in many homes and businesses. Common geothermal applications include homes, churches, banks, schools, car washes, fish farms, ice rinks, swimming pools, restaurants, and anywhere heating, cooling, and hot water are required.

All of ECONAR's products are safety certified and its heat pumps are performance certified by internationally recognized third party testing laboratories. The firm's personnel hold numerous certifications in the geothermal industry and provide

training throughout North America. The firm holds memberships in the International Ground Source Heat Pump Association, the Environmental Protection Agency Energy Star products program, and the Geothermal Heat Pump Consortium, and is a charter member in numerous heat pump associations throughout North America. ECONAR's products hold numerous energy awards, including the 1999 National Home Builders award for Energy Efficiency.

ECONAR has two locations. Appleton is the location of its manufacturing plant and warehouse facilities, and all the purchasing and some of the engineering work is conducted there. Elk River is home to the corporate offices and contains all of the firm's accounting, engineering, sales (both commercial and residential), customer service, marketing, personnel, and administrative departments.

VI.E. ECOsmarte Planet Friendly, Inc.

ECOsmarte Planet Friendly, Inc. is a manufacturer of non-salt, non-chemical water technology and is located in Richfield. The firm has 15 production and service employees. About 20 percent of its customers are industrial and commercial and 80 percent are residential, and 90 percent of its sales are domestic.

ECOsmarte manages and removes minerals without the use of salt or brine discharge, and its products are easier to use, safer, and more effective than traditional methods. The firm's natural oxygen technology is the 100 percent chlorine-free alternative for swimming pool, spa, whole house, freshwater yacht, and commercial applications -- including rooftop and most recently golf course irrigation.

VI.F. MVTL Laboratories, Inc.

Founded in 1951 and located in New Ulm, MVTL Laboratories, Inc. is a diverse group of analytical laboratories offering environmental, agricultural, food science, and energy technology testing services. It has 120 employees, including 95 in Minnesota, and most of its staff consists of degreed technologists. About half of its business is state and local government and half is commercial/industrial; only about one percent of its business is international.

MVTL laboratories are certified by a host of regional and national agencies and have provided high quality data in a timely fashion at competitive fees for over 50 years. Compared with other laboratories, MVTL is more timely, competitive, and responsive than most larger national labs, but is more diversified than most smaller labs.

Service areas include:

- *Agriculture.* Over fifty years ago, Minnesota Valley Testing Laboratory (MVTL) initiated a tradition of analytical excellence in Minnesota, Iowa, and the Dakotas. Currently, as the firm serves customers in North America and abroad, it has expanded the agricultural testing services to include the critical Veterinary Pharmaceutical area and a complete range of tests for animal and crop science.
- *Food and Dairy Science.* The Food and Dairy Science Division of MVTL offers a wide variety of chemical and microbiological analyses of foods, meats, and dairy products. It is staffed and equipped to support programs in HACCP, nutritional labeling, quality control, and sanitation.
- *Environmental Testing.* MVTL provides the analytical services that support environmental projects with scientifically sound, legally defensible, analytical data necessary for successful projects. The firm's analysts are seasoned professionals with years of experience working with consulting engineers, state agencies, and municipalities. MVTL provides a full range of analyses for trace level organic and inorganic contaminants and provides a superior standard of service using the latest technology and commitment to customer service.
- *Water and Wastewater.* For over half a century, MVTL has provided water testing services to individuals, industries, and government agencies. It is certified by applicable regulatory agencies for the analysis of drinking water and wastewater and uses only approved methodologies to perform drinking water analyses. MVTL's testing services include drinking water, ground water, wastewater, and surface water.
- *On-Site Sampling.* MVTL has been measuring wastewater flow and sampling for over 30 years. Customers, including consulting engineers, municipalities, industrial facilities and government agencies, have depended on MVTL for projects ranging from on-site monitoring to all aspects of water sampling.
- *Energy Testing.* MVTL has been a leader in energy testing since 1977. In addition to coal quality analysis for exploration projects, MVTL also provides this service for such industries as electrical generation, food processing, and facilities using coal-fired heating plants. MVTL's complete line up of Energy Testing services includes Coal, Mine Soils (Overburden), Pellet Fuels, Refuse Derived Fuels, and Petroleum Products.

VI.G. Pace Analytical Services, Inc.

Pace Analytical Services, Inc. is located in Minneapolis and provides analytical and environmental testing services. Pace has 600 employees, including 225 in Minnesota, and has hired 40 new staff in the past six months. The firm's employees are primarily scientists, analysts, technicians, and degreed technologists. Its clientele is 20 percent state and local government and 80 percent industrial/commercial, and all of its sales are domestic.

Pace offers extensive capacity for organic and inorganic analysis as well as a broad range of specialty services, which allows it to meet clients' environmental analytical needs. The firm provides services through an integrated system of modern, fully equipped laboratories that can analyze a variety of sample matrices ranging from air and water to hazardous wastes. It has 11 laboratory locations with a core competence in providing analytical services including environmental testing. Pace utilizes U.S. EPA, ASTM Standard Methods, NIOSH, and other accepted test procedures and methods, in accordance with both federal and state regulations.

The strength of the company comes from understanding the importance in developing long-term, on-going communication with clients, and Pace Analytical provides an integrated, local support team which revolves around the client. Its nationwide system provides the local team with additional capacity, specialty services, and experts to ensure that client requirements are met. Pace Analytical is a national system of laboratories with a local presence.

Another strength is Pace Analytical's continued investment in applied technologies in order to give clients faster results, enhanced quality, accurate packages, and easy to interpret results. An example of the firm's commitment to technology is EPIC (Environmental Projects and Information Control System), Pace's laboratory information management system which is installed in each of its laboratory locations. Pace has also developed and continues to enhance a strict system of Quality Assurance/Quality Control protocols. Together with EPIC's ability to provide efficient, flexible data reporting, the two systems ensure reliability and timeliness.

VI.H. STS Consultants

STS Consultants is an environmental engineering consulting firm providing science and engineering solutions for the constructed environment. STS has 14 offices located throughout the Midwest, including the Minneapolis regional office. The firm has 500 employees and most of the staff are scientists, engineers, surveyors, and planners. STS has hired ten new employees over the past six months. About 70 percent of its clients are commercial and residential developers and 30 percent are public agencies; virtually all of its business is domestic.

