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Greenhouse Gas Emissions Inventory Report FY 10-11

UNH Sustainability Institute

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KEY INDICATORS

TOTAL EMISSIONS FY 11

Scope*	t CO ₂ e
Scope 1	33,073.8
Scope 2	3,650.8
Scope 3	21,951.7
Total Emissions	58,676.3
Offsets	-2,372.6
Net Emissions	56,303.7

* See text for definitions of Scope 1, 2 and 3 emissions.

PERCENTAGE CHANGE

Base Year	%
FY1990	-29.6%
FY2001	-25.7%
FY2009	-19.0%

INTENSITY DEMOGRAPHICS

Indicator	t CO ₂ e
Per Student	FY05: 6.2
	FY11: 3.2
Per 2,000 ft ²	FY05: 14.2
	FY11: 7.2

t = metric ton = 2,000 kg
CO₂e = carbon dioxide equivalents

Fiscal Year 2010–2011

GHG Emissions Update Report

This inventory update summarizes the anthropogenic greenhouse gas (GHG) emissions generated by the University of New Hampshire's Durham campus for fiscal years 2010–2011. This report is a supplement to previously published inventory reports (2001, 2003, 2005, 2007, 2009) and extends UNH inventory records through Fiscal Year (FY) 2011, which ran July 1, 2010 to June 30, 2011.

Summary

Overall Emissions & Trends

UNH GHG emissions have fluctuated throughout much of the past two decades (Figure 1). Total campus emissions, offsets and other key indicators are shown in the left sidebar. From 1990–2006, annual emissions ranged from a low of 70,688 tCO₂e in FY2000 to a peak in FY2003 of 83,692 tCO₂e. However, UNH has steadily reduced its carbon footprint over the past five years. These impressive reductions are due primarily to the UNH cogeneration heat and power plant, the UNH EcoLine landfill gas project, and a revolving energy efficiency fund (EEF), all of which are discussed further throughout this report.

UNH sells the Renewable Energy Credits (REC's) associated with EcoLine's electricity generation and is therefore careful not to include any GHG reductions associated with that power generation. Funds from the REC sales are used toward repayment of the EcoLine project cost and investment in

the EEF, which in turn is lowering total campus GHG emissions.

FY1990 is the first year for which UNH emissions were tracked (using historical data) due to the Kyoto Protocol's use of 1990 as the baseline year for international agreements on emissions reductions. FY2001 functions as the baseline year for the reduction targets in WildCAP, the UNH Climate Action Plan, which was adopted in FY2009. FY2005 is the baseline year utilized by the STARS program (Sustainability Tracking, Assessment and Rating System), of which UNH is a charter member and participant. Data cover the UNH Durham campus only and do not include those emissions from UNH Manchester, UNH Law or holdings outside of Durham.

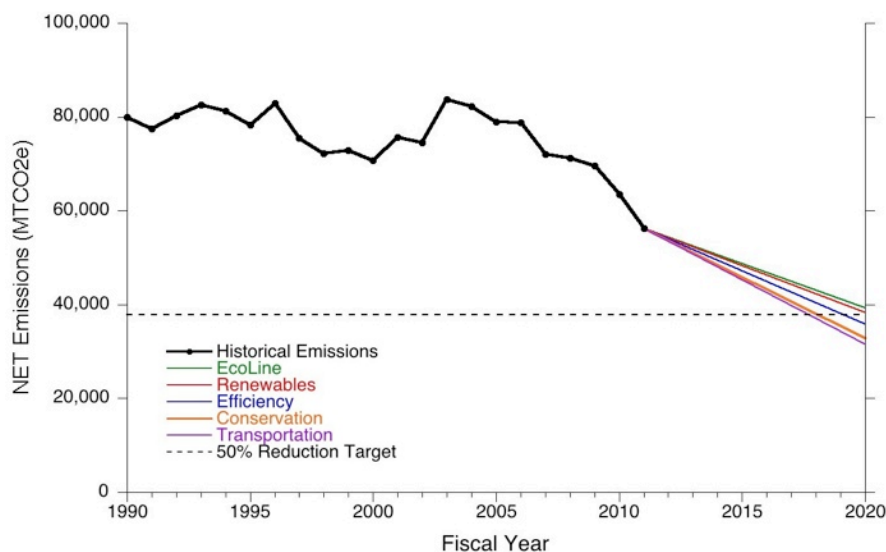
Emissions are expected to continue their downward trajectory in coming years as through the EEF more efficiency projects on campus will be completed (such as a solar pre-heat ventilation project at Kingsbury Hall), new policies and practices are considered, and our transportation demand management and outreach and behavioral programs, including UNH Unplugged (our annual residence hall and apartment energy challenge for students), continue to expand.

