

JOBS CREATION IN THE ENVIRONMENTAL INDUSTRY IN NORTH CAROLINA AND THE UNITED STATES

Prepared By

Roger H. Bezdek
Robert M. Wendling
Management Information Services, Inc.
Washington, D.C.
www.misi-net.com
202-889-1324

For The

Building Diagnostics Research Institute
Chevy Chase, Maryland
www.buildingdiagnostics.org
301-951-5951

This report is a project of the Jobs and Environment Initiative, a pilot program of research, policy analysis and public education. The North Carolina 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 Florida, Michigan, Minnesota, Ohio, and Wisconsin and are available on the above websites.

Contact: Paula DiPerna, 212-688-0042
Roger Bezdek, 703-620-4120

December 2004

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 NORTH CAROLINA ECONOMY IN 2003	19
V. THE ENVIRONMENTAL INDUSTRY AND JOBS IN NORTH CAROLINA	22
V.A. Summary of the Environmental Industry and Jobs in North Carolina	22
V.B. Environmental Jobs in North Carolina by Industrial Sector	22
V.C. Environmental Jobs in North Carolina by Occupation and Skill	25
V.D. The Environmental Industry as an Economic Driver for North Carolina	30

TABLE OF CONTENTS
(Continued)

VI. SUMMARY PROFILES OF SELECTED NORTH CAROLINA ENVIRONMENTAL COMPANIES	32
VI.A. ARCADIS	32
VI.B. CompuChem	34
VI.C. Dewberry	36
VI.D. Engineering Consulting Services, Ltd	37
VI.E. Froehling & Robertson Inc.	38
VI.F. Mid-Atlantic Associates, Inc.	39
VI.G. McKim & Creed	40
VI.H. Olver, Inc.	41
VI.I. Solargenix Energy	41
VI.J. Stantec, Inc.	43
VI.K. Terracon	44
VII. OPPORTUNITIES IN NORTH CAROLINA STATE GOVERNMENT PROGRAMS FOR ENCOURAGING ENVIRONMENT-RELATED JOBS	46
VII.A. Division of Pollution Prevention and Environmental Assistance	46
VII.B. The Energy Division	47
VII.C. Division of Coastal Management	48
VII.D. Coastal Resources Advisory Council	48
VII.E. Environmental Management Commission	49
VII.F. Albemarle-Pamlico National Estuary Program	49
VII.G. The Ecosystem Enhancement Program	50
VII.H. The Clean Water Management Trust Fund	52
VII.I. Renewable Energy Tax Credits	53
VII.J. Wind Energy Initiatives	53
VII.K. State Energy Plan	54
VII.L. North Carolina Solar Center	56
VII.M. Center for Energy Research and Technology	58
VII.N. The Economic Development Board	59
VII.O. The Progress Board	60
VII.P. The Strategic Economic Development Plan	60
VII.Q. Workforce Development Initiatives	62
VII.Q.1. The Commission on Workforce Development	62
VII.Q.2. The Workforce Development Institute	62

TABLE OF CONTENTS
(Continued)

VII.R. Water Infrastructure Issues and Needs	63
VII.R.1. Water and Sewer Infrastructure Requirements	63
VII.R.2. Protecting the Costal Habitat	65
VIII. SUMMARY OF MAJOR FINDINGS	68
BIBLIOGRAPHY	72
APPENDIX: U.S. COMMERCE DEPARTMENT ESTIMATES OF THE ENVIRONMENTAL INDUSTRY IN NORTH CAROLINA	82
ABOUT THE JOBS AND ENVIRONMENT INITIATIVE	87
ABOUT MANAGEMENT INFORMATION SERVICES, INC.	87
ABOUT THE BUILDING DIAGNOSTICS RESEARCH INSTITUTE, INC.	87
BIOGRAPHICAL INFORMATION	83

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 North Carolina and the U.S. in 2003	21
5.	Jobs in North Carolina in 2003, by Industry, Including Environmental Employment	23
6.	Environmental Jobs Generated in North Carolina in 2003, by Selected Occupations	26
7.	Summary of the Select North Carolina Environmental Companies Profiled	33
A.1.	U.S. Department of Commerce Estimates of the U.S. and North Carolina Environmental Industries, 1999	83
A.2.	U.S. Department of Commerce Estimates of the North Carolina Environmental Industry by Metropolitan Statistical Areas, 1999	84
A.3.	Pollution Abatement Costs and Expenditures Estimates for North Carolina and the U.S. From the Census MA200 Survey, 1999	85

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 North Carolina, 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 North Carolina 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 North Carolina in 2003
- Estimates the jobs created in North Carolina 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 North Carolina, 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 North Carolina
- Discusses how encouraging environmental and related industries in North Carolina 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 plant 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 North Carolina, and MISI estimates that in 2003:

- Sales of the environmental industries in North Carolina totaled \$9.1 billion.
- The number of environment-related jobs totaled 112,000.
- The environmental industry in North Carolina generated 3.1 percent of gross state product.
- North Carolina environmental industries accounted for about three percent of the sales of the U.S. environmental industry.

- With 2.9 percent of the nation's population, employment earnings in the North Carolina manufacturing sector account for 3.4 percent of manufacturing earnings nationally.
- Environment-related jobs comprised 2.9 percent of North Carolina employment.
- Environment-related jobs in North Carolina comprised 2.5 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 North Carolina are in the private sector, and these are heavily concentrated in several sectors, including manufacturing, professional, scientific, and technical services, information, and educational services.

Types of Environmental Jobs in North Carolina

Environmental jobs in North Carolina are widely distributed through all occupations and skill levels, and requirements for virtually all occupations are generated by environmental expenditures. Thus, in North Carolina 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 North Carolina, 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 North Carolina 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 North Carolina comprises less than three 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 North Carolina 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 20 employees to large firms employing thousands; they are engaged in a wide variety of activities, including remediation, engineering, testing, monitoring, analysis, etc.; and they include some of the most sophisticated, high-tech firms in the state. Many of these

firms have created significant numbers of new jobs over the past six months, at a time when North Carolina has been concerned about jobs, especially for highly skilled, well-paid, technical and professional workers

Salience of the Jobs-Environment Link in North Carolina 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 North Carolina -- 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 North Carolina are concentrated within a number of sectors, including manufacturing and professional, information, and scientific, and technical services. This is significant because North Carolina is seeking to modernize and expand its high-tech industrial and manufacturing base. Environmental protection offers a means of doing this, and investments in the environment can aid in this objective.

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 North Carolina – 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 North Carolina -- 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, perhaps most important, this study demonstrates that environmental protection can form an important part of a strategy for North Carolina based on attracting and retaining professional, scientific, technical, high-skilled, well paying jobs, including manufacturing jobs. There is no inherent institutional impediment in North Carolina 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 North Carolina economy and labor market
- Chapter V -- Size, employment, and industrial and occupational composition of the environmental industry in North Carolina
- Chapter VI – Profiles of typical environmental firms in the state
- Chapter VII -- North Carolina 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 North Carolina in 2003
- Estimate the jobs created in North Carolina 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 North Carolina, 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 North Carolina

- Discuss how encouraging environment and related industries in North Carolina 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 North Carolina -- 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 5,200 more jobs in North Carolina 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 (13,100) in North Carolina. 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 processes 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 firm in North Carolina that produces emissions control equipment for power plants in Alabama? It seems clear that the jobs in the North Carolina company should be considered green or environmental jobs, even though the user of the equipment in Alabama may cause pollution in North Carolina.

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).

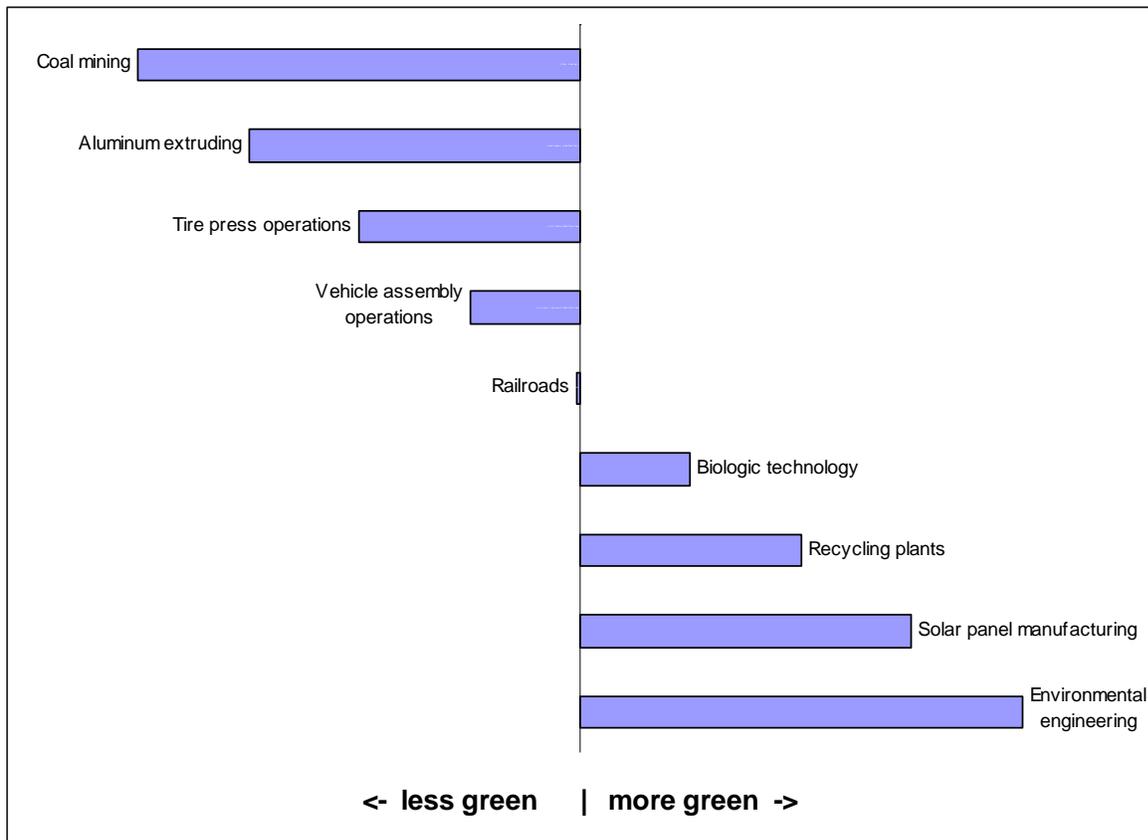
Using the spectrum concept, MISI defines environmental industries and green jobs as those which, as a result of environmental pressures and concerns, have produced the development of numerous products, processes, and services, which specifically target the reduction of environmental impact. Environment-related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

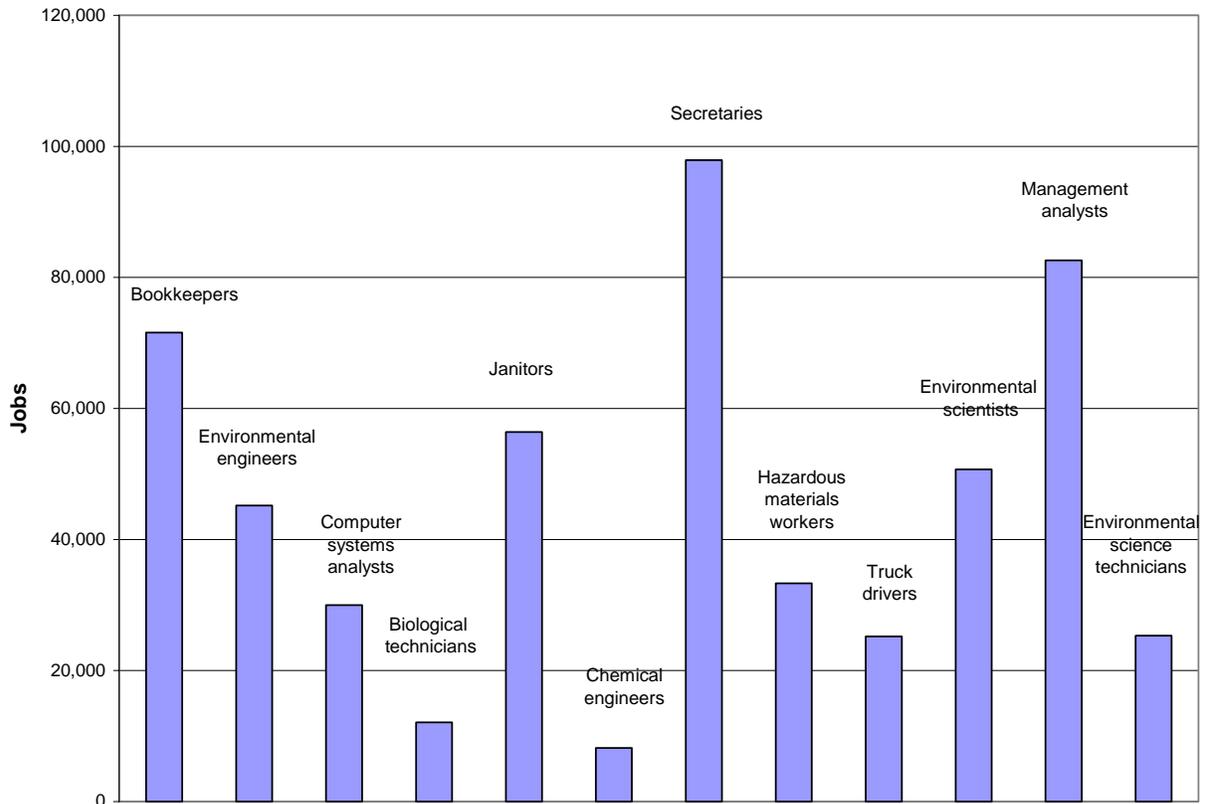


Source: Management Information Services, Inc., 2004.

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 employment 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 who 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 NORTH CAROLINA ECONOMY IN 2003

The North Carolina economy performed well in 2003, growing at about the national rate. State personal income grew 3.1 percent in 2003, just below the national rate of 3.2 percent. Per capita income, while increasing in 2003 to over \$28,300, fell slightly to 90 percent of the national average of \$31,459. Gross state product has steadily increased over the past three years and reached \$290 billion in 2003. The state's contribution to national GDP has remained flat since 2000, accounting for about 2.7 percent of the national total. North Carolina's population has increased an estimated 4.1 percent since the last decennial census, a rate higher than the nation's 3.0 percent growth rate. The state's population exceeded 8.4 million in 2003 and North Carolina remained the 11th largest in the U.S., accounting for almost 2.9 percent of the nation's population.