STS was founded in 1948 as Soil Testing Services, Inc. Since its inception, STS has transformed itself from a two-person testing service to a globally-recognized environmental engineering and consulting firm. Growth for the company has been built on a foundation of solid clients and industry leading talent.

Since 1948, STS has continued to grow and expand its service offerings. In the 1960s, STS made a name for itself in the waste management and environmental services arena. The company's thorough understanding of soil dynamics, groundwater characteristics, and subsurface exploration capabilities made for a natural transition into broader geo-environmental consulting. Siting, permitting, design, and construction of earthen structures such as landfills, lagoons, and impoundments became an area of special expertise for STS.

In the 1970s, STS continued to mature and adjust to clients' new requirements relating to stronger environmental regulations, rapid suburban development, and incorporation of technological advances. STS focused on providing its clients with the expertise necessary to successfully address these issues.

A highlight in the development of STS occurred in the 1980s when it capitalized on an opportunity to combine its engineering and scientific expertise with the strong entrepreneurial spirit that had come to define the firm. STS took an abandoned dam and powerhouse in Michigan that was scheduled to be dismantled and redeveloped the site under the management of its new subsidiary, STS HydroPower, Ltd. The effort successfully reconnected the plant to the grid, and before being sold in the mid-1990s, STS HydroPower, Ltd. grew to include a portfolio of 11 hydroelectric plants in Michigan, Virginia, Colorado, California, and Oregon.

STS focuses on the following markets: Commercial, Federal, Forest Products, Manufacturing, Mining, Municipal Solid Waste, Power, Transportation, and State and Local Government. The firm has completed over 100,000 projects in the United States and abroad and currently provides a comprehensive package of services to a broad client base. STS continues to support its clients' interests at home and abroad, to invest in technology, client support systems and its staff, and to plan a future of high-profile projects.

VI.I. Summit EnviroSolutions

Summit EnviroSolutions is a full-service environmental engineering and consulting firm located in St. Paul. It has 40 employees and has hired three new staff in the past six months, and most of its employees are engineers and technicians. Ninety percent of its sales are commercial/industrial and ten percent are to state and local governments; it has no international business.

Since 1991, Summit has provided technically superior and cost effective solutions as a full-service environmental engineering and consulting firm. The firm's commitment to pioneering innovative technologies is consistent with a vision that it is possible to change the way that the Earth's physical, cultural, biological, and chemical systems are viewed.

Summit has developed technologies in conjunction with NASA that can create "smart" well fields, whereby public and private water suppliers can comply with wellhead protection and sole source aquifer requirements while decreasing their operating costs. Summit has integrated this technology into petroleum refining and distribution, mining, paper production, landfills, transportation, brownfields, Superfund sites, and other applications where environmental compliance and operations issues involve soil, groundwater, surface water, noise, or air quality.

To serve its clients' changing needs, Summit has diversified its services and geographic locations. The firm's expertise and network of professionals and contractors allow it to provide turnkey project management, engineering, and consulting on a wide-ranging scale of size and type of projects.

VI.K. Terra-Therm

Terra-Therm, Inc., located in New Richland, is the Midwest's largest distributor of geothermal heat pump systems, radiant floor heat systems, and high-efficiency gas and electric radiant floor water heaters. It was founded in 1983, has 13 employees in Minnesota, and has hired two new staff over the past six months. The firm's clients are primarily residential and all of its sales are domestic.

Terra-Therm is a full service distributor with over two decades of experience in assisting dealers in providing energy savings to their customers' homes and businesses, and it distributes all of the components that transform parts into systems offering safe, reliable, efficient, clean and comfortable heating and cooling. Dealers with questions about system sizing, design, troubleshooting, and consumer education obtain information and assistance from Terra-Therm, and the firm is committed to excellence through dealer training and support to insure that its systems will provide all of the benefits and energy savings desired.

Terra Therm offers the complete line of ECONAR Cold Climate Heat Pumps (see the discussion of ECONAR in Section VI.D., above) and all heat pump accessories including specialty installation tools. The firm stocks high efficiency Munchkin and Takagi Gas Boilers and Seisco Electric Micro-Boilers, Wirsbo radiant floor heat tubing and manifolds, Embassy Manifolds, circulating pumps, and reflective insulation for beneath the floor. It is also the area distributor of Warmboard for providing radiant heat throughout the home.

VI.L. TSI Incorporated

TSI Incorporated, located in Shoreview, designs and manufactures precision instruments used to measure flow, particulate, and other key parameters in environments. It has 800 employees, including 350 in Minnesota, and has substantial international sales.

TSI serves the needs of industry, governments, research institutions, and universities, with applications ranging from pure research to primary manufacturing. Every TSI instrument is backed by unique technical expertise and outstanding quality.

TSI instruments help people investigate, identify, and solve measurement problems. They often play a pivotal role in designing or modifying production processes or testing procedures, and are used in industrial, university, and government facilities in every industrialized country, in nearly every major industry and technical discipline, often in crucial research or control situations. TSI has a worldwide presence with staff working in facilities in North America and Europe, and it also maintains a network of knowledgeable manufacturers' representatives and distributors to provide local support worldwide.

TSI has two wholly owned subsidiaries: Environmental Systems Corporation (Knoxville, Tennessee), a leading supplier of products and services for outdoor environmental monitoring, and DICKEY-john® Corporation (Auburn, Illinois), a manufacturer of specialized instrumentation used in public works and agriculture. Their facilities total more than 425,000 square feet of space devoted to product development, manufacturing, and customer support. TSI annual sales exceed \$150 million.

TSI researchers and engineers have been granted more than 50 patents and have a proven record of developing instruments that are the first, the only, and the best of their kind. Participation in societies and standards committees has long been a TSI priority, and its engineers have chaired or sat on a variety of committees in organizations such as ASHRAE, ANSI, AIHA, and AAAR.

The company's staff and products are involved in current global issues, such as diesel engine exhaust reduction, biohazard protection, homeland security, environmental pollution, workplace comfort, and facility monitoring. Data provided by TSI instruments are used in monitoring and research applications destined to have a long-term impact on the environment.