Scope 1 Emissions

On-Campus Sources

Scope 1 sources account for more than half of UNH's gross emissions for FY11, totaling 33,073.8 tCO₂e. Scope 1 sources include emissions associated with

Figure 1: UNH Actual and Projected Anthropogenic Greenhouse Gas Emissions 1990 - 2020*



* Air travel data were collected for FY09-11 and used to estimate air travel back to 1990. A conversion factor of \$0.15/mile was used as indicated by the Campus Carbon Calculator; taxes and fees were not taken out, slightly overestimating travel miles. More information can be found in the UNH FY10-11 Greenhouse Gas Emissions Inventory Technical Report.

WILDCAP

CLIMATE ACTION PLAN

UNH adopted its first Climate Action Plan (WildCAP) in September 2009, the result of a two-year process coordinated by the Energy Task Force (ETF). WildCAP calls for greenhouse gas reductions of 50% by 2020 and 80% by 2050.

In 2013, WildCAP will be updated by the UNH Energy Task Force (ETF).

For more information see: www.sustainableunh.edu/wildcap

heating and cooling on campus, electricity produced by the on-campus cogeneration plant, university-owned vehicles, and agricultural activities. For reporting purposes connected to this GHG inventory, emissions associated with the sale of RECs (13,200 tCO_{2e}) are also factored into the total value of Scope 1 emissions for the UNH Durham campus.

Cogeneration & EcoLine

The UNH cogeneration plant (cogen) began operations in FY06. Cogen produces heat and power using multiple fuel sources: natural gas, distillate (#2) fuel oil, and landfill gas (EcoLine). Cogen provides heating, cooling, and electricity for up to 85% of Durham campus buildings. In spring 2009, UNH completed its EcoLine project linking the cogen plant to a nearby source of landfill gas. The superior efficiency of the cogen plant creates significant reductions in total campus emissions as it utilizes cleaner fuels with lower carbon intensity while

simultaneously reducing the need for electricity purchased from outside sources. Thus, in addition to remarkable reductions in GHG emissions, the cogen plant reduces annual budget demands for energy. Additionally, the EcoLine creates a direct income stream for the university via Renewable Energy Credits.

Purchased electricity is discussed further in “Scope 2 Emissions.”

Other Stationary Sources

The majority of energy needs on the Durham campus are met via cogen, but some fossil fuels are still consumed in buildings not connected to the plant. These additional energy sources account for 17% of UNH’s Scope 1 emissions and 10% of net emissions.

Mobile Sources

The UNH vehicle fleet produces 3% of net campus emissions (1,900 tCO_{2e}), consuming a variety of conventional and alternative fuels, such as biodiesel B20 (20% biofuel) and compressed natural gas (CNG). In addition to campus operations and farm activities, UNH vehicle

emissions include WildCat Transit services (the largest public transportation system in the state) both on and off campus.

Since its inception in 2007, B20 use has grown to over 80% of diesel consumption, or just over 85,000 gallons. This likely represents a peak in the UNH B20 diesel fleet as CNG grows in importance. CNG accounted for just under 10% of UNH fleet use in 2011. That share is expected to double by 2015, with most of the shift being from B20 to CNG as a predominant fleet fuel source.

Refrigerants & Chemicals

Refrigerant leaks continue to be an insignificant source of emissions, far less than 1% of overall campus emissions.

Fertilizer Application

While fertilizer use accounts for only a small portion of total GHG emissions, UNH farms and athletic field operations have increased application of synthetic fertilizers in the past few years. Although exact records are difficult to track, significant use of fertilizers composed of

nitrogen, phosphorous and potassium occur at the animal science farms, as well as at UNH athletic fields operations, which include an additional compound containing iron. Estimates place total annual fertilizer use for FY10-11 between 7,000 and 9,000 lbs. UNH Grounds and Events, Thompson School greenhouses, and the horticulture farms on campus use negligible amounts of fertilizer.

Animal Husbandry

The only noteworthy change since FY09 in animal husbandry operations at UNH is the elimination of swine and poultry populations. No research has yet confirmed whether UNH’s organic dairy cow operations create less GHG emissions than conventional dairies. Animal husbandry and fertilizer application combine for 2.7% of net emissions counted under agricultural operations.

Scope 2 Emissions

Purchased Energy

The only Scope 2 energy source directly purchased by UNH is electricity produced by the New England electric power grid, distributed through Public Service of New Hampshire. The majority of steam and hot water used at UNH is produced on campus by cogen.