The labor force grew by around 50,000 from 2002 to 2003, reaching an all-time monthly high exceeding 4,263,000 in October 2003. State employment kept pace with the expansion of the labor force and added around 60,000 new jobs during the year, which kept unemployment during the course of the year bracketed between 265,000 and 282,000. North Carolina's unemployment rate initially rose from 6.4 percent in January to 6.6 percent in July, but then fell consistently through the end of the year, reaching 6.2 percent in December. The state's unemployment rate remained around 0.4 percentage points above the national average throughout the year.

North Carolina leads the nation in the production of tobacco and is a major producer of textiles and furniture, but is gradually diversifying into services and high-tech enterprises. The state has long been a major textile manufacturer, producing cotton, synthetic, and silk goods as well as various kinds of knit items. Other leading manufactures are electrical machinery, computers, and chemicals; the Research Triangle complex near Chapel Hill has spurred high-tech manufacturing, as well as bringing federal jobs into the state. The state also has valuable coastal fisheries. Charlotte developed in the 1980s into a major U.S. banking center, and related businesses have flourished in the area.

However, North Carolina's economy has been undergoing a major transition from traditional industries to new economy companies and that the transition has been characterized by a shift in employment from the manufacturing to the services sector and from labor-intensive to knowledge-based jobs. The state's traditional manufacturing base of textiles, apparel, furniture, and tobacco has decreased by 145,000 workers since the late 1990s, and North Carolina is projected to lose another 200,000 traditional manufacturing jobs over the next decade. The state is attempting to create new jobs fast enough to replace those lost -- particularly new jobs that pay attractive wages.

In terms of competing in the 21 century economy, North Carolina has some strong advantages, but also some serious disadvantages. Its advantages include ranking relatively high (on a 50-state comparison) with respect to certain measures, including⁶:

- 4th in foreign direct investment – the percentage of each state’s workforce employed by foreign companies
- 15th in venture capital – venture capital invested as a percentage of gross state product (GSP)
- 16th in information technology jobs – employment in IT occupations in non-IT industries as a share of total jobs
- 16th in job churning – the number of new start-ups and business failures, combined as a share of all establishments in each state.
- 16th in digital government – a measure of the utilization of digital technologies in state governments
- 19th in industry investment in R&D – industry investment in research and development as a percentage of GSP

The state’s disadvantages include ranking relatively low (on a 50-state comparison) with respect to certain other measures, including⁷:

- 45th in online population – the percentage of adults with Internet access in each state
- 44th in technology in schools – a weighted measure of five factors measuring computer and Internet use in schools
- 42nd in education level of the manufacturing workforce – a weighted measure of the educational attainment of the manufacturing workforce

Table 4 shows the earnings by industry of employment in North Carolina and how these compare to the U.S. averages. This table shows that North Carolina ranks relatively low with respect to sectors such as mining, utilities, information, educational services, and professional, scientific and technical services. However, this illustrates that North Carolina ranks high with respect to several sectors: Specifically, with 2.6 percent of the nation’s personal income:

⁶*The State New Economy Index*, www.neweconomyindex.org.

⁷Ibid.

- Employment earnings in the North Carolina manufacturing sector account for 3.4 percent of total earnings nationally in that sector.
- Employment earnings in the North Carolina management of companies and enterprises account for 3.5 percent of total earnings nationally in that sector.

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

	North Carolina (millions)	North Carolina Share of U.S.	North Carolina Share of Earnings	U.S. Share of Earnings	North Carolina Index
Personal Income (including adjustments)	\$237,931	2.6%	-	-	-
Agriculture, Forestry, Fishing and Hunting	2,105	2.8%	1.1%	1.0%	110
Mining	287	0.5%	0.2%	0.8%	20
Utilities	1,347	1.8%	0.7%	1.0%	71
Construction	11,510	2.7%	6.3%	6.1%	103
Manufacturing	32,782	3.4%	17.8%	13.4%	133
Wholesale Trade	9,633	2.6%	5.2%	5.1%	102
Retail Trade	12,975	2.7%	7.0%	6.8%	104
Transportation and Warehousing	5,439	2.3%	3.0%	3.3%	91
Information	5,159	1.9%	2.8%	3.9%	72
Finance and Insurance	10,737	2.0%	5.8%	7.5%	78
Real Estate and Rental and Leasing	3,762	2.1%	2.0%	2.5%	83
Professional, Scientific, and Technical Services	12,196	1.9%	6.6%	9.1%	73
Management of Companies and Enterprises	5,051	3.5%	2.7%	2.0%	135
Administrative/Support/Waste Management/Remediation Services	6,019	2.4%	3.3%	3.6%	91
Educational Services	1,997	2.1%	1.1%	1.3%	83
Health Care and Social Assistance	16,089	2.4%	8.7%	9.4%	93
Arts, Entertainment, and Recreation	1,610	2.1%	0.9%	1.1%	80
Accommodation and Food Services	4,659	2.4%	2.5%	2.7%	92
Other Services	5,375	2.5%	2.9%	3.0%	97
Public Administration	35,320	3.0%	19.2%	16.3%	118

Source: Management Information Services, Inc., 2004.

V. THE ENVIRONMENTAL INDUSTRY AND JOBS IN NORTH CAROLINA

V.A. Summary of the Environmental Industry and Jobs in North Carolina

MISI estimates that in 2003:

- Sales generated by environment-related industries in North Carolina totaled \$9.14 billion.
- The number of environment-related jobs totaled 112,000.
- The environmental industry in North Carolina generated 3.1 percent of gross state product.
- North Carolina environmental industries accounted for about three percent of the sales of the U.S. environmental industry.
- Environment-related jobs comprised 2.9 percent of North Carolina employment.
- Environment-related jobs in North Carolina comprised 2.5 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 North Carolina by Industrial Sector

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

Comparison of the industrial sector distribution of environment-related jobs in North Carolina 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 North Carolina 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 North Carolina is more manufacturing intensive than other average private sector activity in the state:

Table 5
Environmental-Related Jobs in North Carolina in 2003, by Industry

Industry	Establishments	Total Employment	Environmental Employment	Environmental Jobs (percent)
Agriculture, Forestry, Fishing and Hunting	995	3,700	120	3.2
Mining	194	4,000	293	7.3
Utilities	415	14,000	2,114	15.1
Construction	23,629	211,800	4,732	2.2
Manufacturing	9,409	604,300	14,013	2.3
Wholesale Trade	12,410	163,600	1,827	1.1
Retail Trade	35,163	432,500	2,582	0.6
Transportation and Warehousing	4,969	110,700	632	0.6
Information	2,930	75,600	1,797	2.4
Finance and Insurance	12,009	143,700	855	0.6
Real Estate and Rental and Leasing	8,268	47,800	577	1.2
Professional, Scientific, and Technical Services	17,978	146,300	11,616	7.9
Management of Companies and Enterprises	1,168	61,200	971	1.6
Administrative/Support/Waste Management/Remediation Services	11,005	213,700	10,001	4.7
Educational Services	1,783	61,600	1,753	2.8
Health Care and Social Assistance	18,382	366,600	1,848	0.5
Arts, Entertainment, and Recreation	2,861	44,000	240	0.5
Accommodation and Food Services	16,009	291,000	1,837	0.6
Other Services	21,087	162,400	1,335	0.8
Public Administration	-	644,600	52,865	8.2
State Total	200,665	3,803,100	112,007	2.9

Source: Management Information Services, Inc., 2004.

- 24 percent of private sector jobs in the environmental industry are in manufacturing, compared to 19 percent in manufacturing among all private sector industrial activities in North Carolina.
- 20 percent of private sector environmental jobs are in professional, scientific, and technical services, compared to 5 percent of all private sector jobs in the state.
- 17 percent of private sector environmental jobs are in administrative, support, and waste management services, compared to 7 percent of all private sector jobs in the state.
- 3 percent of private sector environmental jobs are in educational services, compared to 1.2 percent of all private sector jobs in the state.

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

- 4 percent of private sector environmental jobs are in the retail trade sector, compared to 14 percent in retail trade among all private sector jobs in the state.
- 1 percent of environmental jobs are in the finance and insurance sector, compared to 5 percent among all private sector jobs in the state.
- 3 percent of environmental jobs are in the health care and social service sector, compared to 12 percent among all private sector jobs in the state.
- 1 percent of environmental jobs are in the transportation and warehousing sector, compared to 4 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 112,000 environmental jobs account for nearly three percent of the total 3.8 million jobs in North Carolina. However, this distribution is uneven among industry sectors:

- 15 percent of employment in the utilities sector consists of environmental jobs, primarily water, waste treatment, sanitation, and related facilities.
- More than 8 percent of public administration employment in the state consists of environmental jobs.
- Nearly 20 percent of North Carolina jobs in the professional, scientific, and technical services are environmental jobs.
- **About 2.3 percent of the state's manufacturing employment is environment-related**
- 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 less than three percent of total state employment, the industrial sector composition of environmental employment is highly skewed in favor of certain sectors. For example, 24 percent of private sector environmental jobs are in manufacturing, compared to 19 percent of all private sector employment, and nearly one-fifth of private sector environmental jobs are in professional, scientific, and technical services, compared to 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 North Carolina's high-tech and manufacturing sectors. As noted in Chapter IV, North Carolina is seeking to modernize and expand its high-tech industrial and manufacturing base. Table 5 indicates that the environmental industry can aid in this objective.

Similarly, **environmental investments generate, proportionately, five times as many private industry 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 North Carolina – 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 North Carolina by Occupation and Skill

Environmental employment in North Carolina 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 North Carolina are widely distributed among 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 North Carolina in 2003 within selected occupations. This table shows that in 2003 environmental protection generated in North Carolina generated:

Table 6
Environmental Jobs Generated in North Carolina
in 2003, by Selected Occupations

Occupation	Jobs
Accountants and Auditors	493
Biological Technicians	449
Bookkeeping and Accounting Clerks	1,010
Carpenters	489
Chemists	539
Civil Engineers	760
Computer Software Engineers	1,290
Conservation Scientists	388
Customer Service Representatives	1,030
Electricians	420
Electronics Engineers	272
Environmental Engineers	1,262
Environmental Science and Protection Technicians	958
Environmental Scientists and Specialists	2,261
Executive Secretaries and Administrative Assistants	1,289
Financial Managers	546
Forest and Conservation Workers	368
Forresters	177
Hazardous Material Removal Workers	1,077
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	1,080
Industrial Machinery Mechanics	348
Janitors and Cleaners	1,037
Mechanical Engineers	204
Management Analysts	482
Marketing Managers	296
Medical Scientists, Except Epidemiologists	568
Natural Science Managers	575
Office Clerks	1,936
Pest Control Workers	361
Security Guards	553
Septic Tank Servicers and Sewer Pipe Cleaners	194
Sheet Metal Workers	605
Stock Clerks	1,392
Surveying and Mapping Technicians	525
Training and Development Specialists	243
Truck Drivers	1,971
Welders and Solderers	228

Source: Management Information Services, Inc., 2004.

- More jobs for sheet metal workers (605) than for biological technicians (449)
- More jobs for office clerks (1,936) than for pest control workers (361)
- More jobs for executive secretaries (1,289) than for environmental engineers (1,262)
- More jobs for janitors (1,037) than for natural science managers (575)
- More jobs for stock clerks (605) than for chemists (539)
- More jobs for electricians (420) than for conservation scientists (760)
- More jobs for truck drivers (1,971) than for civil engineers (760)
- More jobs for financial managers (546) than for conservation scientists (388)
- More jobs for management analysts (482) than for foresters (177)
- More jobs for computer software engineers (1,290) than for environmental science technicians (958)

Thus, many workers in North Carolina 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 North Carolina 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 North Carolina comprises less than three 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
- Chemical engineers
- Civil engineers
- Computer software engineers
- Electrical engineers
- Electronics engineers
- Medical scientists
- Natural sciences managers
- 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 North Carolina comprises less than three 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
- Chemical plant and systems operators
- Civil engineering technicians
- Control and valve installer and repairers
- Electrical and electronics engineering technicians
- Electrical and electronics equipment assemblers

- Electrical and electronics drafters
- Fiberglass laminators and fabricators
- Forest and conservation technicians
- Heating, air conditioning, and refrigeration mechanics and installers
- Industrial engineering technicians
- 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 North Carolina -- 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 North Carolina generated by environmental protection are close to the average of 2.9 percent of total employment; including:

- Accountants and auditors
- Administrative services managers
- Brickmasons
- Computer and information systems managers
- Construction laborers
- Electricians
- Executive secretaries

- Financial managers
- Health information specialists
- Human resource assistants
- Industrial engineers
- Interviewers
- Machinists
- Network and Computer systems administrators
- Payroll clerks
- Plumbers and Pipefitters
- Purchasing agents
- Security guards
- Stock clerks
- Training and development specialists
- Truck drivers
- Welders

V.D. The Environmental Industry as an Economic Driver for North Carolina

This study demonstrates that environmental protection can form an important part of a strategy for North Carolina 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 North Carolina. For example:

- This study demonstrates that, at present in North Carolina, environmental protection is creating more than 112,000 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 a strengthening of U.S. Federal Corporate Average Fuel Economy (CAFE) standards would create more than 13,000 jobs in North Carolina. Thus, contrary to what many believe, the production of more fuel-efficient vehicles would create substantial numbers of jobs in the state, not reduce them.⁸
- A 2004 study by Redefining Progress estimated that investments in renewable energy and energy efficiency would create 44,000 jobs in North Carolina.⁹
- 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 26,000 jobs in North Carolina.¹⁰

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 North Carolina, which currently has a thriving, job creating environmental industry, currently generating more than 112,000 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 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.

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.

⁹J. Andrew Hoerner and James Barrett, *Smarter, Cleaner, Stronger: Secure Jobs, a Clean Environment, and Less Foreign Oil*, Redefining Progress, Oakland, California, 2004.

¹⁰Tellus Institute and Stockholm Environment Institute, *America’s Global Warming Solutions*, Boston, August 1999.

VI. SUMMARY PROFILES OF SELECTED NORTH CAROLINA ENVIRONMENTAL COMPANIES

We conducted a survey of existing environmental companies in North Carolina, 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 20 employees to large firms employing thousands
- Are engaged a wide variety of activities, including engineering, 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 October 2004.

