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# Greenhouse Gas Emissions Inventory 1990-2000 Executive Summary

UNH Sustainability Institute

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# University of New Hampshire
## Durham Campus

# Greenhouse Gas Emissions Inventory
## 1990-2000

# Executive Summary

## UNIVERSITY of NEW HAMPSHIRE

**A collaborative project of the
UNH Office of Sustainability Programs
and
Clean Air - Cool Planet**

**May 2001**

Clean Air-Cool Planet is an action-oriented advocacy group that seeks to reduce the threat of global warming by engaging all sectors of civil society to take actions that lead to rapid cuts in greenhouse gas emissions. Based in Portsmouth, NH, CA-CP is active throughout New England, New Jersey and New York.

Clean Air-Cool Planet's higher education program is designed to engage administrators, students, faculty, and staff in the global climate change discourse by increasing awareness about the issue and catalyzing direct action to reduce greenhouse gas emissions from campuses throughout the northeast.

The mission of the Office of Sustainability Programs at the University of New Hampshire is to unite the university community in the common purpose of education and institutional change for balancing economic viability with ecological health and human well-being. Our goal is to build a sustainable learning community at UNH that serves as a model for other communities.

We have program initiatives in transportation demand management and global change; food and society; integrated waste management; sustainable landscaping and sustainability and culture.

Second Printing

Adam Wilson
May 2001

## Acknowledgments

# Executive Summary

This report summarizes the anthropogenic greenhouse gas emissions for the University of New Hampshire, Durham Campus, from 1990 – 2000. The emissions are reported in Metric Tonnes Carbon Dioxide Equivalents, according to their Global Warming Potential (GWP) to provide the relative contribution of each gas to climate change forcing. The inventory follows the guidelines of the Intergovernmental Panel on Climate Change (IPCC), a panel of thousands of international scientists organized by the World Meteorological Organization and United Nations Environment Programme. These guidelines were adapted for use at a University. The purpose of completing an inventory of anthropogenic greenhouse gas emissions is twofold: first, to better understand the sources of emissions and second, to initiate the process of reducing them.

Human activities have led to an "enhanced greenhouse effect," also known as global warming. Since the dawn of the industrial age, carbon dioxide concentrations have risen almost 30%, methane has more than doubled, and nitrous oxide has increased about 15%. The IPCC reported that "the balance of evidence suggests a discernible human influence on global climate." It is certain that human activities have been significantly increasing the amount of gases in the atmosphere that contribute to this effect. While it is unclear exactly what the impacts of a rapidly warming planet will be, it is clear that there will be changes.

The global average surface temperature has increased over the twentieth century by about $0.6^{o}C$. It is very likely that the 1990s was the warmest decade and 1998 the warmest year in instrumental history, since 1861. Satellite data shows that there was likely a 10% decrease in snowcover since the late 1960s in the Northern Hemisphere. Northern summer sea-ice extent has decreased by 10-15% and become 40% thinner. Tide gauges have shown that the global average sea level rose 0.1-0.2 meters during the twentieth century. These global changes will be seen in the New England region and New Hampshire as well. For example, the temperature in Hanover, NH has increased over $1^{o}C$ and precipitation has decreased by as much as 20% around the state over the last century. At Seavy Island/Portsmouth, NH, sea level is rising by almost 0.18 meters (7 inches) a century.

With over 15,000 community members, UNH consumes a large amount of energy and therefore is responsible for a significant quantity of greenhouse gas emissions. As a microcosm of society at large, studying UNH's energy use and emissions provides the opportunity to reduce those emissions and educate the University community about the significance of energy choices and climate change.

This inventory represents the first step of a five-step plan undertaken in the collaboration between Clean Air - Cool Planet and the UNH Office of Sustainability Programs. The goal is to increase energy efficiency, reduce greenhouse gas emissions, and utilize the process as an educational tool for the university community. The five steps are as follows:
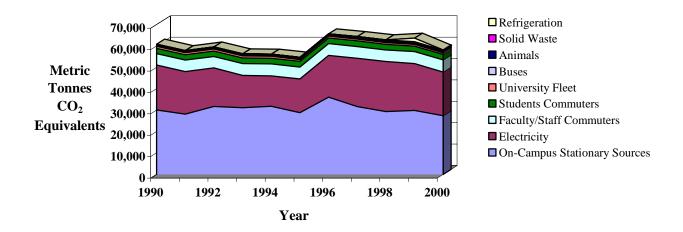
1  Complete an inventory of UNH's greenhouse gas emissions each year from 1990-2000
2  With UNH's assistance, adopt greenhouse gas emission reduction targets and timelines
3  Develop a strategic plan to meet reduction targets
4  Implement the strategic plan
5  Monitor the progress over time

# UNH Emissions: Major findings

♦ UNH emits about 60,000 Metric Tonnes of Carbon Dioxide Equivalents each year.