Purchased Electricity

UNH purchases of electricity have decreased dramatically since cogen became operational in 2006. In FY2011, UNH purchased 82% less electricity than FY06. These reductions are of great significance as purchased electricity has remained a major component of total campus emissions throughout the history of the UNH GHG emissions inventory. Scope 2 emissions also include those associated with purchased electricity to run the Ecoline processing plant onsite at Turnkey Landfill in Rochester, NH.

Scope 3 Emissions

Outsourced Activities

Scope 3 emissions include a number of sources that are difficult to track directly and measure accurately. Faculty, staff, and student commuting account for the lion’s share of Scope 3 emissions. Commuting, air travel, and solid waste disposal comprise the full slate of Scope 3 emissions currently tracked on the UNH Durham campus.

Commuting

Over the past ten years, three official surveys have measured campus commuting patterns and transportation attitudes (2002, 2007 and 2011). UNH has seen declines in parking permit sales, increases in transit use, and increases in housing-transit proximity choice. These positive trends are now flattening. With dramatic reductions in Scope 1 and 2 emissions over the past few years, commuting accounts for a growing portion of overall campus emissions. Currently measured at 25% of net campus emissions, great potential exists for further emissions reductions at UNH via faculty, staff, and student commuting.

Solid Waste Disposal

Considerable efforts have been made to revise this data set, streamline data collection, and improve reporting. A new waste-hauling contract allowed for reporting on actual tonnages of waste disposed, but additional values are still constructed from a series of snapshots over the course of the year. The new system was implemented in FY09, but some difficulties persist in obtaining consistent data; even so, reported solid waste disposal produces less than 1% of total campus emissions.

Long-distance Travel

FY10 was the first year in which UNH tracked emissions from airline travel. All air travel purchases made on UNH credit cards held by university employees (called “p-cards”) were reported and translated into miles in accordance with an emissions factor of \$0.15/mile provided by Clean Air-Cool Planet in the Campus Carbon Calculator. Based on current data, air travel accounts for a significant portion of UNH’s overall carbon footprint, at 14% of FY11 net emissions; however, the emissions factors employed to produce these calculations are very rough estimates. More work needs to be done to enhance the validity of this data set, but UNH aims to conduct the most comprehensive GHG emissions inventory possible and thus we work with the best information available.

Offsets

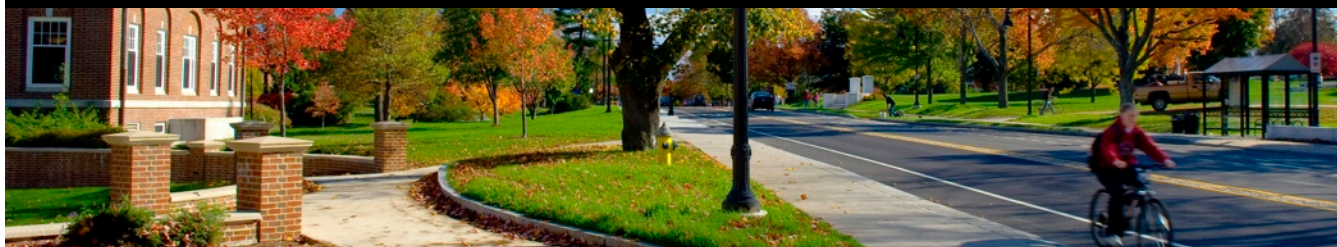
On-Campus Sequestration

Two sources of emissions offsets generated through on-campus activities apply to the UNH GHG emissions inventory: Forest Preservation and Composting.

Forest Preservation

Carbon uptake by campus woodlands and farms includes College Woods, Burley-Demeritt Farm, Woodman Farm, and Kingman Farm, totaling about 785 acres (317.6 hectares)

UNH Net** Carbon Footprint: Emissions Sources for FY11	
Cogen Electricity/ Steam	42%
Commuting	25%
Air Travel	14%
Non-Cogen Energy Production	10%
Purchased Electricity	6%
UNH Mobile Fleet	3%
<i>** These %’s differ from those of gross emissions, illustrating the impact of REC sales.</i>	



for which this GHG inventory tracks carbon sequestration.

An extensive student project in 2009 reassessed the carbon sequestration data on UNH lands. This research determined that calculations in previous versions of the GHG inventory were grossly underestimated. On-campus carbon sequestration is now estimated at 7.33 t/hectare/year, which results in annual emissions offsets of 2,328 t CO₂e. This figure should be considered as a stock of carbon that would have to be added into gross emissions if the university were to sell or deforest those lands.

Composting

UNH continues its on-campus composting program, which began in 2003. Approximately 120 tons of waste are composted annually, reducing net emissions by about 50 t CO₂e per year.