VI.A. ARCADIS

ARCADIS is an engineering, environmental, remediation, and sustainable development services firm with offices in Charlotte, Durham, Greensboro, and Raleigh. It has 9,000 employees worldwide, including 2,800 in the U.S. (300 of which are in North Carolina), and its staff consists of scientists, engineers, technicians, and administrative and support personnel. It is a multinational firm with a large number of private and public sector clients throughout the world.

ARCADIS was founded in the late 1800's and currently offers clients a broad range of integrated services including feasibility studies, design, engineering, project management, site evaluation and remediation, operations, implementation, facility management, and related legal and financial services. The company has been able to provide quality service in all areas by continually investing in state-of-the-art technologies, processes, products, and services.

Table 7
Summary of the Select North Carolina Environmental Companies Profiled

Company	Location	Products/Services	Jobs
Arcadis	Charlotte, Greensboro, Raleigh, Durham	Environmental and sustainable development services	US: 2,800 NC: 300
CompuChem	Cary	Environmental testing, sampling, and analysis	US: 95 NC: 75
Dewberry	Charlotte, Raleigh	Environmental compliance, planning, and design	US: 1,500 NC: 80
Engineering Consulting Services, Ltd.	Charlotte, Greensboro, Wilmington, Raleigh	Geotechnical, environmental, and construction materials engineering	US: 700 NC: 55
Froehling & Robertson, Inc.	Charlotte, Raleigh, Fayetteville, Asheville, Hickory	Environmental engineering, laboratory testing, and geotechnical services	US: 370; NC: 107
Mid-Atlantic Associates, Inc.	Raleigh, Charlotte	Environmental engineering, remediation, and consulting	US: 43; NC: 23
Olver, Inc.	Charlotte, Raleigh	Water supply, wastewater management, and solid waste services	US: 60 NC: 17
McKim & Creed	Wilmington, Bolivia, Cary, Charlotte, Greensboro, New Bern	Environmental engineering, surveying, and water and stormwater management	US: 300 NC: 175
Stantec, Ltd.	Charlotte, Raleigh, Winston-Salem	Environmental, engineering, planning, wastewater treatment, and water reclamation systems	US: 1,500 NC: 25
Solargenix Energy	Raleigh, Sanford	Solar energy system design and installation	US: 20 NC: 20
Terracon	Charlotte, Raleigh, Winterville	Geotechnical and environmental engineering and related services	US: 1,600 NC: 45

Source: Management Information Services, Inc., 2004.

A core element of ARCADIS' business strategy is Sustainable Development. The concept of sustainability is built around the premise that corporations, governments, and communities can improve their financial performance and longer term viability while responsibly addressing more global environmental and social impacts. Sustainable projects range in size from a small solar-powered reverse osmosis drinking water treatment facility in a remote national park to the largest industrial complex sustainable design in the world – the Ford Rouge Center in Dearborn, Michigan. Sustainable solutions are cost effective and provide peace of mind to both government and private sector clients. ARCADIS' sustainable design features address needs such as energy efficiency, alternative energy sources, environmentally-friendly materials, resource conservation, lean manufacturing, recycling, treatment and other restorative process, worker and public safety, and alternative transportation.

ARCADIS recently became the recipient of the prestigious Phoenix Award for excellence in Brownfield redevelopment awarded by the U.S. Environmental Protection Agency. The award highlighted and honored ARCADIS' environmental accomplishments in the development of a 103-acre, \$560 million mixed-use project, named Belmar, which will become the "downtown" for the city of Lakewood -- Colorado's fourth largest city. ARCADIS developed and implemented an overall business solution to enable the revitalization and redevelopment of an aging 1960s vintage mall into a mixed-use urban community. The utilization of its GRiP® Remediation Program, patented in-situ reactive zone technologies, and emerging hydraulic fracturing technology enabled ARCADIS to provide a cost-effective remediation solution. ARCADIS secured the funds necessary to complete remediation through the award of a \$110,000 Brownfield Grant fund from the city of Lakewood and \$2 million in low-interest loan funds originating from largest Brownfield loan ever issued by the U.S. EPA.

VI.B. CompuChem

CompuChem is located in Cary and offers a wide range of analytical services to support environmental engineers, private industry, and state and federal government agencies. The firm has 95 employees, including 75 in North Carolina, and has hired 11 new employees over the past six months. Its staff consists of engineers, chemists, analysts, degreed technologists, and administrative and support staff. About 70 percent of its business is with private industry and 30 percent is with government; all of its clients are domestic.

CompuChem is proficient in EPA and industry standard methods for analyzing organic and inorganic contaminants in liquid, solid, and tissue samples, and combines the talent and experience of the company's professionals with the latest instrumentation to produce quality data. The firm is located near the Research Triangle Park and is less than five miles from the Raleigh-Durham International Airport. Its laboratory facility has over 30,000 square feet of space divided proportionately between a number of laboratory and support areas.

CompuChem was founded in 1980 and has established itself as one of the nation's leading EPA contract laboratories. By the mid-1980s, the client base expanded to include both commercial firms and government agencies, and by the 1990s the company was performing organic, inorganic, and wet chemistry analyses for a large number of commercial and government clients. In 1996, CompuChem underwent management restructuring and became a part of Liberty Analytical Corporation, and in 1997 purchased an 11-acre site and relocated to a new laboratory facility in Cary. The firm's services include:

- *Analytical Chemistry.* The company has analyzed samples of every conceivable type of matrix, including, fish tissue/organs/oil, bird tissue/organs, concrete chips, heavy oil, and ceiling tiles, and its environmental testing laboratory has analyzed tens of thousands of samples with sludge, sediment, soil, water, biota, and waste matrices.
- *USEPA Contract Lab Program (CLP).* For more than 20 years, CompuChem's analytical ability in CLP routine analytical services has allowed the laboratory to handle multiple organic and inorganic sample analysis bid lots for the U.S. EPA and to offer CLP-style services to other government and commercial clients.
- *Project Management.* CompuChem's Environmental Testing Lab Project Managers take pride in thoroughly reviewing and assessing customer work plans. All customer technical scopes are reviewed by Quality Assurance staff, as well as the managers, whose lab area(s) will contribute to the preparation and analysis of the project samples.
- *Deliverables.* Historically, CompuChem environmental testing has provided comprehensive, fully validatable data packages that are consistent with the requirements of the US EPA Contract Laboratory Program, and most of the firm's Federal Services Contractors routinely require CLP-like data packages. While CompuChem specializes in full deliverables, its laboratory also offers reduced deliverables styles depending on the client's requirements. CompuChem can provide any reporting format that is necessary to meet the needs of its customers.
- *Sampling Supplies.* Preservatives must be added in the field at the time of sample collection unless the glassware is already pre-preserved, and preservatives should be recorded on the Chain-of-Custody form in the "Remarks" column on a per sample basis. For certain methods and parameters, the laboratory verifies upon receipt that the sample pH falls within an acceptable range, and improperly preserved samples or samples with pH values outside of

the specified range are noted in the sample receiving documentation. The client is contacted and given the option of resampling, directing the laboratory to preserve the sample in-house, or processing the sample as it was received. To document the action taken, a Quality Assurance Notice is included in the data report for any occurrence.

VI.C. Dewberry

Dewberry is a professional services planning, design, and environmental compliance firm with offices in Charlotte and Raleigh. The firm has 1,500 employees nationwide, including 80 in North Carolina, and it has hired six new staff over the past six months. Its employees include environmental engineers and scientists, surveyors, transportation and planning specialists, architects, technologists, and support personnel. About half of its business is with government agencies and the other half with the private sector – primarily architectural firms and real estate developers; all of its business is domestic.

A privately held firm, Dewberry was established as a small land design and surveying practice in 1956 in Arlington, Virginia, and in 1965, the headquarters office was relocated to Fairfax County, Virginia. The firm provides services in program management, planning, engineering, architecture, surveying, geographic information services, and the environmental sciences, and its clients include government agencies at all levels, corporations, real estate developers, colleges and universities, school districts, and other commercial and institutional organizations.

Over time, Dewberry expanded upon its civil engineering and surveying expertise and added offices, is currently an *Engineering News-Record* “Top 50” design firm, and ranks in the top 25 in several of ENR’s market categories. Dewberry’s practice encompasses a broad range of services, including:

- Architecture
- Building engineering
- Design-build
- Emergency management
- Environmental sciences & engineering
- Facilities planning & design
- Federal programs support

- Geographic information services
- Land development services
- Municipal infrastructure engineering
- Security and homeland defense
- Surveying
- Telecommunications
- Transportation planning & engineering
- Water resources engineering

VI.D. Engineering Consulting Services, Ltd

Engineering Consulting Services, Ltd. (ECS) is a diverse consulting firm specializing in the related fields of geotechnical, environmental, and construction materials engineering and has offices in Charlotte, Greensboro, Wilmington, and Raleigh. It employs over 700 persons nationwide, including 55 in North Carolina, and has hired five new employees over the past six months. Its staff includes registered professional engineers and geologists, certified laboratory technicians and construction inspectors, field engineers and lab technicians, construction inspectors, and related administrative staff. About half of ECS business is government and half is in the private sector; all of its sales are domestic.

Founded in 1987, ECS headquarters are in Chantilly, Virginia, and the firm operates 24 full-service branch offices in the Eastern, Midwest and Southern United States. The firm's services include:

- *Environmental Engineering.* Environmental engineering encompasses a wide range of specialties, and ECS has tailored its environmental capabilities to serve the business development community, manufacturing industries, municipalities, financial institutions, owners, and prospective buyers of existing buildings.
- *Geotechnical Engineering.* Foundation design and earthwork construction are key elements in the success of any construction project, and the ECS geotechnical engineering team has a broad understanding of all the relevant factors and issues that govern practical foundation design and construction.

- *Materials Testing & Engineering.* Quality Construction is a requirement for a successful project, and ECS helps the construction team make decisions during construction that are cost-effective, expedient, and correct. ECS staff use a fully computerized reporting system which allows test results and field observations to be transmitted efficiently.
- *Specialty Engineering.* Specialty engineering services include pressure meter testing, retaining wall design, and AutoCad™ drafting. ECS Specialty Engineering Services provides cost-effective solutions when developing complex projects.
- *Roofing and Waterproofing.* ECS Roofing and Waterproofing Services are tailored to provide quality service from the evaluation phase through to periodic maintenance after a new roofing system is installed. Key members of ECS Roofing and Waterproofing Services are either professional engineers or registered with the Roof Consultants Institute.

VI.E. Froehling & Robertson Inc.

Froehling & Robertson Inc. (F&R) is an environmental engineering and testing company with offices in Charlotte, Raleigh, Fayetteville, Asheville, and Hickory. It has 370 employees, including 107 in North Carolina. Staff includes engineers, ecologists, chemists, environmental scientists, construction inspectors, degreed technologists, technicians, and administrative and support personnel, and the firm has hired 10 new employees within the past six months. About 70 percent of its business is with the private sector and 30 percent is with federal, state, and local governmental agencies; all of its sales are domestic.

F&R is a full-service engineering company and testing laboratory offering geotechnical and environmental engineering services, analytical chemistry, and materials testing and inspection. It provides a wide range of environment services including:

- Site assessments
- Asbestos and lead paint surveys
- Air quality and industrial health studies
- Wetland delineations
- Storm water management

F&R was founded in 1881, by Dr. Henry Froehling in Richmond, Virginia. For over 122 years, it has worked with some of the largest and most respected firms in the mid-Atlantic region, throughout the United States, and overseas.

The firm is continuing to expand, develop, and refine company operations to meet the needs of an ever-changing industry. As one of the oldest independent engineering and environmental laboratories in the nation, F&R offers the services of professional engineers, chemists, environmental scientists, construction inspectors and technicians, as well as administrative staff.

F&R has grown significantly and today staffs over 370 trained personnel throughout four states in the mid-Atlantic region. The company's equipment and laboratory facilities have been continually upgraded to offer the latest technological advancements.

F&R was ranked number 295 on the 2004 rankings of top design firms as compiled by the *Engineering News-Record*. Companies were ranked according to revenues for design services performed in 2003.

VI.F. Mid-Atlantic Associates, Inc.

Mid-Atlantic Associates, Inc. (MAA) is an engineering and environmental consulting firm headquartered in Raleigh, with an additional office in Charlotte. Its employees are engineers, technicians, and administrative and support staff. The firm has 43 employees, including 23 in North Carolina. Its business is divided equally between public and private sector clients, and all of its sales are domestic.

Since 1993, MAA has provided technically proficient engineering and environmental solutions throughout the eastern United States. It offers a wide variety of services including environmental site assessments, hazardous waste investigations, remediation services, underground storage tank management, residential oil tanks, Phase I real estate transfer assessments, brownfield projects, environmental permitting, air quality engineering, indoor air quality, water resources management, asbestos, radon, and lead paint services.

MAA was selected as one of the 100 fastest-growing firms according to Zweig Letter Hot Firm 2002 list. It was selected from several hundred U.S. based firms that derive the majority of their revenue from the practice of architecture, engineering, planning, environmental consulting, or allied disciplines. The Zweig Letter is compiled by ZweigWhite, a leading management consulting, publishing, and training firm serving the A/E/P, construction and environmental industries throughout the U.S. and internationally.

VI.G. McKim & Creed

McKim & Creed is an environmental consulting firm with office locations throughout the Southeastern United States, including six located in North Carolina in Wilmington, Bolivia, Cary, Charlotte, Greensboro, and New Bern. It has 300 employees, including 175 in North Carolina, and has hired 41 new staff within the past six months. The firm's employees consist of engineers, surveyors, landscape architects, ecologists, environmental scientists, technicians, and administrative and support personnel. Its clients are primarily government and industrial, and all of its sales are domestic.

McKim & Creed is an employee-owned firm that offers a full range of environmental, architectural, engineering, surveying, planning, and landscape architectural services, and it specializes in environmental engineering, surveying, water reclamation, water and stormwater management, permitting, and infrastructure rehabilitation. Since its inception in 1978, it has grown from a single-office generalist to an infrastructure specialist. McKim & Creed's staff of professionals design water systems that enable communities to recycle and reuse water, and ensure that people have clean, safe water from municipal water treatment and wastewater treatment facilities. The firm also engineers efficient, cost-effective processes that increase manufacturing production and decrease harmful pollutants, and surveys and measures boundaries, across land and water, using cutting-edge technology. McKim & Creed's full service offerings include:

- Environmental Engineering
- Civil Engineering
- Instrumentation and Controls
- Landscape Architecture
- Structural Engineering
- Geomatics (Surveying)
- Information Technology Services

McKim & Creed is ranked among *Engineering News-Record's* top 500 design firms and top 200 environmental firms in the U.S. The top 200 environmental companies were ranked on the basis of gross revenues reported in 2003 for providing environmental services and products to domestic and international markets. The top 500 design firms were ranked according to revenues for design services performed in 2003.