VI.M. West Central Environmental Consultants

West Central Environmental Consultants (WCEC) is a full service environmental company that offers a complete range of services relating to the detection, assessment, and remediation of above and below ground pollution. It is located in Morris and has 50 employees, most of whom are degreed technologists, and it has hired six new staff in the past six months. Fifty percent of its business is with state and local governments

and 50 percent is with commercial/industrial clients; about five percent of its sales is international.

WCEC has expertise in many fields of environmental technology, including underground and above ground storage tank (UST and AST) management, emergency response to spills or leaks, phase I and II environmental assessments, hazardous waste remediation, landfill design and monitoring, and surface water quality and watershed assessments.

WCEC staff has developed respected and successful working relationships with a broad spectrum of state and local agencies and organizations that oversee pollution control, water and soil resource management, land use, agricultural practices, and health issues. This relationship has resulted in a clear understanding of the often complex rules and regulations that govern environmental issues and activities. The staff is also proactive in government affairs with federal and state legislators in developing a more common-sense approach to environmental regulations and controls.

WCEC has developed and directed projects to investigate surface and groundwater quality and to identify point- and non-point source pollution. It has initiated pilot projects designed to identify unused water wells and procedures to prioritize these wells for proper abandonment, as well as projects to determine sedimentation rates in surface water bodies. These studies, conducted in conjunction with state and federal agencies, have resulted in a better understanding of sources of contamination and have enabled the use of more cost-efficient methods in problem solving.

WCEC is involved with research projects to determine seasonal nitrate movement in groundwater, the fate of petroleum saturated soil if handled in accordance with state and federal regulations, and the best management strategies for solid and hazardous wastes. As soil and groundwater contamination remediation becomes increasingly more complicated and regulations more stringent, the firm's knowledge of federal, state, and local regulations enable it to offer clients full technical support and advice in designing individualized approaches to site remediation.

Wind Turbine Industries Corporation

Wind Turbine Industries Corporation (WTIC) and its sister company Prior Lake Company manufacture, assemble, market, and service Jacobs[®] wind turbines. They are located in Prior Lake and have 11 employees engaged in parts manufacturing, service, and sales. Their clientele consist of residential customers and state and local government owned utilities, and about one-third of the sales are international.

The Jacobs[®] Wind Energy Systems have over 70 years of history providing clean, quality, reliable, and efficient power in the U.S. and around the world, and since its acquisition of the Jacobs[®] wind energy products in 1986, WTIC has implemented changes to the systems to improve the operation and performance and to stay with

current trends in the market. Founded in the mid 1920s, the Jacobs® name is the oldest and best established company in the field of wind energy, and Jacobs® wind turbines are the "Cadillac" of the wind turbine industry. In 1986 WTIC acquired from Earth Energy Systems, Inc., a subsidiary of Control Data, Inc., the rights to the Jacobs® name, as well as the assets of Jacobs® Wind Energy Systems. WTIC also acquired from EESI the exclusive right to develop, market, and sell the 10 thru 20 Kw hybrid system.

At present, WTIC has three product lines: The 10 thru 17.5 Kw Wind Turbine, the 20 Kw Wind Turbine, and the 10 Kw thru 20 KW Hybrid System. WTIC conducts research and development on all of its products, and has introduced fiberglass blades for the 20 Kw system. It also continues to develop the 10 thru 20 Kw Hybrid System, which has the capability of combining wind, solar, and diesel power for generation of electricity. In addition to research and development, the company has been investigating the potential market for its three products. The three areas to which WTIC markets are the United States, international markets which have isolated areas to which traditional electric power can only be supplied with great difficulty and at great cost, and governments, including places where local or state governmental entities are tasked with supplying electrical energy to a particular area.

With the established Jacobs® name, WTIC is focusing its marketing in areas where supplying traditional electric power is both costly and difficult. The company, through its authorized agents and internally, continues to market to customers seeking wind turbines for personal or commercial use and continues to supply approximately 1,200 wind turbine owners with parts and service support.

VII. OPPORTUNITIES IN MN STATE GOVERNMENT PROGRAMS FOR ENCOURAGING ENVIRONMENT-RELATED JOBS

VII.A. Governor's Initiatives

VII.A.1. The Minnesota Sustainable Development Initiative

The Minnesota Sustainable Development Initiative is a collaboration of business, government, and civic interests designed to promote policies, institutions, and actions that ensure Minnesota's long-term environmental, economic, and social well-being. It is administered by Minnesota Planning and the Environmental Quality Board and is based on the premise that if Minnesota's prosperity is to be sustained over time, what is good for business, the environment, and communities must eventually become one and the same. Sustainable Development is defined by Minnesota Statute as "development that maintains or enhances economic opportunity and community well-being while protecting and restoring the natural environment upon which people and economies depend. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs." The Sustainable Development Initiative's vision is of a future where businesses grow and prosper while respecting the natural and human environments that support them.

As part of the Initiative, The Minnesota Round Table on Sustainable Development was mandated by the state legislature to develop principles to guide sustainable development. In its 1999 publication *Smart Signals: Economics for Lasting Progress*, the Round Table recommended several principles for rethinking and reforming government policies and programs to correct errant economic signals. It also identified several characteristics of sustainable communities from its conversations with Minnesota communities and the experiences of other communities around the country.

The Sustainable Development Initiative is a "classically green"-oriented entity. Its recommendations may create jobs, but have no component that maximizes, publicizes, or further develops the current jobs creation benefits or potential. However, the goals are broad enough to include environment-related jobs programs. Thus, the jobs component of these programs could be readily optimized. Ultimately, promotion of sustainable development at significant scale would support diverse businesses and create diverse jobs across Minnesota.

VII.A.2. MPCA Governor's Forums

The Minnesota Pollution Control Agency periodically holds a series of Governor's Forums around the state designed to allow citizens to speak out on environmental issues, and it also conducts periodic statewide citizen surveys on environmental issues. These forums, which are co-sponsored by the Governor and are entitled "The Governor's Forums: Citizens Speak Out on the Environment," actively involve

Minnesotans in discussions about environmental issues facing the state and the role of the MPCA in those issues. The MPCA complements these efforts with separate, statewide telephone surveys in which respondents are asked about their environmental awareness, concerns, values, and priorities. The format of the forums is unique: Participants use hand-held, wireless keypads to anonymously respond to questions posed by a moderator. Results of the keypad voting are tabulated by a computer and immediately displayed to the group. The MPCA uses the information gathered during the forums and surveys to plan for future needs and programs and to identify education and communication needs.

