



# *Towson University*

## *Greenhouse Gas Inventory*



September, 2008

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# Climate Commitment-Team Members

## Towson University

**Dr. Robert L. Caret**  
*President of the University*

**James P. Sheehan**  
*Vice President of Administration*

## Project Team ARAMARK

**Matthew Judge, LEED AP, CPO**  
*Project Director*

**Christopher Flouris**  
*Project Engineer*

**Courtney McGinn**  
*Data Management*

## Advisory Panel ARAMARK

**Steve Guenther, PE, LEED AP**  
*Associate Vice President,  
Operations Excellence*

**Christopher Stemen, LEED AP**  
*Senior Director, Sustainability*

## Towson's Climate Commitment Committee

**Stephen Showers**, Facilities Management  
*Associate Vice President*

**Jack Nye**, Facilities Management  
*Director – Planning*

**Amie Voith**, Administration & Finance  
*Special Assistant to VP & CFO*

**Gina Conroy**, Facilities Management  
*Manager – Support Services*

**Liina Laden**, Chemistry Department  
*Director – Chemistry Tutor Center*

**Pat Brady**  
*Graduate Student*

**Gloria Gaguski**, Library  
*Administrative Assistant*

**Timothy Sullivan**, Economics  
*Associate Professor*

**Jason Stefanski**, SGA  
*Student*

**Rachel Fauber**, Towson Energy Activists  
*Campaign Director*



# Executive Summary

- The Greenhouse Gas Inventory
  - Fulfills **only the first year terms** of the American College and University Presidents Climate Commitment (ACUPCC)
  - Determines Towson's Carbon Footprint
    - Measure of the impact due to human activities on the environment in terms of amount of greenhouse gases produced
  - Report is inclusive of *all* campus operations and activities
  - Performed in the Summer of 2008 by ARAMARK Higher Education using Clean Air-Cool Planet's Carbon Calculator ([www.cleanair-coolplanet.org](http://www.cleanair-coolplanet.org))



# Introduction



# President's Climate Commitment



AMERICAN COLLEGE & UNIVERSITY  
PRESIDENTS CLIMATE COMMITMENT (ACUPCC)

The fight against global warming will shape the 21<sup>st</sup> century. Colleges and universities must exercise leadership in their communities and throughout society by modeling ways to eliminate global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by eliminating global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. We hope you will join us in supporting the American College & University Presidents Climate Commitment.

Sincerely,  
The Signatories of the American College & University  
Presidents Climate Commitment