♦ There has been a net decrease (-4.5%) in total emissions from 1990-2000 (Figure ES-1)
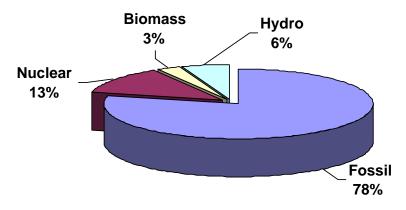
### Figure ES-1: Total UNH Direct Emissions 1990-2000

Electricity emissions are those from electric production, which are released off-campus.  On-campus stationary sources are all fuels burned on campus except those used for transportation, for purposes such as heating and cooking.
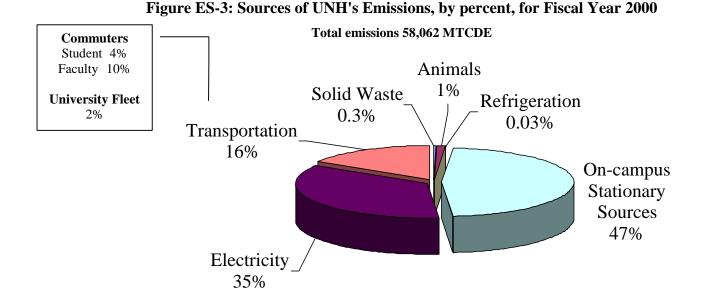


♦ Energy use per square foot has decreased (15%) from 213 kBtu per SF in 1989 to 181 kBtu per SF in 2000.

♦ Total energy use has increased (+5.0%) and energy use per student has also increased (+1.2%) from 1990-2000, but emissions per student has decreased (-7.6%) from 1990-2000

♦ Total emissions have decreased over the decade despite increasing energy use

♦ Changes in fuel types by both the University and its electric providers have resulted in fewer emissions per unit of energy

♦ Energy efficiency projects undertaken by the UNH Energy Office have resulted in both reduced consumption and emissions

♦ UNH relies on fossil fuels (coal, oil, gasoline, diesel, natural gas, and propane) for 78% of its energy needs (Figure ES-2).

### Figure ES-2: UNH's Energy sources, Fiscal year 2000.
**Includes on-campus production, off-campus electric production, and transportation.  "Hydro" is hydroelectric power production, "biomass" is mostly wood with some refuse.**

♦ The majority of UNH's emissions comes from on-campus stationary sources (47%) and electricity (35%), with all forms of transportation adding up to 16% of total emissions. Solid waste disposal, agriculture and refrigerant releases make up the remaining 2%. (Figure ES-3)

**Figure ES-3: Sources of UNH's Emissions, by percent, for Fiscal Year 2000**

**Total emissions 58,062 MTCDE**

| Commuters |
| --- |
| Student  4% |
| Faculty  10% |
| **University Fleet** |
| 2% |

Animals 1%

Solid Waste 0.3%

Refrigeration 0.03%

Transportation 16%

On-campus Stationary Sources 47%

Electricity 35%

♦ UNH's upstream emissions were also calculated. These are the emissions associated with the collection of the source fuel (such as crude oil), the transport, storage, and refining of the fuels as they are brought to the location of combustion (such as the automobile or University boiler). For example, it takes fuel to power an oil barge across the ocean or drive a tanker truck to deliver gasoline. When upstream emissions are included, total emissions increase by about 16% (Figure ES-4)
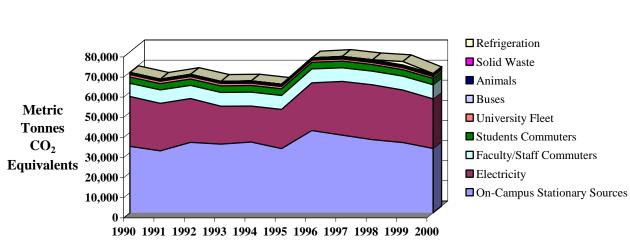
**Figure ES-4: Direct and Upstream Emissions**