These forums represent excellent opportunities to raise jobs and the environment issues at the level of the governor and senior state officials.

VII.A.3. Governor's Council on Workforce Development

The Governor's Council on Workforce Development is comprised of state officials and private citizens and has the mandate to identify and make recommendations relating to the major issues facing Minnesota's labor force. The full Council meets quarterly, and its committees meet monthly or bi-monthly. Interested parties who are not members of the GCWD are encouraged to attend and become active in GCWD. The council has several committees that focus on youth and emerging workers, employers' needs to reduce worker shortages, guidance for continuous improvement efforts, strategies to support people with barriers to employment, and other issues.

If there were staff in Minnesota focused on jobs and environment issues, they could participate in the Sustaining and Enhancing the Workforce committee.

VII.B. State Commissions

VII.B.1. Minnesota Environmental Quality Board

The Environmental Quality Board consists of five citizens and the heads of 10 state agencies that play a vital role in Minnesota's environment and development. The board develops policy, creates long-range plans, and reviews proposed projects that would significantly influence Minnesota's environment. Its mission is to lead Minnesota environmental policy by responding to key issues, providing appropriate review and coordination, serving as a public forum and developing long-range strategies to enhance Minnesota's environmental quality. The Board was established by the Minnesota Legislature in 1973 to:

- Ensure compliance with state environmental policy
- Manage the environmental review process

- Advise the governor and the legislature
- Coordinate environmental agencies and programs
- Study environmental issues
- Convene environmental congresses

Our review of the EQB's work over the past decade indicates that there have been no projects supported that dealt with jobs and the environment issues; however, the Board does have the authority and resources to conduct such work.

Another potential contribution the Board could make would be to convene an environmental congress on jobs and the environment issues in Minnesota. It has sponsored congresses on sustainable development, and the time may thus be opportune to convene a congress on jobs and the environment.

VII.B.2. MPCA Citizens' Board

The Minnesota Pollution Control Agency Citizens' Board considers and makes decisions on varied and complex pollution problems that affect areas of the state. These decisions are intended to achieve a reasonable degree of purity of the water, air, and land resources of the state in order to provide for the maximum enjoyment and use of these resources for the welfare of the people. The Citizens' Board consists of the commissioner and eight members who are appointed by the governor and confirmed by the senate to four-year staggered terms. One member must be knowledgeable in the field of agriculture, and one member must be a representative of organized labor. The commissioner serves as chair of the Board.

VII.C. Environment and Natural Resources Trust Fund

The Trust Fund was established in the Minnesota constitution in 1990 to fund environmental and natural resource projects from money derived from the state lottery. The Fund receives 40 percent of the Lottery net proceeds – about \$22 million annually, and it funds over 100 projects a year by state agencies, local governments, colleges, schools, and nonprofit organizations. The current size of the fund is nearly \$400 million, and growing -- by design, every year the Fund's revenues exceed its expenditures so that it can build an endowment. Few, if any, projects related to jobs and the environment have been funded in the Fund's 14 year history. However, from a review of the Fund's enabling legislation, by-laws, and projects previously funded, it is clear that projects related to jobs and the environment could be funded. Therefore, this Trust Fund may be a viable and important potential source of funding for such projects:

- It is an excellent example of an environmental program that has permanent, statutory, earmarked funding.
- Our review of the types of projects funded over the past decade indicates that Fund expenditures could be used for jobs and the environment programs.

VII.D. Minnesota Renewable Hydrogen Initiative

The Minnesota Renewable Hydrogen Initiative (MRHI) is a partnership of industry, university, government, and non-government organizations, and leads the state's effort to grow and promote Minnesota's renewable hydrogen industry. It is designed to create jobs, encourage economic development, and foster new industries in Minnesota, while decreasing the risk to the state's health, environment, and energy security. The goal is that by 2010, Minnesota will be a national leader in the production of hydrogen from renewable, bio-based, and wind energy sources, thereby achieving statewide economic development, reduced risk to the environment, enhanced public health, and enhanced national energy security.

In 2003, Minnesota established a number of statutory policies to support this goal, including:

- The Department of Employment and Economic Development is required to establish a program to attract hydrogen-related businesses and establish energy enterprise zones for a hydrogen infrastructure.
- Hydrogen production from renewables may count toward a utility's renewable energy objective after 2010.
- The Department of Commerce will issue a Request for Proposals to build a wind-powered, electrolysis-to-hydrogen project that includes pipeline, storage, and fuel cell components.
- The University of Minnesota Initiative for Renewable Energy and the Environment (IREE) will support basic and applied research and demonstration activities related to renewable energy, including hydrogen. IREE received \$10 million from the Xcel Energy Renewable Development Fund in 2003 and will receive approximately \$10 million in additional funding over the next five years from the Xcel Energy Conservation Improvement Program.

To guide this effort, MRHI has outlined a roadmap to identify and implement the most strategic opportunities that will best leverage resources to move the state to hydrogen as an increasing source of energy for its electrical power, heating, and

transportation needs. This roadmap will structure and pursue the partnerships needed between industry, government, and institutions to functionally achieve the technological, policy, and product development steps necessary to achieve the initiative's goal and vision. Under this roadmap, MRHI will:

- Perform a niche analysis to determine the areas of greatest strength and opportunity for Minnesota to pursue its goal.
- Identify opportunities to leverage Minnesota's experience and expertise regarding increasing use of alternative fuels and hybrid electric vehicles. Areas to be examined include strategies used, lessons learned, and benefits of increased use of E85, natural gas, and biodiesel fueled vehicles, hybrid gasoline-electric vehicles, and hybrid fuel cell-electric vehicles, as critical steps in development of cost-effective hydrogen fuel vehicles.
- Identify opportunities to include and leverage Minnesota's experience and expertise regarding production of renewable energy and materials. Areas being examined include development, production, and use of wind power, ethanol fuel, biodiesel fuel, biological and biomass derived, fuels from forest products, agricultural hybrid poplar, crops, crop residue, and animal and food processing wastes, renewable methanol solar, and micro hydro industries biomaterials, products, and refineries.
- Identify and leverage the available expertise and information to develop and promote a public campaign on the long-term, economic health, environmental, and energy benefits of producing and exporting hydrogen made from Minnesota's renewable energy resources.
- Identify opportunities and current research, projects, and products underway in the region that are applicable to this initiative. Sectors to be examined include universities, utilities, hydrogen storage and transport industry, alternative fuels industry, renewable energy equipment manufacturers and component suppliers, fuel cell component suppliers, and state and regional units of government and other organizations.