VI.H. Olver, Inc.

Olver, Inc. is a multidisciplinary professional environmental engineering services with offices in Charlotte and Raleigh. It has 60 employees, including 17 in North Carolina, and has hired two new employees over the past six months. The firm's staff consists of engineers, planners, scientists, geologists, technicians, and support personnel. Its clientele is 10 percent industrial and 90 percent state and local government; all of its sales are domestic.

Olver was founded in 1975 and provides comprehensive engineering and planning services to local, state, and federal governments and industries throughout the Carolinas and Virginia. The firm's headquarters is in Blacksburg, Virginia, and it specializes in industrial wastewater treatment systems, hazardous waste management, environmental audits, remedial investigations, and feasibility studies.

For over 30 years, Olver has serviced both public and private sector clients. The firm's service offerings include water supply services, wastewater management services, industrial and environmental services, solid waste services, site development and building design services, and construction support services.

Current regulatory changes are affecting drinking water supply systems at a rapid rate. Olver has a skilled technical staff that stays current with new regulatory and technological developments and has an affiliated full-service laboratory for testing purposes. By keeping abreast of the ever changing regulations and by keeping up with the latest technology, the firm develops safe, reliable, and affordable water supply systems.

Known for innovative solutions to wastewater management challenges, Olver has been delivering wastewater management solutions for clients across the southeastern United States and has innovative, environmentally sound, cost-effective solutions for wastewater management needs. Most staffers hold advanced technical degrees and have been recognized nationally for their work. Olver has the capability of implementing a simple, low cost solution for wastewater management in a small rural community as well as the technology to manage a complex wastewater stream.

VI.I. Solargenix Energy

Solargenix Energy, LLC, is a solar design and installation company with worldwide experience in energy and environmental engineering, solar design and building construction, and has offices in Raleigh and Sanford. Its employees consist of solar energy specialists, system design engineers, installers, and technicians. It has 20 employees, all in North Carolina, its business is residential, industrial, institutional, and utilities, and all of its sales are domestic.

Solargenix, founded in 1999, designs, markets, manufactures, installs, and maintains a patented solar system capable of producing hot water, steam, or electricity for residential, industrial, institutional, commercial, and utility customers. It has acquired key licensing agreements, filed patents, and registered trademarks on solar thermal collectors that cover operating temperatures from 120°F (48°C) to 750°F (398°C), thus spanning the complete range of solar thermal application from solar water heating to power generation.

The basis for Solargenix technologies is a science called Non-Imaging Optics. This patented technology, when used in conjunction with evacuated tube collectors, improves the efficiency of converting solar energy to thermal energy. The collectors can be utilized in many different configurations: They can be added to an existing roof or, in the case of the patented Solargenix Power Roof™, can be integrated into the roof of a new structure. Solargenix Energy also has technologies that can be ground mounted if desired by the client.

The company has assembled a highly qualified management and technical team. Principals and strategic partners have over 100 years of combined experience in the fields of design, engineering, building, manufacturing, power engineering, solar energy, and related research and development. Included in the management team are highly recognized leaders in the field of solar energy with excellent contacts in the international energy community.

Solargenix has a core group of dedicated highly experienced professionals to provide turnkey solar thermal or solar hybrid systems for customers. The company has assembled a highly qualified management and technical team consisting of some of the most experienced personnel in the world for the development, design, supply, construction and operation of solar thermal hybrid systems. The company's capabilities include research & development, engineering and design, construction and system integration, project and program management, automation and controls, manufacturing, and advanced technology and services. The firm's core services areas include:

- *Large Scale Power Generation.* Solargenix and its subcontractor companies have available the most experienced personnel for the development, design, supply, construction and operation of solar power projects and plants. Key personnel from LUZ International, which developed nine Solar Electric Generating Systems (SEGS) in California that has been operating successfully for over a decade, are on staff.
- *Low-Medium Temperature.* Solargenix personnel are pioneers in designing and installing low-medium temperature driven systems such as the largest successful solar absorption HVAC systems in the early 1980s at Wagner College in New York City and the double effect solar driven cooling system on a print shop in Sacramento, California in March 1998.

- *Zero-Energy Buildings.* Solargenix Energy has incorporated daylighting, natural ventilation, passive heating, and radiant barriers in conjunction with thermal solar technology in cost-effective energy buildings. The firm and its partners have built numerous schools and commercial buildings in the US.

VI.J. Stantec, Inc.

Santec Consulting International, Ltd., is a multinational environmental engineering and design company founded in 1954 with offices in Charlotte, Raleigh, and Winston-Salem. It has 1,500 employees nationwide, including 25 in North Carolina, and has hired one new employee in the state over the past six months. Its staff consists of environmental scientists, architects, landscape architects, business professionals, project managers, engineers, surveyors, technicians, interior designers, technologists, and support staff. About 80 percent of Santec's work is for government and 20 percent is for the private sector; it has substantial international sales.

Santec provides environmental, design, and consulting services in planning, engineering, architecture, interior design, landscape architecture, surveying, and project management, and its major service areas include consulting engineering, planning, wastewater treatment systems, and water reclamation systems. Santec's services are offered through more than 4,000 employees operating out of over 50 locations in North America and the Caribbean, including three locations in North Carolina. The firm's multidisciplinary practice areas serve public and private sector clients in the U.S., Canada, and abroad.

Since its inception in 1954, Stantec has evolved from a one-person consulting engineering business to an environmental engineering and design firm operating across North America. Stantec has provided North Carolina with a multi-disciplined scope of services and technologies for more than five decades in the markets of buildings, environment, industrial, transportation, and urban land use.

Stantec has an aggressive growth plan designed to elevate the firm to a top 10 global design firm by 2008 and attaining annual revenues approaching \$1 billion and employing 10,000 people worldwide. It plans to achieve this goal through excellence in design and project delivery and by following an orderly growth plan that builds on its core competencies.

Stantec was ranked as number 50 on the list Top 150 Global Design Firms as compiled by the *Engineering News-Record* in 2004. Companies on the list were ranked according to total revenue for design services performed in their home country and abroad during 2003.

VI.K. Terracon

Terracon is a geotechnical, environmental and materials engineering company with offices in Charlotte, Raleigh, and Winterville. It has 1,600 employees in the U.S., including 45 in North Carolina, and has hired five new staff in the past six months. Its staff includes engineers, scientists, materials specialists, technicians, and support personnel. Half of its business is public sector and half is private sector, and all of its sales are domestic.

Terracon is an employee-owned consulting firm of engineers and scientists providing geotechnical, environmental, construction materials, and related services from more than 60 offices nationwide. Since its founding in 1965, the firm's network of offices has provided local expertise backed by extensive national resources to service local, regional, and national clients.

Terracon is a leading provider of geotechnical, environmental, construction materials, and related services, and has completed projects of all sizes for clients in a variety of industries nationwide. Areas of specialties include:

- *Environmental.* Major environmental services provided include site assessments and investigations; remedial design and implementation; brownfield and site redevelopment; natural resources, wetlands delineation and mitigation; health and safety; industrial hygiene, mold, indoor air quality; asbestos and lead; regulatory compliance; environmental management systems; and solid waste planning and design.
- *Geotechnical.* Design and construction of functional and cost-effective structures require a thorough understanding of local soil, rock, and groundwater conditions. Terracon provides a wide range of services to support all phases of a project, from preliminary design through completion of the building process.
- *Services.* From the ground up, Terracon provides practical solutions to geotechnical, environmental, construction materials, and related engineering challenges. Its national network of over 60 offices provides local expertise backed by national resources to get the job done cost effectively and efficiently. On both small and large projects, Terracon's experienced professionals work closely with clients to achieve success, on time and on budget.

- *Construction Materials.* Proper selection, quality, and workmanship of construction materials play a vital role in ensuring that buildings and infrastructure perform adequately over long time periods. Terracon works with clients to minimize material replacements, reduce the likelihood of deterioration, avoid potential failures, and investigate and evaluate construction materials related problems and failures when they do occur.

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

VII.A. Division of Pollution Prevention and Environmental Assistance

The mission of the Division of Pollution Prevention and Environmental Assistance is to protect the environment and conserve natural resources by providing technical assistance on the elimination, reduction, reuse, and recycling of wastes and pollutants. It has seven major goals:

- Goal 1: Facilitate the establishment of environmental management systems in two new sectors -- hog farms and government agencies. DPPEA has established pilot projects with eight hog farms and eleven government agencies and is working with each of these pilots to design and implement an Environmental Management System (EMS), using the ISO 14001 model.
- Goal 2: Implement an Environmental Stewardship Initiative. DPPEA staff is working with other DENR divisions and external partners to develop the Environmental Stewardship Initiative (ESI), designed to promote and encourage superior environmental performance by North Carolina's regulated community. This initiative seeks to reduce the impact on the environment beyond measures required by any permit or rule, producing a better environment, conserving natural resources, and resulting in long-term economic benefits.
- Goal 3: Help establish five to seven new recycling businesses and facilitate the permanent diversion of 50,000 tons of waste from landfills. Partnering with the Division of Waste Management and the Department of Commerce, DPPEA is providing assistance to a number of recycling businesses that are in various stages of developing recycling capacity.
- Goal 4: Enhance interdivision coordination efforts in environmental education on nonpoint source pollution runoff. DPPEA and the Office of Environmental Education are coordinating a public education and awareness campaign on polluted runoff.
- Goal 5: Implement a water conservation and reuse program in the coastal plain capacity use area. In response to the drought, DPPEA switched its focus from the coastal plain capacity use area to Tier I and II water systems. This statewide effort targeted businesses and industries in the areas most threatened with water shortages.

- Goal 6: Implement a Polluted Runoff Education Program. Working with divisional action plans, the Nonpoint Source Workgroup and the Environmental Education Advisory Council, a coordinated two-year plan was developed to educate North Carolinians about the environmental consequences of polluted runoff, and its control and prevention.
- Goal 7: Develop and implement a public information/marketing plan for DPPEA services.

DPPEA currently has no office or division dealing with jobs and the environment issues. However, such an office or division could be established within DPPEA.

VII.B. The Energy Division

The Energy Division was created by the Legislature to help North Carolinians cope with energy-related emergencies – emergencies that can arise from an over-dependence on foreign oil or from energy outages created by natural disasters. The Division has pioneered a series of programs to develop newer and better technologies that preserve fuel supplies while helping to protect the environment. Division programs have provided direct assistance to people in every one of the state’s 100 counties, helping families and individuals save on energy bills. The office offers residential, industrial and commercial, transportation, agriculture, and energy-related emergencies programs, including:

- *Residential.* Residential programs apply new technologies, provide assistance to residents, and encourage the adoption of energy conservation and renewable technologies. The Energy Office provides workshops, seminars, brochures, manuals, and other sources of information to help reduce spending on heating and cooling.
- *Industrial and Commercial.* These programs include energy audits, steam trap surveys, humidity control, motor efficiency, and other technologies that help small and large business cut operating costs.
- *Transportation.* These programs include alternative fuel vehicles, electric cars, fuel cells, and other impending changes.
- *Agriculture.* Energy Office programs range from fish barns and preventive maintenance to biomass and postharvest technologies, all designed to increase profits for North Carolina farmers.
- *Energy-related Emergencies.* The Office offers tips and guidelines on what to do in energy-related emergencies created by hurricanes,

tornadoes, snowstorms, ice storms, extreme heat, and other forms of severe weather.

- *Students and Schools.* Programs include science facts, school construction, daylighting, student energy patrols, and success stories of schools that have saved taxpayers money on energy costs.
- *Geothermal Heat Pump Education.* Programs include educational opportunities and materials that describe residential geothermal heat pumps.

Of the program areas mentioned above, the Residential and Industrial-Commercial programs offer the most opportunities for energy efficiency recommendations, renewable energy applications, and environment-related jobs initiatives.

VII.C. Division of Coastal Management

The Division of Coastal Management works to protect, conserve, and manage North Carolina's coastal resources through an integrated program of planning, permitting, education, and research. DCM implements the state's Coastal Area Management Act, the Dredge and Fill Law, and the Federal Coastal Zone Management Act of 1972 in the 20 coastal counties, using rules and policies of the North Carolina Coastal Resources Commission, known as the CRC. The division serves as staff to the CRC.

Coastal Management is part of the Department of Environment and Natural Resources, which is responsible for maintaining the state's environment. The division also receives oversight (and part of its funding) from the Office of Ocean and Coastal Resource Management, part of the Federal National Oceanic and Atmospheric Administration. DCM is responsible for several programs, including permitting and enforcement, CAMA land-use planning, public beach and waterfront access, North Carolina Coastal Reserves, and grants for marine sewage pumpout. The division also collects and analyzes data for erosion rates, wetlands conservation and restoration, and assessment of the impacts of coastal development.

VII.D. Coastal Resources Advisory Council

The Coastal Resources Advisory Council (CRAC) is a 45-member group that provides the Coastal Resources Commission (CRC) with local government perspectives and technical advice. Members represent coastal counties and cities, regional councils of government, and state agencies, and they serve at the pleasure of the appointing body.

VII.E. Environmental Management Commission

The Environmental Management Commission is a 19-member Commission appointed by the Governor, the Senate Pro Tempore, and the Speaker of the House. The Commission is responsible for adopting rules for the protection, preservation and enhancement of the state's air and water resources. Commission members are chosen to represent various interests, including the medical profession, agriculture, engineering, fish and wildlife, groundwater, air and water pollution control, municipal or county government, and the public at large. The Commission oversees and adopts rules for several divisions of the Department of Environment and Natural Resources, including the Divisions of Air Quality, Land Resources, Water Quality, and Water Resources.

The Environmental Management Commission could be an appropriate entity to raise jobs and the environment issues at the level of the governor and senior state officials, although this has thus far not been its focus. Nevertheless, integrating these issues into the state's portfolio of economic, industry, and job development programs and initiatives is congruent with the Council's responsibilities.