Carbon/Energy Market Activity

UNH participates in various markets for carbon and renewable energy created through regional cap-and-trade programs such as the Regional Greenhouse Gas Initiative (RGGI) and the Renewable Portfolio Standards (RPS) enacted by several states in New England. RECs create a direct income stream for UNH, but every credit sold inflates the campus's ultimate net emissions profile.

Renewable Energy Credits

UNH sells the RECs associated with landfill methane capture and electricity generation via the EcoLine project. In the first year of operation, FY09, UNH sold just 3,452 MWh worth of RECs, but in FY10 that number expanded to 46,285 MWh. REC sales decreased to 39,388 MWh in FY11.

The sale of RECs precludes the university from claiming any of the emissions reductions associated with those megawatts. Through FY11, REC sales accounted for 30,000 t CO₂e that have been factored back into the university's net emissions profile. UNH sells RECs to help offset the capital investment in the EcoLine project and also to bolster the EEF, both of which are integral components in successful implementation of WildCAP.

Purchased Offsets

UNH does not purchase any RECs. The current plans outlined in WildCAP call for a 50% reduction in net emissions by 2020 without the use of any purchased offsets.

Revolving Energy Efficiency Fund

Launched in 2009 with a \$650,000 grant from the American Recovery and Reinvestment Act (ARRA), UNH's revolving Energy Efficiency Fund (EEF) has already seen more than \$500,000 in energy savings "returns," including over \$250,000 in FY12 alone. The UNH Energy Task Force (ETF) estimates that after a decade, the university will realize more than \$4 million in energy savings and prevent more than 8,500 metric tonnes of greenhouse gases emissions -- the equivalent of over 1,600 passenger vehicles or 19,000 barrels of oil -- through the EEF. The EEF has invested in many projects, such as a solar pre-heat ventilation project at Kingsbury Hall, efficient lighting retrofits, and installation of insulation for steam distribution piping across campus. In 2011, UNH joined 32 other colleges and universities to launch a national challenge called the Billion Dollar Green Challenge to invest in revolving

UNH GHG INVENTORY SERIES

Produced through the collaborative efforts of the UNH Energy Task Force (ETF) and the Sustainability Institute, this update to the UNH GHG emissions inventory series serves as a tool for measuring the university's impact on regional and global climate, tracking institutional progress in meeting Climate Action Plan goals and American College & University Presidents' Climate Commitment (ACUPCC) obligations, and informing the decision-making of the university as it strives to respond to unprecedented disruption of the climate system.

Under its Climate Education Initiative, UNH-Durham is committed to being a *Climate Protection Campus* that pursues a sustainable energy future through emissions reduction policies, practices, research, and education.

The Sustainability Institute at UNH is a convener, cultivator and champion of sustainability on campus, in the state and region, and around the world. Learn more at www.sustainableunh.unh.edu.

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funds that finance energy efficiency upgrades on campus.

Next Steps

Future Data Considerations

New methods for tracking greenhouse gas emissions, in addition to new research and data, make the UNH GHG emissions inventory an evolving process. While some emissions can only be estimated, identifying all potential sources helps to create a more complete picture of the UNH carbon footprint. Emissions factors are updated as new technologies change the way we produce and consume energy and as international climate guidelines evolve.

As UNH succeeds in reducing Scope 1 and 2 emissions, Scope 3 sources will demand more significant consideration in the university's emissions reduction efforts. Questions of additionality (e.g., if an emissions reduction project would have happened even in the absence of revenue from carbon offsets) and other carbon offset market issues also become more important over time. Further research is needed concerning the large forest areas owned by the university for carbon

management and sequestration. Proposed requirements that such lands be conserved under easements and the carbon sequestration be verified by a third party -- as if it were being sold on the carbon offset market -- could be considered in future updates to the UNH Climate Action Plan.

Based on current carbon reductions goals set forth in the 2009 WildCAP, UNH is well on its way to achieving the goal of 50% GHG emissions reductions by 2020: our FY10-11 net emissions are 25.7% less than our FY01 baseline. What's more, in FY2011, UNH purchased 82% less electricity than FY06. Plans for 2013 include updating WildCAP as part of the university's 2014 progress report to the ACUPCC. Working towards carbon neutrality, campus-wide conservation and efficiency efforts solidify the university's commitment to climate protection by modeling best practices and expanding our role as a leader in sustainability in higher education.

For more detailed information on this inventory, please read the UNH FY10-11 Greenhouse Gas Emissions Inventory Technical Report at www.sustainableunh.unh.edu/ghginventory.