MRHI will focus on and support those partnerships and projects that bring highest value to achieve the vision and goal. Categories include:

- *Research and development.* The principal focus for R&D efforts will take advantage of the state's most significant renewable resources -- biological and biomass-based hydrogen production

and wind electrolysis. Added focus will include opportunities for increasing use of solar and micro hydro.

- *Regional partnerships.* Other states and Canadian provinces in the region have strengths in other sources of energy that may be used to produce hydrogen. Partnerships will be developed such that regional cooperation is in place to assure coordinated progress toward a common and viable hydrogen economy future.
- *Demonstration projects.* Demonstration projects will support contributions to the approaching hydrogen economy and will support regional efforts to develop a hydrogen infrastructure. These projects will stimulate demand for hydrogen and related technologies, be replicable elsewhere in the state and region, leverage use of applied R&D, demonstrate complementary aspects of hydrogen production, storage, distribution, and use opportunities, result in functional infrastructure development, and maximize use of Minnesota business and expertise.
- *Education and promotion.* A public education campaign will promote awareness of the long-term, economic, public health, environmental, and energy security benefits of producing and exporting hydrogen from Minnesota's renewable energy resources.

The MRHI represents an excellent vehicle for bringing jobs and the environment issues to the forefront in Minnesota:

- It is a new, high priority statutory state program.
- It leverages unique state resources and expertise.
- It has the express goal of creating high-tech renewable energy jobs and businesses.
- It is amply funded.

VII.E. Office of Environmental Assistance

OEA "seeks to help make Minnesota environmentally healthy and economically strong through efficient resource use, responsible management of waste, pollution prevention, and sustainable practices." The Office does not enforce laws; rather it is a service organization that helps business, nonprofits, local governments, etc. solve environmental problems. It has 70 staff and 5 divisions: Policy, Evaluation, Research and Grants, Business Assistance, Project Assistance, Local Government Assistance, and Environmental Education.

OEA's mandate is to assist local environmental initiatives that bring government, business, residents, and other organizations together to further the state's economic and social priorities in an environmentally sensitive manner. The Office:

- Creates partnerships with local governments, businesses, community organizations, and individual citizens to advance innovative environmental programs and concepts.
- Works with government, business, and community organizations to develop consensus approaches to achieving environmental goals and objectives.
- Collaborates in the design and delivery of OEA's programs.
- Provides financial incentives with grants and loans to advance implementation of environmentally beneficial initiatives.
- Educates, informs, and promotes pollution prevention.
- Works with trade groups, environmental organizations, and educational institutions to identify improvements in the nature and delivery of environmental education.

OEA has been offering grants to local governments, businesses, non-profits, schools, and community groups since 1984 for the improvement of waste related practices. In 1996, OEA was given the authority to create a new broad-based grant program for a variety of environmental assistance activities, and this new grant program replaced most existing OEA grant programs. The purpose of these environmental assistance grants is to help organizations move toward more sustainable practices, with an emphasis on pollution prevention, recycling, and environmental education. OEA works with local units of government, private and nonprofit organizations, businesses, educational institutions, and community groups. Grant funds are available for the development and/or implementation of specific project activities not already underway within organizations.

OEA offers Environmental Assistance Grants on an annual basis, and funds are available for projects focusing on pollution prevention, recycling market development, environmental education, sustainable communities development, and resource recovery. Since 1985, the OEA has awarded more than \$11 million in grants to organizations across Minnesota, and in 2001 alone, OEA provided over \$1.5 million to 26 projects leveraging over \$3 million in matching funds and/or in-kind contributions. None of these specifically addressed the jobs and environment nexus. However, there is no reason why OEA could not fund such initiatives, since it has broad authority to award grants for almost anything in the environmental area.

VII.F. The Minnesota Pollution Control Agency

The Minnesota Pollution Control Agency is organized around four broad strategies that the agency uses to help accomplish its environmental goals, and the agency's organizational structure has been designed to support them. These strategies are designed to enable MPCA to retain its place as a national leader in environmental protection and become more responsive to the concerns Minnesotans have about their environment. The four strategies are:

- Shared Goals -- MPCA develops common goals in cooperation with customers of all types to establish a broad plan of action to protect Minnesota's environment. It feels that developing shared goals is a key to building trust with all MPCA customers.
- Environmental Outcomes -- the agency utilizes a comprehensive process for measuring the environmental outcomes of its activities, and the information is presented to its customers and used to identify mutually desired outcomes and to align internal resources and processes to best achieve those results. This strategy is key to tracking progress in achieving the desired environmental goals.
- Situational Alliances -- MPCA forms alliances with a broad spectrum of customers to achieve shared environmental goals, and the agency will foster trust within the alliances by opening its programs and processes to all participants.
- The Learning Organization -- the agency seeks to become a "learning organization" and will continually seek out and embrace new ideas and change for the future.

MPCA currently has no office or division dealing with jobs and the environment issues. However, such an office or division could be established within MPCA – perhaps in the Operations and Planning Branch within the Policy and Planning Division.

VII.G. Minnesota Business Subsidies Law

The Minnesota Business Subsidies Law requires that all businesses in the state that receive a state-financed subsidy agree, in writing, to specific goals in return for the subsidy. If the agreement is not adhered to, the firm must repay the government the amount of the subsidy, plus interest. Importantly, all subsidy agreements, in addition to any other goals, must include:

- Goals for the numbers of jobs created and/or retained.

- Wage goals for the jobs created and/or retained.

Businesses receiving a subsidy must create a net increase in jobs in Minnesota within two years of receipt of the subsidy.

This program could be used to create environmental jobs, and its replication in other states presents an important potential opportunity.