VII.F. Albemarle-Pamlico National Estuary Program

The Albemarle-Pamlico National Estuary Program (APNEP) was among the first National Estuary Programs established by the U.S. EPA in 1987. The mission of the APNEP is to identify, restore, and protect the significant resources of the Albemarle-Pamlico estuarine system. Unlike traditional regulatory approaches to environmental protection, the APNEP is a cooperative effort jointly sponsored by the North Carolina Department of Environment and Natural Resources and the U.S. Environmental Protection Agency, in cooperation with the Virginia Department on Conservation and Recreation. This unique program targets a broad range of issues and engages local communities in the process.

The program focuses not just on improving water quality in the region's estuaries, but on maintaining the integrity of the whole system -- its chemical, physical, and biological properties, as well as its economic, recreational, and aesthetic values. Important components of the APNEP are the consideration of water quality, fisheries resources, land and water habitats, and the interaction of humans with the natural resources of the estuarine system.

The APNEP is designed to encourage local communities to take responsibility for managing the resources in their respective jurisdictions and is comprised of representatives from federal, state, and local government agencies responsible for managing the region's resources, as well as members of the community -- citizens, business leaders, educators, and researchers. These stakeholders have worked together to identify problems in the region, develop specific actions to address those problems, and create and implement a formal management plan to restore and protect the estuary.

The APNEP has funded demonstration projects which illustrate new methods of protecting marshes, aquatic habitats, and private property from erosion; control systems that protect rivers and streams from stormwater runoff; composting techniques that turn waste from agriculture and crab processing into fertile soil; and new fishing gear that reduces the unintended capture of non-targeted species. Other projects include opening historic spawning areas for shad and herring that had been blocked by dams and roads and replenishing scallop beds that were decimated by the 1987 Red Tide.

Since 1987, research generated by the APNEP has been instrumental to the development of a Comprehensive Conservation and Management Plan. This plan is composed of recommendations for management strategies that address concerns in the A/P Sounds region and protect the system's estuarine resources. The APNEP is administered within the Office of Conservation and Community Affairs in the North Carolina Department of Environment and Natural Resources. Program staff work closely with the U.S. EPA's Office of Water to implement the many objectives and key management actions contained in the APENP's Comprehensive Conservation and Management Plan.

The APENP has thus far not focused on environment-related industries, and we recommend that such a focus be added. This would integrate well with the Program's integrated, cooperative approach to environmental management.

VII.G. The Ecosystem Enhancement Program

North Carolina is committed to balancing development and environmental protection. The state's quality of life has facilitated growth, bringing the need for appropriate transportation infrastructure and overall economic development to accommodate an increasing population. Clean water, clean air, and thriving natural habitats are fundamental indicators of a healthy environment, and protecting North Carolina's ecosystems is critical to maintaining the state's quality of life, continuing its economic growth, and ensuring the health and well-being of its citizens. The mission of the Ecosystem Enhancement Program is to "restore, enhance, preserve, and protect the functions associated with wetlands, streams, and riparian areas, including but not limited to those necessary for the restoration, maintenance, and protection of water quality and riparian habitats throughout North Carolina."

In 1997, North Carolina founded the Wetlands Restoration Program, a wetlands-oriented mitigation program for development under the North Carolina Department of Environment and Natural Resources (NCDENR). However, the state's mitigation programs functioned independently with different operating processes, a situation that failed to meet the satisfaction of either federal and state regulatory agencies or environmental interest groups. To address this situation, a cooperative process-improvement initiative in North Carolina involving more than ten state and federal natural-systems agencies convened in 2001. This panel's conclusions led to recommendations that mitigation should be provided years in advance of project impact,

and be designed to replace unavoidable functional losses to wetlands and riparian buffers. The panel also conceived and set into motion events leading to the creation of the Ecosystem Enhancement Program.

A Memorandum of Agreement between NCDOT, NCDENR, and the U.S. Army Corps of Engineers established the EEP's procedures on July 22, 2003. The MOA recommended a two-year transition period during which the EEP will complete operational and organizational development. As a result, North Carolina has created a national model for wetlands mitigation through the EEP, earning a 2002 national award for innovation from the National Association of Development Organizations, and contributing in 2003 to recognition of NCDOT and NCDENR by the Federal Highway Administration for outstanding environmental stewardship.

The EEP facilitates responsible economic growth while providing high-quality ecosystem enhancement to offset impacts from development. Importantly, EEP's mitigation program addresses environmental impacts proactively, not reactively, and funds are invested in environmental protection ahead of the date the impact will occur. This basic foundation of the EEP allows North Carolina to address the need for economic development while simultaneously protecting and enhancing the environment, an issue germane to every state in the nation.

Acting on the philosophy that a programmatic, watershed-based planning process will focus all biological engineering resources toward the best possible environmental return, the EEP also embraces partnerships that work to create streamlined government for the state. The EEP's formation helps to eliminate duplicative resources, and also embraces the expertise of all stakeholders affected by its processes.

The EEP partners with the private sector to offset unavoidable environmental impacts. The program's alliance with local and regional land trusts across the state, unprecedented in the nation on this scale, harnesses the expertise, innovation, and local knowledge of 22 separate trusts to promote land acquisition and open-space protection. The partnership's aim is to provide fair economic return to landowners while achieving open-space protection for the state. It also partners with more than 20 private biological-engineering and mitigation-banking companies on wetlands restoration and enhancement programs across the state. The EEP provides:

- High-quality, cost-effective projects for watershed improvement and protection
- Compensation for unavoidable environmental impacts associated with transportation infrastructure and economic development
- Detailed watershed-planning and project-implementation efforts within North Carolina's threatened or degraded watersheds

The EEP has thus far not focused on environment-related jobs, and we recommend that such a focus be added. This would integrate well with the Program's core functions, which include facilitating economic growth and development and enhancement of transportation infrastructure

VII.H. The Clean Water Management Trust Fund

North Carolina's Clean Water Management Trust Fund (CWMTF) was established by the General Assembly in 1996. At the end of each fiscal year, 6.5 percent of the unreserved credit balance in North Carolina's General Fund (or a minimum of \$30 million) is allocated to the CWMTF, and revenues from the CWMTF are allocated in the form of grants to local governments, state agencies, and conservation non-profits to help finance projects that specifically address water pollution problems. The 18 member, independent CWMTF Board of Trustees has full responsibility over the allocation of moneys from the Fund, but depends on local communities and organizations to develop creative proposals for protecting and restoring North Carolina's rivers, lakes, creeks, and estuaries.

Since 1997, the CWMTF has provided \$63 million to assist the North Carolina Wildlife Resources Commission with the acquisition of 93,635 acres -- more than any other state agency. WRC and its partners have matched CWMTF's contributions with \$77.3 million. Many of CWMTF's most significant land and water conservation projects have involved the WRC,

CWMTF and WRC conservation efforts ensure the future of important water resources to guarantee the health of all of North Carolina. The CWMTF/WRC partnership also preserves the rich outdoor recreation tradition in North Carolina -- a growing sector of the state's tourism economy. In addition, CWMTF and WRC are expanding their partnership to help preserve land and water around North Carolina's military bases for both habitat protection and to help protect these economically important installations from encroaching development. Funding of these and other NCWRC grants depends on appropriations to CWMTF from the General Assembly.

The CWMTF funds projects that:

- Enhance or restore degraded waters
- Protect unpolluted waters
- Contribute toward a network of riparian buffers and greenways for environmental, educational, and recreational benefits

Few, if any, projects related to jobs and the environment have thus far been funded by the CWMTF. 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.I. Renewable Energy Tax Credits

The North Carolina General Assembly originally passed solar and renewable energy tax credits in 1977, spurred by the need to support indigenous energy sources as a result of the oil crises of the 1970's. To simplify and modernize the North Carolina tax credits for solar and other renewable energy sources, new legislation was enacted in the 1999 legislative session. Fourteen different credits were eliminated and replaced by one general credit that covered residential and non-residential solar and other renewable energy property. A credit of 35 percent was established for all renewable energy sources, with the maximum limits varying by renewable energy resource or technology, and by residential or non-residential sectors.

The North Carolina renewable energy tax incentives programs represent excellent vehicles for bringing jobs and the environment issues to the forefront in the state:

- They are high priority statutory state programs.
- They leverage unique state resources and expertise.
- They have the express goal of creating high-tech renewable energy jobs and businesses.
- They are amply funded.

VII.J. Wind Energy Initiatives

Wind energy, the world's fastest growing energy source, is a clean and renewable source of energy that has been in use for centuries in Europe and more recently in the United States and other nations. Wind turbines, both large and small, produce electricity for utilities and homeowners and remote villages. North Carolina has a number of wind energy initiatives, including:

- *North Carolina Economic Development.* Offshore wind farms are wind developments located in submerged lands, lands that are owned by state and federal governments. Local communities benefit directly and indirectly from offshore wind facilities, once a system is established that will channel monies to these affected local communities. An increase in local services to support new jobs created from offshore wind farm development, a preferential bidding system, and existing community development programs are some ways in which a local community could benefit indirectly.
- *North Carolina Offshore Wind Permitting.* The North Carolina State Energy Office, the North Carolina Solar Center, and the Renewable Energy Policy Project have formed the Coastal Wind Working Group to implement a public outreach process to determine how the wind resources of North Carolina can be developed consistently with community interest and other constraints on development.

An aggressive state policy to develop wind resources could have multiple benefits:

- It would reduce the state's dependence on fossil fuels.
- It would help develop an indigenous state wind industry and related jobs.

VII.K. State Energy Plan

The North Carolina State Energy Plan was adopted in June 2003 and its objectives include insuring energy reliability, improving public health and environmental quality, implementing strategies supportive of the state economy, and achieving sustainable energy strategy. In the plan, the Energy Policy Council recommended a number of key policies, including:

- *Economic and Environmental Issues.* The state should encourage and support energy-related enterprises whose products increase energy efficiency or use renewable resources; communicate the energy research being performed in the state to the State Department of Commerce for its recruiting and economic development strategy; and create a greenhouse gas registry to track emissions of carbon dioxide and other greenhouse gases, establish baseline emissions, and to demonstrate emissions reductions for potential greenhouse gas trading systems.

- *Alternative Fuels from Biomass.* The state should support the development of an alternative fuel industry through dedicated funding and grant matching of promising alternative fuel projects. These efforts should include agricultural waste processing facilities, biodiesel and ethanol refineries, fueling stations for alternate-fueled vehicles, production incentives for farmers and refiners, incentives for highly efficient or alternative fueled vehicles, and education and awareness programs. The General Assembly should pursue strategies that convert animal waste into environmentally sound energy sources.
- *Alternative Energy Sources.* The General Assembly should consider adopting net metering for application to all electric utilities in the state; evaluate a renewable portfolio standard that complements the state's GreenPower program and fosters the development of a renewable electricity market; reexamine the Mountain Ridge Protection Act as it pertains to wind energy; and require that all electric utilities in North Carolina provide generation disclosure of fuel mix percentages and emissions statistics annually. The State Energy Office should propose incentives and regulatory or administrative measures for development of renewable electricity generation facilities, solar water heating, passive and active solar space heating, and daylighting.
- *Energy Use in the Public Sector.* State agencies and universities should reduce energy consumption in existing state buildings to save 20 percent by 2008. The State Energy Office should monitor, analyze, and report on energy savings attributed to the new life-cycle costing requirements, and the state should facilitate efforts of local governments to finance energy efficiency and renewable energy projects.
- *Energy Use in the Residential Sector.* The state government should continue to support a strong low-income weatherization program and review the effectiveness of energy conservation programs conducted through the weatherization program and analyze opportunities for improvements.
- *Funding for Energy Programs.* The General Assembly should review options, such as a Public Benefits Fund or other means, to enable funding of the basic services provided by the State Energy Office and the recommendations in the State Energy Plan.

The creation of environment-related jobs is currently not a major focus of the state energy plan, and this deficiency should be remedied. Such a focus is consistent with the plan's objectives, including:

- Implementing strategies supportive of the state economy
- Encouraging and supporting energy-related enterprises whose products increase energy efficiency or use renewable resources
- Supporting development of an alternative fuel industry
- Fostering development of a renewable electricity market
- Facilitating efforts of local governments to finance energy efficiency and renewable energy projects

VII.L. North Carolina Solar Center

The North Carolina Solar Center was founded in 1988 to serve as a clearinghouse for solar and other renewable energy programs, information, research, technical assistance, and training. The Center is sponsored by the North Carolina Department of Administration's State Energy Office, the U.S. Department of Energy, and the North Carolina Solar Center Foundation, and is operated by North Carolina State University's Industrial Extension Service.

Through its programs and services, the Center seeks to stabilize energy costs for consumers, stimulate local economies, reduce dependence on foreign fuels, and mitigate the environmental impacts associated with fossil fuels. By capitalizing on its close ties with the state government, North Carolina State University, the renewable energy industry, and various non-profit organizations, the Center has developed into one of the premier renewable energy centers in the United States.

Since its founding, the Center has grown and developed into an organization with diverse capabilities and services and serves as a clearinghouse for information, technical assistance, and education on solar and renewable energy technologies. Specific programs include:

- **Weatherization:** Provides funds to local community action agencies for the purchase and installation of insulation, weatherstripping and other weatherization improvements.
- **Repair and Replacement Program:** Offers assistance to families to repair, replace, or perform energy conservation.
- **Building Energy Code:** Develops workshops on the North Carolina residential energy codes. The building code is a simplified version of the 1995 Model Energy Code, and it is mandatory statewide. Training is provided for building professionals – such as code inspectors, architects, engineers, builders, and insulation

contractors – to ensure that residences in North Carolina are energy efficient.

- **Solar House:** Constructed in 1981 by the North Carolina State Engineering Department, the house is as a showcase facility for education, demonstration, and research.
- **Electric Vehicle Garage and Solar Charging Station:** The center has developed a combined solar charging station, electric vehicle, and alternative fuel vehicle demonstration facility next to the Solar House.
- **Outreach and Extension:** Provides information through a toll-free hot line, publications and videos, web site, solar home tours, and exhibits at events and conferences.
- **Research and Development:** Testing and evaluating building-integrated photovoltaic systems catalyzed the development of a research program at the Solar Center in 1995.
- **Education and Training:** Since its formation, the Center has concentrated a large portion of its resources on training professionals and providing educational opportunities for decision-makers and the public to learn about solar energy.
- **Demonstrating Solar Technology:** In trying new technologies and showing them to the public, the Center has provided leadership in designing, installing, and monitoring a number of systems around the state.
- **Policy Analysis:** The Solar Center has provided analytical, education, and information services at the state and national levels. In North Carolina, the Center has analyzed the potential impacts of electricity restructuring on renewable energy and energy efficiency, and made recommendations on how renewable energy could be advanced in a competitive electricity marketplace. The Center has also assisted the North Carolina Department of Revenue in revising the guidelines for the state tax credits and assessing the potential revenue impacts of proposed changes in the credits. In addition, the Center has conducted research on the steps that will be needed for the state to reach its goal of obtaining 20 percent of its energy from renewable resources by 2010.
- **Million Solar Roofs Initiative:** North Carolina is a partner in this national drive to install one million solar systems on rooftops by 2010. The Solar Center is leading this effort, working with

communities throughout the state to develop local programs and get installations in place.