# Conclusion

UNH should be commended for keeping emissions relatively steady over the past decade. Despite a growing population of faculty, staff, and students, greenhouse gas emissions have not increased. This is primarily due to a shift from carbon intensive production such as the incinerator, to natural gas on campus. The energy efficiency projects of the UNH Energy Office have also played a major role. The 4,500 metric tonnes of carbon dioxide emissions avoided annually because of these projects would have accounted for over 7% of the total emissions. If it were not for the careful management of UNH's energy infrastructure by the Energy Office, it is likely that total emissions would have reflected the growing population and appetite for energy of the UNH community and the nation in general. The efficiency projects undertaken by the Energy Office save $4 million a year (compared to similar sized schools in 2000) in reduced consumption according to a study completed by the US Department of Energy.

The fuels used to produce our electricity (although UNH has no direct control over them) have also shifted to less carbon intensive fuels like natural gas, biomass, hydroelectric, and nuclear. This shift should not put UNH completely at ease, however, for despite less greenhouse gas emissions, these fuel sources are have many environmental and social impacts. The problems and safety of nuclear waste disposal are manifold and the flooding of huge tracts of land for hydropower create environmental and social problems we are just beginning to understand.

UNH electric use has increased 15% over the decade, while on-campus energy production has increased 3.5%. This increase has surpassed the increasing size of the student body, as there has been a 1.2% increase in energy use per student. However, energy use per square foot has decreased 15% from 213 kBtu per SF in 1989 to 181 kBtu per SF in 2000. Despite the great work of the UNH Energy Office, it is clear that UNH is following the national trend towards more energy intensive operations and therefore unlikely that UNH's emissions will continue to decrease without continued conscious decisions and management plans.

UNH energy policy, including the efficiency projects of the energy office have to date been driven largely by economics and technology. However two factors point to the importance of placing UNH energy policy in a broader educational context: first, as noted above, energy use will likely continue to increase without purposeful policies to mitigate that trend that include an explicit community ethic to conserve energy. Second, with the establishment of the its Office of Sustainability Programs in 1997, UNH has committed itself to a university-wide educational goal of ensuring that all of its graduates develop the competence and character to advance sustainability in their civic and professional lives. This educational goal can only be achieved through modeling best practices in its energy policies as well as all other areas of UNH operations, and integrating those practices into the formal curriculum.

OSP's partnership with Clean Air - Cool Planet, which was initiated with this inventory project, is part of a broader Climate Education Initiative developed to address these educational issues. Other collaborators include the Climate Change Research Center (CCRC) of the UNH Institute of Earth, Oceans and Space, the Campus Energy Office, the UNH Transportation Policy Committee, and Facilities Design and Construction. One project of note is a general education course on global environmental change in which students negotiate implementation of the Kyoto Protocol at UNH. Students first interview and then play the role of senior administrators and other UNH decision-makers and then specify policies and practices to achieve reduction.

## Recommendations

UNH has the opportunity to actively reduce greenhouse gas emissions.  The work of the UNH Energy Office has shown that emission reduction is not only possible, but can also be economically advantageous. To continue reducing emissions, the following principles should be considered:

- As part of the UNH Climate Education Initiative, the OSP, UNH Energy Office, the Climate Change Research Center, and relevant departments should strengthen their collaboration and coordination to: advance greater energy efficiency in all UNH operations, participate in regional climate impact assessment research, and strengthen innovative curriculum in general education and in the emerging Masters of Public Health Program.
- UNH should continue to work towards more energy efficient construction, operation, and policy.
- UNH should approach energy decisions keeping in mind not only the economic cost, but also the environmental effects and educational opportunities of efficient energy production and consumption.
- UNH should incorporate sustainable construction and design principles into all building renovations and new construction standards.
- UNH should pursue the construction of a co-generation power plant that could supply the university with energy efficient heat and electric.  This type of plant uses heat produced in electric generation to heat buildings, rather than wasting two-thirds of the generated energy like most power generating facilities.
- With the deregulation of the electric market, UNH should factor the educational and social benefits of cleaner power into the decision of what kind of electric production methods (such as fossil, nuclear, hydroelectric, biomass, solar, wind, or others) to support.
- UNH should incorporate principles of Transportation Demand Management (TDM) into decisions made regarding all forms of transportation.  TDM is a tool to maximize mobility while reducing congestion and the resulting pollution. TDM includes: campus shuttles and an efficient bus system, car and van pooling, parking management strategies, alternative mode incentive programs, bicycles and pedestrian planning, and housing and scheduling management.