VII.H. Hubert H. Humphrey Institute

The Hubert H. Humphrey Institute of the University of Minnesota has developed an economic development strategy for Minnesota entitled *Emerging Principles in State and Local Economic Development: A Benchmarking Tool*, and has worked with the state and local governments to implement the strategy. This strategy states that "rather than targeting individual firms or businesses, economic development agencies should focus on supporting clusters of industries that are well-suited to an area." It recommends that state and local economic development authorities replace government-initiated and government-supplied workforce and productivity initiatives with industry-driven programs in which the government serves as a facilitator. These governments should shift their attention from individual firms to industries, use public dollars to leverage private sector cooperation and coordination, and focus their efforts more strategically. Instead of funding technologies or education that may or may not meet the needs of area businesses. They should target their resources on efforts that build on their comparative advantages and strengthen key industries, focus on key determinants of competitiveness, examine industries, assess public policies, and redefine economic development strategies.

The strategy does not specifically mention the environmental industry as a key one to focus on; however, an economic development/jobs strategy could be planned around a "cluster" of environmental industries.

VIII. SUMMARY OF MAJOR FINDINGS

This report presents information about jobs creation and the potential of the environmental industry in the state of Minnesota, as well as background information on the jobs impact of the environmental industry in the nation as a whole. The report finds that the environmental industry is a major player in both the state and national economy, and that the direct and indirect jobs creation potential of the environmental industry is significant, multi-sectoral, under-appreciated, and could be maximized for broad socio-economic and environmental benefit.

Jobs and the National Environmental Industry

The report summarizes MISI findings on the national environmental industry. MISI research has found that over the past four decades, protection of the environment has grown rapidly to become a major sales-generating, profit-making, job-creating U.S. industry. This “industry” ranks well above those in the top of the Fortune 500, and MISI estimates that in 2003 protecting the environment generated:

- \$301 billion in total industry sales
- \$20 billion in corporate profits
- 4.97 million jobs
- \$45 billion in Federal, state, and local government tax revenues

It is likely that the environmental industry will continue to grow significantly for the foreseeable future, and MISI forecasts that in the U.S. real expenditures (2003 dollars) will increase from \$301 billion in 2003 to:

- \$357 billion in 2010
- \$398 billion in 2015
- \$442 billion in 2020

Environmental protection generates large numbers of jobs throughout all sectors of the economy and within many diverse occupations, and MISI forecasts that U.S. employment created directly and indirectly by environmental protection will increase from 4.97 million jobs in 2003 to:

- 5.39 million jobs in 2010
- 5.76 million jobs in 2015

- 6.38 million jobs in 2020

Environmental protection created nearly five million jobs in the U.S. in 2003, and these were distributed widely throughout all states and regions within the U.S. The vast majority of the jobs created by environmental protection are standard jobs for accountants, engineers, computer analysts, clerks, factory workers, truck drivers, mechanics, etc. In fact, most of the persons employed in these jobs may not even realize that they owe their livelihood to protecting the environment.

Firms working in the environmental and related areas employ a wide range of workers at all educational and skill levels and at widely differing earnings levels. Even in environmental companies, most of the employees are not classified as "environmental specialists." Rather, most of the workers are in occupations such as laborers, clerks, bookkeepers, accountants, maintenance workers, cost estimators, engine assemblers, machinists, machine tool operators, mechanical and industrial engineers, welders, tool and die makers, mechanics, managers, purchasing agents, etc.

Jobs in Minnesota and Minnesota's Environmental Industry

We found that environmental protection is a large and growing industry in Minnesota. MISI estimates that in 2003:

- Sales of the environmental industries in Minnesota totaled \$5.1 billion.
- The number of environment-related jobs totaled more than 92,000.
- The environmental industry in Minnesota comprised 2.6 percent of gross state product.
- Minnesota environmental industries accounted for 1.7 percent of the sales of the U.S. environmental industry.
- Environment-related jobs comprised 3.5 percent of Minnesota employment.
- Environment-related jobs in Minnesota comprised 1.8 percent of the total number of environment-related jobs in the U.S.
- Environment-related employment in the state has been increasing in recent years between one and two percent annually.

Most of the environment-related jobs in Minnesota are in the private sector, and these are heavily concentrated in several sectors, including manufacturing, professional, scientific, and technical services, and educational services.

Environmental jobs in Minnesota are widely distributed through all occupations and skill levels and, while the number of jobs created in different occupations varies substantially, requirements for virtually all occupations are generated by environmental spending. Thus, in Minnesota as in the U.S. generally, the vast majority of the jobs created by environmental protection are standard jobs for all occupations.

Nevertheless, we found that, in Minnesota, the importance of environmental protection for jobs in some occupations is much greater than for others. For some occupations, such as environmental scientists and specialists, environmental engineers, hazardous materials workers, water and liquid waste treatment plant operators, environmental science protection technicians, refuse and recyclable material collectors, and environmental engineering technicians, virtually all of the demand in Minnesota is created by environmental protection activities. This is hardly surprising, for most of these jobs are clearly identifiable as "environmental" jobs.

However, for many occupations not traditionally identified as environment-related, a greater than proportionate share of the jobs are also generated by environmental protection. While, on average, environment-related employment in Minnesota comprises only 3.5 percent of total employment, in 2003 environmental protection generated jobs for a greater than proportionate share of many professional, scientific, high-tech, and skilled workers in the state.

Our survey of existing environmental companies in Minnesota revealed a wide range of firms, located throughout the state and across sectors, including manufacturing. These firms:

- Are located throughout the state, in major urban centers, suburbs, small towns, and rural areas.
- Range in size from small firms of 10 employees to large firms employing thousands
- Are engaged a wide variety of activities, including remediation, manufacturing, testing, monitoring, analysis, etc.
- Include some of the most sophisticated, high-tech firms in the state; for example:
 - Ecolab (St. Paul) is a \$3 billion company that is the leading global developer and marketer of premium cleaning, sanitizing, pest elimination, maintenance, and repair

- products and services for the world's hospitality, institutional, and industrial markets.
- ECONAR (Elk River and Appleton) is the nation's leading manufacturer of "Cold Climate" geothermal heat pump systems.
- Pace Analytical Services, Inc. (Minneapolis) is one of the nation's leading analytical and environmental testing services.
- STS Consultants (Minneapolis) is one of the Midwest's major environmental engineering consulting firms providing science and engineering solutions for the constructed environment.
- TSI Incorporated (Shoreview) is a major manufacturer of precision instruments used to measure flow, particulate, and other key environmental parameters.