- **Coastal Wind Initiative:** North Carolina's Coastal Wind Initiative strives to educate landowners and communities about the wind potential that exists in eastern North Carolina, provide data to help assess the economics of wind turbines, and address concerns specific to coastal wind resource development, with a particular emphasis on how wind energy can help support rural communities and family farms.
- **Students Fueling the Future:** This program teaches middle school students about renewable energy through fuel cell technology. Middle school science and technology classes throughout the state of North Carolina are participating.
- **North Carolina Daylighting Consortium:** The purpose of the Daylighting Consortium is to improve the quality of life and reduce economic and environmental costs for the citizens of North Carolina through the use of natural light in buildings.

Thus far, few projects related to jobs and the environment have been funded by the Solar Center. However, from a review of the Center's charter and projects it has previously funded, it is clear that projects related to jobs and the environment could be funded. This would integrate well with the Center's objectives, which include stabilizing energy costs for consumers, stimulating local economies, reducing dependence on foreign fuels, and mitigating the environmental impacts associated with fossil fuels. Therefore, the North Carolina Solar Center may be a viable and important potential source of research and funding for such projects.

VII.M. Center for Energy Research and Technology

The Center for Energy Research and Technology (CERT) at North Carolina A&T State University is researching energy use and energy efficiency in buildings and industrial processes. Specific programs include:

- **Methane Recovery:** This program has led several methane-recovery efforts that have helped curtail the release of the greenhouse gas into the environment and led to technologies that use methane for fuel.
- **Rebuild America:** This program helps municipalities offset the trend of declining downtowns through cooperative local efforts that boost downtown business. Help includes funding and technical assistance.

- Energy Management Technology and Technical Assistance Program: For the commercial and industrial sector, this program, located at the Industrial Extension Service at North Carolina State University, helps facility managers and maintenance supervisors reduce operating costs.
- Commercial and Residential Building Codes: Sponsors workshops to help builders, contractors, building code officials, developers and design professionals learn the latest in energy technologies and techniques.
- Business Energy Improvement Program: This is a loan program that helps businesses make building improvements that produce a rapid energy-savings return on the money invested.
- Steam Traps: With the state's industrial base in mind, a steam trap program was designed that helps companies identify energy trouble spots in the production process. Companies in the state have been able to reduce their steam losses, which often add dramatically to a company's energy costs.
- Climate Wise: A coalition of state and federal government agencies, the Climate Wise program aims to protect the environment by encouraging businesses to take part in projects that improve energy efficiency and waste reduction, while significantly reducing energy bills.

The findings noted above for the North Carolina Solar Center are applicable to the Center for Energy Research and Technology. Thus far, few projects related to jobs and the environment have been funded by CERT. However, from a review of CERT's charter and projects it has previously funded, it is clear that projects related to jobs and the environment could be funded. This would integrate well with CERT's objectives. Therefore, the North Carolina Center for Energy Research and Technology may be a viable and important potential source of research and funding for such projects.

VII.N. The Economic Development Board

The Economic Development Board is comprised of some of the state's premier leaders from the business, education, tourism, and workforce communities, serves as the state's top economic development policy advisory body, and is responsible for recommending economic development policy to the governor. Appointments to the Board are made by the Governor, by the Speaker of the House, and by the President Pro Tempore of the Senate. The Board's membership includes the Secretary of Commerce, the Lieutenant Governor, the Secretary of State, the Secretary of Revenue,

the President of the University of North Carolina, and the President of the North Carolina Community College System.

The Economic Development Board could be an appropriate entity to raise jobs and the environment issues at the level of the governor and senior state officials, although this has thus far not been its focus. Nevertheless, integrating these issues into the state's portfolio of economic, industry, and job development programs and initiatives fits in well with the Board's mandate to recommend economic development policy to the governor.

VII.O. The Progress Board

The North Carolina Progress Board is a 24-member commission chaired by the governor that was created by the North Carolina General Assembly in 1995, as recommended by the Commission for a Competitive North Carolina. The Board serves as the state government's compass, setting broad directions for the state, and is creating a detailed map toward meeting certain goals, measuring the state's progress in meeting those goals, and reporting any progress -- or lack of progress. One of the major issue areas that the Board is mandated to assess is a sustainable environment, and, significantly, in its report *North Carolina 20/20* it stated that: "The myth of 'jobs versus environment' cannot be supported; states can and do have strong economies and simultaneously protect the environment. In fact, states with the strongest environmental records also claim the distinction of having the best job opportunities and climate for long-term economic development."

This represents clear recognition that environmental programs and investments can and do stimulate jobs growth and economic development. It is important that this message be communicated throughout the state to government and private sector policy-makers.

VII.P. The Strategic Economic Development Plan

In 2002, at the direction of the governor, the Economic Development Board developed a comprehensive strategic economic development plan for the state that recommended innovative and strategic approaches to such issues as incentives, recruitment and retention strategies, workforce development, development of future technologies, and coordination of state agencies. The plan noted that North Carolina's economy has been undergoing a major transition from traditional industries to new economy companies and that the transition has been characterized by a shift in employment from the manufacturing to the services sector and from labor-intensive to knowledge-based jobs. The state's traditional manufacturing base of textiles, apparel, furniture, and tobacco has decreased by 145,000 workers since the late 1990s, and North Carolina is projected to lose another 200,000 traditional manufacturing jobs over the next decade. The challenge is to create new jobs fast enough to replace those lost -

- particularly new jobs that pay attractive wages. The plan determined that North Carolina's economic development agencies must help North Carolinians make the transition by creating high quality jobs that increase incomes and enhance the quality of life for families and that the state must accelerate the growth of high-skilled jobs in high-tech manufacturing and knowledge companies. Specifically, its recommendations include that the state:

- Establish an aggressive and coordinated state agenda of investment in research, support for technology development and transfer, and effective use of university outreach
- Ensure a competitive environment for the recruitment and retention of business, capital investment, and jobs creation
- Develop thriving rural areas that maintain a high quality of life critical to sustainable economic development and expand basic infrastructure such as water, sewer, and wastewater treatment facilities
- Develop a competitive regionally based infrastructure, including water and sewer systems, and promote sustainable economic development.
- Develop strong tourism, film, and sports industries and preserve and promote the state's cultural, natural, and heritage assets – the state's tourism, film, and sports industries generate over \$12 billion annually and generate more than 250,000 jobs, and North Carolina is the sixth most visited state in the nation. In addition, tourism-related industries and cultural amenities help attract knowledge workers, business investment, and new economy companies.

However, thus far, environment-related industries have not been a major priority emphasized under the state's strategic economic development plan, and this is an oversight that should be remedied. The environmental industry and the jobs it creates adhere well to the objectives of the plan, and such an emphasis could:

- Ensure a competitive environment for jobs creation
- Help develop North Carolina into a global leader in knowledge-based jobs, leading-edge technology, and competitive enterprises
- Develop thriving rural areas that maintain a high quality of life critical to sustainable economic development
- Expand basic infrastructure such as water, sewer, and wastewater treatment facilities

- Develop a strong tourism industry and promote the state's cultural, natural, and heritage assets
- Diversify North Carolina's economy and help it achieve global competitiveness

VII.Q. Workforce Development Initiatives

VII.Q.1. The Commission on Workforce Development

The North Carolina Commission on Workforce Development has the responsibility of recommending policies and strategies that will enable the state's workforce to compete in the current and future global economy. The 38-member Commission, led by a private sector chair, includes representatives from the business community, heads of state workforce agencies, educators, community leaders, and representatives from organized labor. The Commission seeks to create an effective, coherent, and comprehensive workforce system from the numerous workforce programs administered through various state and local agencies. The Commission's mission is to "To establish and guide a world class workforce development system for North Carolina. This system will be comprehensive, integrated, relevant, and effective. It will produce well-educated, highly skilled workers who perform at high levels and work in economically viable enterprises that provide good jobs at good wages". The Commission serves as the state's Workforce Investment Board for the federal Workforce Investment Act and is the state's workforce development policy board advising the governor, General Assembly, state agencies, businesses, and citizens concerning workforce issues.

VII.Q.2. The Workforce Development Institute

The Workforce Development Institute of the Department of Commerce was founded in 1994 utilizing Job Training Partnership Act capacity building funds. The Board of Directors includes seven Directors from the Job Training Administrators Association, a representative from the Division for Employment and Training, representatives from agencies operating state level JTPA contracts, and one member each from the Private Industry Council Association, the North Carolina Employment and Training Association, and the National Association of Workforce Development Professionals.

The Institute develops administrative partnerships within the workforce development system, and its objectives are to provide meaningful, interactive, quality training and to transfer learning to its customers. Its portfolio of offerings is based on job functions, major responsibilities or tasks prioritized by "best practitioners," as determined by ongoing needs-assessments surveys, by needs identified on training evaluations, or by direct requests. In addition to development of contracted training, the Institute also conducts leadership issue forums, coordinates interagency training for

one-stop implementation sites, maintains a clearing house for a core curriculum for workforce development direct-services staff, and certifies workforce development professionals.

Thus far, there appears to be little focus on the environmental industry at the Commission on Workforce Development or the Workforce Development Institute, but such a focus could strategically leverage the benefits of environmental protection for workforce development. Both the Commission and the Institute could be used to assist North Carolina firms in environmental industries upgrade the skills of their workers.

VII.R. Water Infrastructure Issues and Needs

North Carolina currently faces a number of serious issues related to its water infrastructure, as summarized below.

VII.R.1. Water and Sewer Infrastructure Requirements

The North Carolina Water and Sewer Initiative conducted a comprehensive assessment of North Carolina water and sewer systems and compiled the nation's first comprehensive, standardized information base on a state's public community water and sewer systems. The report identified serious needs and funding requirements for the future and provided a blueprint for state action.

Total State Water and Sewer Needs

- The study estimated \$11.34 billion in water and sewer needs across the state -- double previous estimates.

Water System Concerns

- Nearly 75 percent of North Carolinians are served by small water systems, systems serving fewer than 3,300 people -- compared to 10 percent nationally.
- There are severe problems of old, deteriorating, leaking pipes, and the single largest need is line rehabilitation. Many distribution systems are 40 years old and some are more than 70, and North Carolina has some of the oldest water systems in the Southeast.
- There exists inadequate capacity for growth. More than 80 percent of water systems rely on groundwater, and only about a quarter of these systems have the "excess" treatment capacity required for economic growth.

Sewer System Concerns

- Many systems suffer from aged, deteriorating pipes. Nearly 3,000 miles of pipe are made of vitrified clay, most of it installed during the 1930s. Clay pipes beneath city streets are crumbling and leaking, and replacement can cost as much as \$75/ft.
- There are inflow and infiltration problems. More than half the systems have problems with inflow and infiltration -- the intrusion of groundwater and storm water runoff.
- There exists inadequate capacity for growth. Only about a quarter of the systems have 100,000 gallons of excess sewer capacity, the amount typically required for industrial locations, and most have no excess capacity at all.

Financial Concerns

- Costs of regulation are increasing. Federal and state governments have continued to enact regulations to protect water resources, but most of these have been “unfunded mandates.”
- Public funds are decreasing. In 1981, the federal government contributed 43 cents of every dollar spent on water and sewer development in North Carolina, but by the late 1990s that contribution had declined to 17 cents. Many communities are not “bank eligible.” North Carolina has experienced a dramatic growth in water and sewer financing by private financial institutions, but 375 out of 527 municipalities do not qualify.

The report concluded that North Carolina must recognize the special challenges faced by small and rural systems in supplying safe drinking water and treating wastewater, and recommended that the state:

- Approve clean water bonds to meet the state’s urgent water and sewer needs
- Set aside funds to rehabilitate collection systems and prevent enforcement action
- Encourage regional water and sewer systems to improve service and reduce costs
- Pursue wastewater treatment alternatives to reduce costs and protect resources

- Make capital improvement plans a priority for guiding local investments
- Establish a cooperative technical assistance program for small communities
- Create a dedicated source of funding for water and sewer improvements
- Complete and maintain water and sewer data for improved planning at all levels

VII.R.2. Protecting the Costal Habitat

North Carolina's coastal fisheries are among the most productive in the United States because of the wide variety of habitats available, the largest estuarine system of any single Atlantic coast state, and location of North Carolina at the transition between mid-Atlantic and south Atlantic regions. However, over the past two decades the condition of many important fish stocks has declined. Recognizing the critical importance of healthy and productive habitats to produce fish for human benefits, the North Carolina General Assembly mandated that the Department of Environment and Natural Resources prepare Coastal Habitat Protection Plans (CHPPs) to determine the long-term enhancement of coastal fisheries associated with each habitat.

The CHPPs identified management and funding needs, reviewed threats to the coastal habitat, and recommended actions to address them. Four general goals were identified and a series of recommendations to reach each goal was made. Implementation of these recommendations will involve new program activities and revised priorities for existing programs within DENR and other agencies, and will require significant new funding.

Goal 1: Improve Effectiveness of Existing Rules and Programs Protecting Coastal Fish Habitats

- Enhance enforcement of, and compliance with, Coastal Resources Commission, Environmental Management Commission, and Marine Fisheries Commission rules and permit conditions
- Coordinate and enhance water quality, habitat, and fisheries resource monitoring from headwaters to the nearshore ocean
- Enhance and expand educational outreach on the value of fish habitat

- Coordinate rulemaking and enforcement among regulatory commissions and agencies

Goal 2: Identify, Designate, and Protect Strategic Habitat Areas

- Identify, evaluate, and designate Strategic Habitat Areas using ecologically based criteria
- Analyze existing rules and enact measures needed to protect Strategic Habitat Areas
- Improve programs for conservation and acquisition of areas supporting Strategic Habitat Areas

Goal 3: Enhance Habitat and Protect it From Physical Impacts

- Greatly expand habitat restoration, including creation of subtidal oyster reef no-take sanctuaries and re-establishment of riparian wetlands and stream hydrology
- Prepare and implement a coast-wide beach and inlet management plan
- Protect fish habitat by revising estuarine and public trust shoreline stabilization rules
- Protect and enhance habitat for Submerged Aquatic Vegetation and anadromous fishes

Goal 4. Enhance and Protect Water Quality

Point Sources

- Reduce point source pollution from wastewater by increasing inspections of wastewater treatment facilities, collection infrastructure, and land disposal sites and by upgrading wastewater treatment systems
- Adopt or modify rules or statutes to prohibit ocean wastewater discharges
- Prohibit new or expanded stormwater outfalls to coastal beaches and to coastal shellfishing waters and continue to phase-out existing outfalls

Non-point sources

- Enhance coordination with, and financial/technical support for, local government actions to better manage stormwater and wastewater
- Improve land-based strategies to reduce non-point pollution, and minimize cumulative losses to wetlands and streams through voluntary actions, assistance, and incentives
- Develop and implement a comprehensive coastal marina and dock management plan and policy to prevent closures of shellfish harvest waters and minimize cumulative impacts to fish habitat
- Reduce non-point source pollution from large-scale animal operations

VIII. SUMMARY OF MAJOR FINDINGS

This report presents information about jobs creation and the potential of the environmental industry in the state of North Carolina, 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 North Carolina and North Carolina’s Environmental Industry

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

- Sales of the environmental industries in North Carolina totaled \$9.1 billion.
- The number of environment-related jobs totaled more than 112,000.
- The environmental industry in North Carolina generated 3.1 percent of gross state product.
- North Carolina environmental industries accounted for about three percent of the sales of the U.S. environmental industry.
- Environment-related jobs comprised 2.9 percent of North Carolina employment.
- Environment-related jobs in North Carolina comprised 2.5 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 North Carolina are in the private sector, and these are heavily concentrated in several sectors, including manufacturing, information, professional, scientific, and technical services, and educational services.

Environmental jobs in North Carolina are widely distributed among 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 North Carolina 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 North Carolina, 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 North Carolina 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 North Carolina comprises less than three 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 North Carolina revealed a wide range of firms, located throughout the state and across sectors. These firms:

- Are located throughout the state, in major urban centers, suburbs, small towns, and rural areas.
- Range in size from small firms of 20 employees to large firms employing thousands
- Are engaged a wide variety of activities, including engineering, remediation, testing, monitoring, analysis, etc.
- Include some of the most sophisticated, high-tech firms in the state; for example:
 - Arcadis, (Charlotte, Greensboro, Raleigh, Durham), a leading provider of environmental and sustainable development services in the United States and internationally.

- Compuchem (Cary) provides advanced environmental testing, sampling, and analysis.
- Engineering Consulting Services, Ltd. (Charlotte, Greensboro, Wilmington, Raleigh) is a leader in geotechnical, environmental, and construction materials engineering.
- Froehling & Robertson, Inc. (Charlotte, Raleigh, Fayetteville, Asheville, Hickory), a leader in environmental engineering, laboratory testing, and geotechnical services.
- Stantec, Ltd. (Charlotte, Raleigh, Winston-Salem) provides sophisticated environmental, engineering, planning, wastewater treatment, and water reclamation systems.

A number of these firms, including Compuchem, Dewberry (Charlotte, Raleigh), Engineering Consulting Services, Ltd., Froehling & Robertson, Inc., McKim & Creed (Wilmington, Bolivia, Cary, Charlotte, Greensboro, New Bern), Olver, Inc., (Charlotte, Raleigh), Santec (Charlotte, Raleigh, Winston-Salem), and Terracon (Charlotte, Raleigh, Winterville) have created significant numbers of new jobs over the past six months.

We identified a number of existing state agencies and initiatives that could be used to maximize the jobs creation benefit and potential of the environmental industry. These include the Division of Pollution Prevention and Environmental Assistance, the Energy Division, the Division of Coastal Management, the Coastal Resources Advisory Council, the Environmental Management Commission, the Albemarle-Pamlico National Estuary Program, the Ecosystem Enhancement Program, the Clean Water Management Trust Fund, renewable energy tax credits, wind energy initiatives, the state energy plan, the North Carolina Solar Center, the Center for Energy Research and Technology, the Economic Development Board, the Progress Board, the Commission on Workforce Development and the Workforce Development Institute. Of these, the Environmental Management Commission, the Clean Water Management Trust Fund, the North Carolina Solar Center, the Center for Energy Research and Technology, the Economic Development Board, the Progress Board, and the Workforce Development Institute are especially notable and hold considerable promise.

We suggest policy options that could maximize the jobs benefits of the environmental industry in North Carolina, 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 North Carolina, a state that is currently seeking new ideas for employment generation, stable good jobs, and workforce development.

BIBLIOGRAPHY

"About the Division of Coastal Management." North Carolina Division of Coastal Management, 2004.

Allison, G. *Are Jobs Really the Price of a Clean Environment?* Washington, D.C., League of Women Voters, 1977.

American Council for an Energy Efficient Economy. *Energy Innovations: A Prosperous Path to a Clean Environment*, July 1997.

American Federation of State, County, and Municipal Employees. *Thinking Creatively About Welfare-To-Work Job Creation*. Washington, DC, July 1998.

American Petroleum Institute. *A Reconstruction and Reconciliation of Administration Estimates*, July 1998.

"The Albemarle-Pamlico National Estuary Program." North Carolina Department of Environment and Natural Resources, 2004.

Arnold, Frank S. *Environmental Protection: Is it Bad for the Economy? A Non-Technical Summary of the Literature*. EPA Economy and Environment, July 10, 1999.

Australian Conservation Foundation, Australian Council of Trade Unions, and the Commonwealth Department of Employment, Education, and Training. *Green Jobs in Industry -- Research Report*. Melbourne, May 1994.

Baily, Wallace K. "Local Area Personal Income, 1982-97." *Survey of Current Business*, May 1999, pp. 50-67.

Banzhaf, Spencer. "Accounting for the Environment," *Resources*, Issue 151 (Summer 2003), pp. 6-10.

Barnow, Burt. *The U.S. Experience with Public Service Employment Programs*. Johns Hopkins University Institute for Policy Studies, Baltimore, MD, September 1994.

Bartch, Charlie and Christine Anderson. *Matrix of Brownfield Programs by State*. Northeast-Midwest Institute, September 1998.

Benefiting North Carolina Communities with Offshore Wind Offshore Wind Farm Approval Process, North Carolina. The North Carolina State Energy Office, the North Carolina Solar Center, and the Renewable Energy Policy Project Coastal North Carolina Wind Resource Assessment Project, 2004.

Berman, Eli and Linda Bui. *Clearing the Air: The Impact of Air Quality Regulations on Jobs*. Economic Policy Institute Study, 1997.

Bezdek, Roger H. "The Environmental Protection Industry and Environmental Jobs in the U.S.A.," in Leal Filho and Kate Crowley, eds., *Environmental Careers, Environmental Employment, and Environmental Training: International Approaches and Contexts*. Frankfurt am Main: Peter Lang Publishers, pp. 161-179, 2001.

_____. "State of the Industry: Jobs and Sales Created by Environmental Protection." *New England's Environment*. Vol. 1, No. 8 (August 1999), pp. 12-16.

_____. "The Net Impact of Environmental Protection on Jobs and the Economy." Chapter 7 in Bunyan Bryant, editor., *Environmental Justice: Issues, Policies, and Solutions*, Washington, D.C.: Island Press, 1995, pp. 86-105.

_____. "The Economy, Jobs, and the Environment." *Proceedings of GEMI '95: Environment and Sustainable Development*, Arlington, Virginia, March 1995, pp. 65-79.

_____. "Environmental Protection: A Recession-Proof Industry?" *Virginia's Environment*, February 1994, pp. 10-16.

_____. "Environment and Economy: What's the Bottom Line?" *Environment*, Vol. 35, No. 7 (September 1993), pp. 7-32.

_____. "The Economic and Employment Effects of Investments in Pollution Abatement and Control Technologies." *Ambio*, Vol. XVIII, no.3, (1989), pp. 274-279.

_____, 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.

_____. "Acid Rain Abatement: Costs and Benefits." *International Journal of Management Science*, Vol. 17, No. 3 (1989), pp. 251-261.

Blodgett, John E. "Environmental Protection: How Much It Costs and Who Pays," *Congressional Research Service Report for Congress*, No. 97-459 ENR, April 1997.

California State Department of Conservation. *Green Business: Growing Jobs and Profits*. Sacramento, CA, July 1995.

Campbell, M. and W. Glenn. *Profit From Pollution Prevention*. Toronto: Pollution Probe, 1982.

Clark, Lyman. *The Environmental Industry in the United States*. Report to the Economic Analysis and Research Branch, Office of Regulatory Management and Evaluation, Environmental Protection Agency, Washington, D.C., January 1991.

Cropper, Maureen L. and Wallace E. Oates,. "Environmental Economics: A Survey." *Journal of Economic Literature*, Vol. 30, No. 2 (June 1992), pp. 12-36.

Current Developments, State Conservationist Message, February, 2001, www.info.usda.gov.

"CWMTF and the North Carolina Wildlife Resources Commission: A Key Partnership for Natural Resources Conservation." North Carolina Clean Water Management Trust Fund, 2004.

Darmstadter, Joel. "Greening the GDP: Is It Desirable? Is It Feasible?," *Resources*, Issue 135 (Spring 2000), pp.11-15.

DiPerna, Paula. *Creating Jobs and Sustainable Livelihoods Through Agenda 21 and Other Environmental Policies: A Critical Catalyst for Implementation*. Report Prepared for UNDP, October 1997.

DRI. "Potential Benefits of Integration of Environmental and Economic Policies: An Incentive-Based Approach to Policy Integration." Report prepared for the Commission of the European Communities, Luxembourg, 1994.

ECOTEC. "The Employment Impact of Environmental Policies." Discussion Paper No. 2 in the series "Sustainability, Employment, and Growth," ECOTEC, Birmingham, England, 1993.

Electronic Industries Alliance, International Cooperative for Environmental Leadership, and World Resources Institute. *Taking a Byte Out of Carbon: Electronics Innovation for Climate Protection*, July 1998.

Employment Research Associates. *Biomass Resources: Generating Jobs and Energy*. Great Lakes Regional Biomass Energy Program, September 30, 1999.

Environmental Activism Conference at Northwestern University, January 11, 1999. www.great-lakes.net.

Environmental Law & Policy Center. *About the Environmental Law & Policy Center*, www.elpc.org.

Environmental Law Institute. *Barriers to Environmental Technology Innovation and Use*. ELI Research Report, February 2000.

_____. *Innovation, Cost, and Environmental Regulation: Perspectives on Business, Policy and Legal Factors Affecting the Cost of Compliance*. Environmental Law Institute, May 1999.

Greenwald, Judith M. *Labor and Climate Change: Getting the Best Deal for American Workers*. Progressive Policy Institute, October 1998.

Green Jobs Project. *Environment and Employment in Spain*. Spanish Report, April 1998.

"Green Power Choice for North Carolina." October 2, 2003.

Goodstein, E.B. "Jobs or the Environment? No Trade-off." *Challenge* (January-February 1995), pp. 41-45.

_____. *Jobs and the Environment: The Myth of a National Trade-Off*. Economic Policy Institute, Washington, D.C., 1994.

Grady, Dennis, and Jason Hoyle. *State Energy Plan Recommendations 1 and 2: Economic Development Initiatives*. Appalachian State University Energy Center, 2004.

Hoerner, J. Andrew, Alan Miller, and Frank Muller. "Promoting Growth and Job Creation through Emerging Environmental Technologies." *Global Change* (Electronic Edition), April 1995.

Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies. *Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy Technologies by 2010 and Beyond*. Washington, D.C.: U.S. Department of Energy, 1997.

International Institute for Sustainable Development. *Making Budgets Green: Leading Practices in Taxation and Subsidy Reform*. Winnipeg, 1994.

International Labour Office. *Employment and Training Implications of Environmental Policies in Europe*. ETIEPE, Geneva, 1989.

Jacobs, M. *Green Jobs? The Employment Implications of Environmental Policy*. WWF Report, Lancaster/Brussels, 1994.

Jaffe, A.B., Peterson, S.R., Portney, P.R., and R.N. Stavins. "Environmental Regulation and the Competitiveness of US Manufacturing." *Journal of Economic Literature*. Vol. XXXIII (March 1995), pp. 132-163.

Jorgenson, Dale, Richard Goettle, Daniel Gaynor, Peter Wilcoxon, and Daniel Slesnick. *The Clean Air Act and the U.S. Economy: Final Report of Results and Findings*. Environmental Economics Report Inventory, August 27, 1993.

_____, and Peter Wilcoxon, "Environmental Regulation and U.S. Economic Growth." *RAND Journal of Economics*, Vol. 21, No. 2, Summer 1990, pp. 153-167.

Laitner, Skip, John DeCicco, Neal Elliott, Howarfd Geller, Marshall Goldberg, Robert Morris, and Steven Nadel. *Energy Efficiency and Economic Development in the Midwest*. American Council for an Energy-Efficient Economy, April 1995.

Management Information Services, Inc. *Job Creation in the Environmental Industry in Minnesota and the United States*. Report prepared for the Building Diagnostics Research Institute, September 2004.

_____. *Job Creation in the Environmental Industry in Wisconsin and the United States*. Report prepared for the Building Diagnostics Research Institute, September 2004.

_____. *Jobs in the Environmental Industry in Michigan and the United States*. Report prepared for the Building Diagnostics Research Institute, July 2004.

_____. *Jobs in the Environmental Industry in Ohio and the United States*. Report prepared for the Building Diagnostics Research Institute, May 2004.

Survey of Jobs and the Environment Issues in Six Midwestern States: Identifying Policy Challenges and Opportunities. Report prepared for the Joyce Foundation, Chicago, Illinois, July 2001.

_____. *Assessing The Impact Of Environmental Protection On Job Creation, Protection, And Enhancement, And On Workforce Development And Training For The Poor, Underemployed, And Unemployed In Indiana*. Report prepared for the Joyce Foundation, July 2000.

_____. *Federal Subsidies and Incentives for the Energy Industries*. September 1998.

_____. *Costs Incurred by Electric Utility Companies Due to Federal Air Pollution Control Requirements*. Report prepared for the Edison Electric Institute, 1996.