A number of these firms, including BARR Engineering (Minneapolis, Hibbing, and Duluth), Braun Intertec (Minneapolis, Albertville, Blaine, Hibbing, Lakeville, Rochester, St. Cloud, and St. Paul), Ecolab, Pace Analytical Services, STS Consultants, Summit EnviroSolutions (St. Paul), Terra-Therm (New Richland), and West Central Environmental Consultants (Morris, Fridley, and Perham) have created significant numbers of new jobs over the past six months.

We identified a number of existing state initiatives that could be used to maximize the jobs creation benefit and potential of the environmental industry. These include the Minnesota Sustainable Development Initiative, MPCA Governor's Forums, the Environment and Natural Resources Trust Fund, the Minnesota Renewable Hydrogen Initiative, Office of Environmental Assistance Grants, and the Minnesota Business Subsidy Law. Two of these -- the Environment and Natural Resources Trust Fund and the Minnesota Renewable Hydrogen Initiative – are especially notable and hold considerable promise.

We suggest policy options that could maximize the jobs benefits of the environmental industry in Minnesota, with no institutional impediment. Such initiatives should be encouraged and expanded. This study demonstrates that environment-related initiatives can create substantial numbers of jobs in Minnesota, a state that remains manufacturing oriented and seeks new ideas for employment generation, stable good jobs, and workforce development.

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APPENDIX: U.S. COMMERCE DEPARTMENT ESTIMATES OF THE ENVIRONMENTAL INDUSTRY IN MINNESOTA

There are two historical sources of information about the environmental industry in Minnesota. Unfortunately, they only address certain segments of the industry, do not focus on jobs, and were conducted for 1999. These are briefly summarized below.

International Trade Administration

One estimate of the size of the environmental industry is available through the U.S. Department of Commerce.¹² The Department's International Trade Administration (ITA), Office of Environmental Technologies Industries estimated, for 1999, the world market for environmental products and services and the size of the U.S. market, including estimates at the state and metropolitan statistical area levels. In this example of environmental accounting, the environmental industry is defined to include:

- Environmental-related services
 - Environmental testing and analytical services
 - Wastewater treatment works
 - Solid waste management
 - Hazardous waste management
 - Remediation/Industrial services
 - Consulting and engineering
- Environmental equipment
 - Water equipment and chemicals
 - Water equipment and chemicals
 - Instruments and information systems
 - Air pollution control equipment
 - Waste management equipment
 - Process and prevention technology;
- Environmental resources:
 - Water utilities
 - Resource recovery
 - Environmental energy sources.

ITA estimated that the 1999 U.S. environmental market totaled \$189 billion, almost 38 percent of the global \$499 billion market. In meeting the demands of those markets, the U.S. environmental industry was estimated to have generated \$196 billion

¹²See U.S. Department of Commerce, International Trade Administration, Office of Environmental Technologies Industries, *Environmental Industry of the United States*, a USDOC/ITA web-accessible briefing generated by Environmental Business International, Inc. for 1999.

of revenues. ITA also estimated the U.S. environmental trade balance for 1999. It estimated that the U.S. exported \$21 billion worth of environmental products and services and imported \$14 billion, thus generating a positive net U.S. exports balance of just over \$7 billion in environmental-related goods and services.

The ITA U.S. industry estimates were disaggregated by state, and Table A.1 lists the estimated industry revenues, jobs, the number of companies, and the exports of the industry in Minnesota. The ITA estimated that, in 1999, Minnesota accounted for about 1.9 percent of the U.S. industry, and that the number of environmental jobs in the state totaled more than 27,000.

Table A.1
U.S. Department of Commerce Estimates
of the U.S. and Minnesota Environmental Industries, 1999

		Minnesota	U.S.	Minnesota Share of U.S.
Revenues	(millions)	\$3,782	\$196,465	1.9%
Jobs	(number)	27,360	1,389,638	1.9%
Companies	(number)	2,523	115,030	2.1%
Exports	(millions)	\$620	\$21,310	2.9%

Source: U.S. Department of Commerce (ITA) and Environmental Business International; 1999.

The ITA report disaggregated the Minnesota industry by metropolitan statistical area (MSA) – see Table A.2. In Minnesota, this consisted of the Minneapolis-St. Paul MSA. Minneapolis-St. Paul accounted for about 60 percent of the industry in the state and about 16,500 environment-related jobs.

Table A.2
**U.S. Department of Commerce Estimates of the Minnesota
Environmental Industry by Metropolitan Statistical Areas, 1999**

		Minneapolis- St. Paul
Revenues	(millions)	\$2,275
Jobs	(number)	16,455
Companies	(number)	1,518
Exports	(millions)	\$373
MSA Average Share of Minnesota		60%

Source: U.S. Department of Commerce (ITA) and Environmental Business International; 1999.

Census Bureau -- Pollution Abatement Costs and Expenditures (PACE)

The Census MA200 survey has been one of the more respected sources for information on the U.S. environmental industry.¹³ This report was not available for a number of years after 1994, but was revived for the year 1999. The results of the survey are not consistent with previous reports for a number of reasons, but they do present a snapshot of major portions of the environmental industry with information available by detailed North American Industry Classification System (NAICS) industry and geographically, by state. However, the survey's biggest weakness is that it only covers the mining (NAICS 21), manufacturing (NAICS 31-33), and electric power generation industries (NAICS 22111). Clearly, the U.S. agricultural, services, transportation, and government sectors have pollution abatement costs and expenditures that contribute to and help define the U.S. environmental industry, but they are not included in the PACE survey. Therefore, while the survey estimates are of sufficient quality, they lack comprehensiveness and describe only a small fraction of the environmentally-related business activities in the U.S.

Table A.3. lists the pertinent information for Minnesota and the United States from the most recent survey, for 1999. Pollution abatement costs in these selected Minnesota industries included over \$120 million of capital expenditures and nearly \$300 million for operating costs. Together with \$59 million in operating costs for disposal and recycling activities and other categories of economic activity, the PACE estimates for Minnesota in 1999 totaled nearly \$600 million. This represented two percent of the overall PACE estimates in the United States.

¹³See U.S. Department of Commerce, Economic and Statistics Administration, Census Bureau, *Pollution Abatement Cost and Expenditures: 1999*, MA200(99), November 2002.

Table A.3
Pollution Abatement Costs and Expenditures Estimates for Minnesota
and the U.S. From the Census MA200 Survey, 1999
(million dollars, except where noted)

	Minnesota	U.S.	Minnesota Share of U.S.	
Pollution abatement				
Capital expenditures	120.4	5,809.9	2.1%	
Non-hazardous	103.1	4,497.8		2.3%
Hazardous	17.3	1,312.0		1.3%
Air	50.3	3,463.7		1.5%
Non-hazardous	44.0	2,644.7		1.7%
Hazardous	6.3	819.0		0.8%
Water	42.2	1,801.9		2.3%
Non-hazardous	32.0	1,488.2		2.2%
Hazardous	10.2	313.7		3.3%
Solid Waste	(D)	361.9		(D)
Non-hazardous	(D)	245.5		(D)
Hazardous	0.8	116.4		0.7%
Multimedia	(D)	182.3		(D)
Non-hazardous	(D)	119.4		(D)
Hazardous	-	62.9		-
Operating Costs	293.6	11,864.4	2.5%	
Non-hazardous	234.7	8,924.9		2.6%
Hazardous	58.9	2,939.5		2.0%
Air	129.8	5,069.1		2.6%
Non-hazardous	106.8	3,941.2		2.7%
Hazardous	23.0	1,127.9		2.0%
Water	86.2	4,586.5		1.9%
Non-hazardous	75.8	3,511.8		2.2%
Hazardous	10.4	1,074.6		1.0%
Solid Waste	73.2	2,013.3		3.6%
Non-hazardous	47.8	1,320.4		3.6%
Hazardous	25.4	692.9		3.7%
Multimedia	4.4	195.5		2.3%
Non-hazardous	4.3	151.5		2.8%
Hazardous	0.1	44.0		0.2%
Disposal and recycling				
Capital expenditures	7.5	398.7	1.9%	
Disposal	5.4	267.2		2.0%
Non-hazardous	1.3	218.0		0.6%
Hazardous	4.1	49.2		8.3%
Recycling	2.1	131.5		1.6%
Operating costs	59.0	4,923.6	1.2%	
Disposal	43.3	3,680.9		1.2%
Non-hazardous	31.1	2,466.2		1.3%
Hazardous	12.1	1,214.7		1.0%
Recycling	15.8	1,242.7		1.3%

(continued)

Table A.3 (Continued)
Pollution Abatement Costs and Expenditures Estimates for Minnesota
and the U.S. From the Census MA200 Survey, 1999
(million dollars, except where noted)

Pollution prevention	39.4	2,767.9	1.4%	
Other expenditures	44.0	3,154.5	1.4%	
Site cleanup	8.4	1,039.3	0.8%	
Remediation	6.6	827.3	0.8%	
Replacement	1.6	83.1	1.9%	
Other	0.1	128.8	0.1%	
Habitat protection	0.4	155.2	0.3%	
Monitoring/testing	13.8	599.5	2.3%	
Administration	21.4	1,360.4	1.6%	
Other payments				
Payments to government	30.4	959.1	3.2%	
Permits/fees	29.7	816.6	3.6%	
Fines/penalties/charges	0.7	116.3	0.6%	
Other	-	26.2	-	
Tradeable permits - bought	-	20.2	-	
Tradeable permits - sold	-	23.7	-	
Tradeable permits - other	-	12.6	-	
Total	594.3	29,934.6	2.0%	

Source: U.S. Department of Commerce (ESA/Census Bureau), 2002.

ABOUT THE JOBS AND ENVIRONMENT INITIATIVE

The Jobs and Environment Initiative, founded in 2004 by Paula DiPerna, is a pilot program of research, policy analysis and public education. The objective of the Initiative is to examine and demonstrate the links between jobs creation in all sectors of economic activity, including manufacturing, and all aspects of environmental management. The Initiative seeks to describe and analyze current jobs benefits of environmental investment and stewardship; bring further public and policy attention to the strength and scope of the environmental industry; examine potential for further jobs creation; highlight policy opportunities, and improve understanding of the positive contributions of environmental management to economic growth and employment generation, at the local, state, regional, national and international levels. The Initiative conducts state-based and national reports and other inquiries, and is a collaboration between Management Information Services, Inc. (www.misi-net.com) and the Building Diagnostics Research Institute (www.buildingdiagnostics.org). For information contact Paula DiPerna at 607-547-8356

ABOUT MANAGEMENT INFORMATION SERVICES, INC.

Management Information Services, Inc. (MISI) is an economic research firm with expertise on a wide range of complex issues, including energy, electricity, and the environment. The MISI staff offers expertise in economics, information technology, engineering, and finance, and includes former senior officials from private industry, federal and state government, and academia. Over the past two decades MISI has conducted extensive proprietary research, and since 1985 has assisted hundreds of clients, including Fortune 500 companies, nonprofit organizations and foundations, academic and research institutions, and state and federal government agencies including the National Academy of Sciences, the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Department of Defense, and the Energy Information Administration.

For more information, please visit the MISI web site at www.misi-net.com.

ABOUT THE BUILDING DIAGNOSTICS RESEARCH INSTITUTE

The Building Diagnostics Research Institute, Inc. (BDRI) is a Section 501(c)(3) not-for-profit organization dedicated to providing the highest level of research, education and training, and public outreach on issues related to the effects of building performance on health, safety, security, and productivity. The Institute's mission is to leverage more than 25 years of building diagnostics experience in order to enhance health, safety, security, and productivity, and it is implemented by conducting basic and applied research, providing education and training for health and building professionals, disseminating knowledge, and serving as an advocate for the general public. BDRI's

basic and applied research, its education and training, and its public outreach are carried out by an interdisciplinary team of staff and external scientists and professionals representing a variety of disciplines, including chemistry, industrial hygiene, engineering, microbiology, and law and public policy.

For more information, please visit the BDRI web site at www.buildingdiagnostics.org.

BIOGRAPHICAL INFORMATION

Paula DiPerna, founder of the Jobs and Environment Initiative, served formerly as President of the Joyce Foundation, and Vice-President for International Affairs for the Cousteau Society and is a widely published author and public policy analyst.

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