_____. *Anticipating the Labor Markets of the 21st Century*. Report prepared for the American Management Association, 1994.

_____. *Potential Economic and Employment Impact on the U.S. Economy of Increased Exports of Environmental and Energy Efficiency Technologies Under NAFTA*. Report prepared for the White House, 1993.

_____. *Environment and Employment in Canada: Final Report of the Symposium*. Prepared for the Canada Employment and Immigration Advisory Council, 1992.

_____. *The Net Costs and Benefits to Each State and to the Nation of Acid Rain Abatement Legislation*. 1987.

_____. *Simulation of the Economic Impact of Pollution Abatement and Control Investments: Methodology, Data Base, and Detailed Estimates*. 1986.

_____. *Economic and Employment Benefits of Investments in Environmental Protection*. 1986.

_____, and 20/20 Vision. *Fuel Standards and Jobs: Economic, Employment, Energy, and Environmental Impacts of Increased CAFE Standards Through 2020*. Report prepared for the Energy Foundation, San Francisco, California, July 2002.

Presentation by Robert McGuffey - North Carolina Policies and Programs for Energy Efficiency and Renewable Energy

Morgenstern, Richard D., William A. Pizer, and Jih-Shyang Shih. *Are We Overestimating the Real Economic Costs of Environmental Protection?* Resources for the Future Discussion Paper 97-36-REV, June 1997.

“North Carolina Clean Water Management Trust Fund Fact Sheet.” North Carolina Clean Water Management Trust Fund, 2004.

North Carolina Department of Administration, State Energy Office. Programs. www.energync.net

North Carolina Department of Environment and Natural Resources. “About The Ecosystem Enhancement Program,” 2004, www.ncgov.com.

_____. “The Ecosystem Enhancement Program: Designing and Implementing a National Model, 2004

_____. North Carolina Coastal Habitat Protection Plan, Division of Marine Fisheries. September, 2004.

North Carolina Division of the Environment and Natural Resources, Division of Coastal Management. *CWMTF and the North Carolina Wildlife Resources Commission: A Key Partnership for Natural Resources Conservation*, 2003

North Carolina Department of Environment and Natural Resources, Office of Conservation and Community Affairs. *The Albemarle-Pamlico National Estuary Program*, 2004

_____. *Comprehensive Conservation and Management Plan*, 2003

North Carolina Division of Pollution Prevention and Environmental Assistance. *DPPEA Environmental Policy*, 2004.

North Carolina Division of Pollution Prevention and Environmental Assistance. *DPPEA Performance and Outcome Measures*, 2004.

_____. "DPPEA Mission, Goals and Objectives," 2004.

_____. *Twelve Month Goals Report*, 2003.

_____. *DPPEA 2002 Goals Report*, 2003.

North Carolina Economic Development Board. *We Are Changing the Way We are Doing Business: North Carolina's 2002 Economic Development Strategic Plan*, 2002.

"North Carolina Offshore Wind Permitting. The North Carolina State Energy Office and the North Carolina Solar Center, 2004.

North Carolina Progress Board. *North Carolina 20/20*, 2002.

The North Carolina Rural Economic Development Center and the North Carolina Rural Development Council. *Clean Water: Our Livelihood, Our Life*, Raleigh, 1998.

North Carolina Solar Center. "The Coastal Wind Initiative," 2004

_____. "North Carolina Daylighting Consortium." , 2004.

_____. "The North Carolina Solar Center's State Observation of Wind Program," 2004.

North Carolina State Energy Office, the North Carolina Solar Center, and the Renewable Energy Policy Project. "Coastal North Carolina Wind Resource Assessment Project, 2003.

North Carolina State Energy Plan. Prepared for the North Carolina Energy Policy Council by the State Energy Office North Carolina Department of Administration and Appalachian State University Energy Center, June 2003.

Organization for Economic Cooperation and Development. *Environmental Policies and Employment*. Paris, 1997

Proceedings of the Conference on Cost, Innovation, and Environmental Regulation: A Research and Policy Update. Environmental Economics Report Inventory, June 1, 1999.

Public Attitudes Towards Wind Energy in Coastal North Carolina: A Systematic Study. The North Carolina State Energy Office, the North Carolina Solar Center, and the Renewable Energy Policy Project Coastal North Carolina Wind Resource Assessment Project, 2004.

Public Attitudes Towards Wind Energy in Western North Carolina: A Systematic Study. The North Carolina State Energy Office, the North Carolina Solar Center, and the Renewable Energy Policy Project Coastal North Carolina Wind Resource Assessment Project, 2004.

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

Renner, M. *Jobs in a Sustainable Economy.* Worldwatch Paper 104. Washington, D.C.: Worldwatch Institute, 1991.

Repowering the Midwest: The Clean Energy Development Plan for the Heartland. Environmental Law and Policy Center, Chicago, February 2001.

Resource Data International. *The Economic Risks of Reducing the U.S. Electricity Supply,* November 1997.

_____. *Energy Choices in a Competitive Era: The Role of Renewable and Traditional Energy Resources in America's Electric Generation Mix.* April 1995.

Tellus Institute. *America's Global Warming Solutions,* August 1999.

Simonson, Adrienne. "A Snapshot of Septic System Repair Funding in North Carolina: A Comprehensive Catalogue of Policy Options and Funding Resources," University of North Carolina at Chapel Hill, April 2004.

Small Cities Development Program, Fact Sheet. www.dted.state.nc.us.

The State New Economy Index, www.neweconomyindex.org.

Sustainable Communities Program. *Conferences and Events,* www.moea.state.nc.us.

Unemployment Data for U.S. and North Carolina. www.dted.state.nc.us.

United Nations, European Commission, International Monetary Fund, Organization for Economic Co-operation and Development, and World Bank. *Integrated Environmental and Economic Accounting 2003, A Handbook of National Accounting,* 2003.

U.S. Congressional Budget Office. *Environmental Regulation and Economic Efficiency.* Washington, D.C., 1985.

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States.* 2004.

_____. *County Business Patterns.* Annual Series, 2004.

- _____. *Survey of Environmental Products and Services*. February 1998.
- _____. *Population Projections: States: 1995 – 2025*. 1998.
- _____. *Current Population Reports*. Various issues.
- _____. *Current Population Survey, Annual Demographic Study*. Annually.
- _____. *Pollution Abatement Cost and Expenditures: 1999*. MA200(99), November 2002.
- U.S. Department of Commerce, Bureau of Economic Analysis. *State Personal Income, Quarterly Series*. 2004.
- _____. *Gross State Product, Annual Series*. 2004.
- U.S. Department of Commerce, Office of Technology Policy. *Meeting The Challenge: U.S. Industry Faces the 21st Century - The U.S. Environmental Industry*. September 1998.
- U.S. Department of Energy. *The Jobs Connection: Energy Use and Local Economic Development*, www.eren.doe.gov.
- U.S. Department of Energy. *U.S. Carbon Reductions by 2010 and Beyond: The Potential Impact of Energy-Efficient and Low-Carbon Technologies*. September 1997.
- U.S. Department of Labor, Bureau of Labor Statistics. *Employment and Wages, Annual Series*, 2004.
- _____. *Local Area Unemployment Statistics*. Monthly Series, 2004.
- _____. *Occupational Employment and Wage Estimates*. Annual Series, 2004.
- _____. *State and Area Employment, Hours, and Earnings*. Monthly Series, 2004.
- U.S. Environmental Protection Agency. *The Benefits and Costs of the Clean Air Act, 1970 to 1990*. Report prepared for the U.S. Congress, October 1997.
- U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation. *Environmental Investments: The Cost of a Clean Environment*. EPA-230-11-90-083, November 1990.
- U.S. Office of Technology Assessment. *Industry, Technology, and the Environment: Competitive Challenges and Business Opportunities*. OTA-ITE-586, U.S.GPO, Washington, DC, 1994.

Wagner, Gernot. "The Political Economy of Greening the National Income Accounts," *AERE Newsletter*, Association of Environmental and Resource Economists, Vol. 21, No. 1 (May 2001), pp.14-18.

WEFA, Inc. *Global Warming: The High Cost of the Kyoto Protocol*, June 1998.

Why Wind Power for North Carolina. The North Carolina State Energy Office, the North Carolina Solar Center, and the Renewable Energy Policy Project Coastal North Carolina Wind Resource Assessment Project, 2004.

World Resources Institute. *U.S. Competitiveness is Not at Risk in the Climate Negotiations*. October 1997.

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

There are two historical sources of information about the environmental industry in North Carolina. 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.¹¹ 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.

¹¹See 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.

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 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 North Carolina. The ITA estimated that, in 1999, North Carolina accounted for about 4.9 percent of the U.S. industry, and that the number of environmental jobs in the state totaled more than 66,000.

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

		North Carolina	U.S.	North Carolina Share of U.S.
Revenues	(millions)	\$4,746.3	\$196,465	2.4%
Jobs	(number)	33,790	1,389,638	2.4%
Companies	(number)	2,611	115,030	2.2%
Exports	(millions)	\$345.9	\$21,310	1.6%

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

The ITA report disaggregated the North Carolina industry by metropolitan statistical area (MSA) – see Table A.2. In North Carolina, this consisted of the Charlotte-Gastonia-Rock Hill MSA. This MSA accounted for 18 percent of the industry in the state and about 6,300 environment-related jobs.

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

		Charlotte-Gastonia-Rock Hill (NC/SC)
Revenues	(millions)	\$879.2
Jobs	(number)	6,259
Companies	(number)	484
Exports	(millions)	\$64.1
MSA Average Share of North Carolina		18%

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.¹² 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 North Carolina and the United States from the most recent survey, for 1999. Pollution abatement costs in these selected North Carolina industries included \$58 million of capital expenditures and over \$152 million for operating costs. Together with \$10 million in operating costs for disposal and recycling activities and other categories of economic activity, the PACE estimates for North Carolina in 1999 totaled \$623 million. This represented two percent of the overall PACE estimates in the United States.

¹²See 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 North Carolina
and the U.S. From the Census MA200 Survey, 1999
(million dollars, except where noted)

	North Carolina		U.S.		North Carolina Share of U.S.
Pollution abatement					
Capital expenditures	58.4		5,809.9		1.0%
Non-hazardous		32.0		4,497.8	0.7%
Hazardous		26.4		1,312.0	2.0%
Air	38.6		3,463.7		1.1%
Non-hazardous		18.9		2,644.7	0.7%
Hazardous		19.7		819.0	2.4%
Water	15.0		1,801.9		0.8%
Non-hazardous		9.6		1,488.2	0.6%
Hazardous		5.5		313.7	1.8%
Solid Waste	3.0		361.9		0.8%
Non-hazardous		1.7		245.5	0.7%
Hazardous		1.2		116.4	1.0%
Multimedia	1.8		182.3		1.0%
Non-hazardous		1.8		119.4	1.5%
Hazardous		-		62.9	-
Operating Costs	267.7		11,864.4		2.3%
Non-hazardous		226.5		8,924.9	2.5%
Hazardous		41.1		2,939.5	1.4%
Air	86.8		5,069.1		1.7%
Non-hazardous		70.1		3,941.2	1.8%
Hazardous		16.7		1,127.9	1.5%
Water	116.3		4,586.5		2.5%
Non-hazardous		103.7		3,511.8	3.0%
Hazardous		12.6		1,074.6	1.2%
Solid Waste	51.3		2,013.3		2.5%
Non-hazardous		39.6		1,320.4	3.0%
Hazardous		11.7		692.9	1.7%
Multimedia	13.3		195.5		6.8%
Non-hazardous		13.1		151.5	8.6%
Hazardous		0.2		44.0	0.5%
Disposal and recycling					
Capital expenditures	9.9		398.7		2.5%
Disposal		5.1		267.2	1.9%
Non-hazardous		4.2		218.0	1.9%
Hazardous		1.0		49.2	2.0%
Recycling		4.8		131.5	3.7%
Operating costs	152.4		4,923.6		3.1%
Disposal		92.1		3,680.9	2.5%
Non-hazardous		61.9		2,466.2	2.5%
Hazardous		30.2		1,214.7	2.5%
Recycling		60.4		1,242.7	4.9%

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

Pollution prevention	40.8		2,767.9		1.5%	
Other expenditures	55.4		3,154.5		1.8%	
Site cleanup		9.8		1,039.3		0.9%
Remediation			8.1	827.3		1.0%
Replacement			0.1	83.1		0.1%
Other			1.7	128.8		1.3%
Habitat protection		0.3		155.2		0.2%
Monitoring/testing		10.1		599.5		1.7%
Administration		35.2		1,360.4		2.6%
Other payments						
Payments to government	28.3		959.1		3.0%	
Permits/fees		23.5		816.6		2.9%
Fines/penalties/charges		4.8		116.3		4.1%
Other		0.1		26.2		0.4%
Tradeable permits - bought	-		20.2		-	
Tradeable permits - sold	-		23.7		-	
Tradeable permits - other	-		12.6		-	
Total	612.9		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.

Roger H. Bezdek, Ph.D., is President of Management Information Services, Inc. He has 30 years experience in consulting and management in the environmental, energy, economic forecasting, and regulatory areas, serving in private industry, academia, and the Federal government. He has served as a consultant to the White House, Federal and state government agencies, environmental organizations, and various corporations and research organizations. Dr. Bezdek, is an internationally recognized expert in economic forecasting and environmental analysis, and is the author of four books and of 200 articles in scientific and technical journals. He received his Ph.D. in Economics from the University of Illinois (Urbana).

Robert M. Wendling is Vice President of Management Information Services, Inc. He has 28 years experience in consulting and management in the energy, environmental, statistical/econometric modeling, and regulatory areas. He has served in industry as corporate CEO and president and as corporate vice president and in senior positions in the U.S. Department of Commerce and the Department of Energy. He is the author of 75 reports and professional publications on energy and environmental topics and lectures frequently on various energy, forecasting, regulatory, and economic modeling topics. He received an M.A. in Economics from George Washington University.

James E. Woods, Ph.D. is CEO of the Building Diagnostics Research Institute. He has 35 years experience in management and consulting in the environmental industry, serving in academia, industry, and as an advisor to DOE, EPA, NIST, and the National Academy of Sciences. He has extensive experience in end-use demand in the residential, commercial, and industrial sectors, environmental factors, and energy modeling, has managed 20 large scale energy and environmental research projects, and is the founder of the Building Diagnostics Research Institute. He received a Ph.D. in Mechanical Engineering from Kansas State University.