Dr. Robert L. Caret Signed in September, 2007

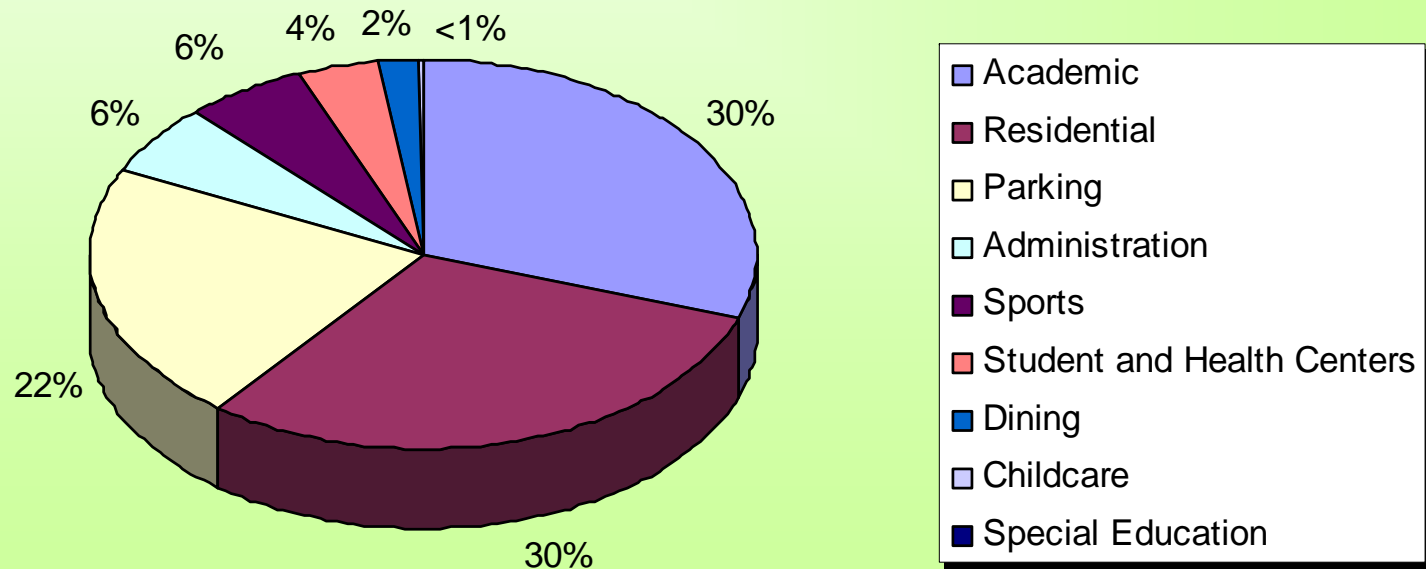


# Contextual Overview

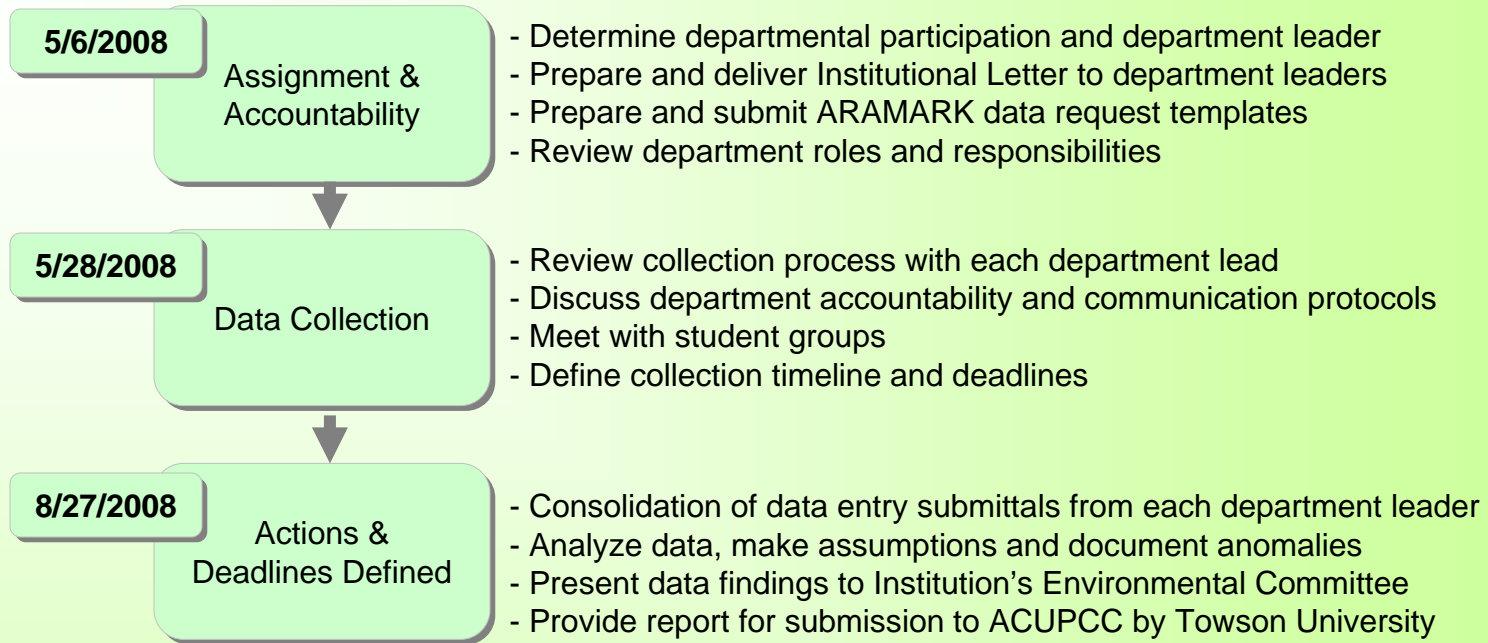
## Towson University

- 8 miles north of Baltimore
- Suburban campus
- 4,332,123 sq. ft. total building space
- 19,758 Total Students in 2007
- 1,375 Faculty
- 1,659 Staff

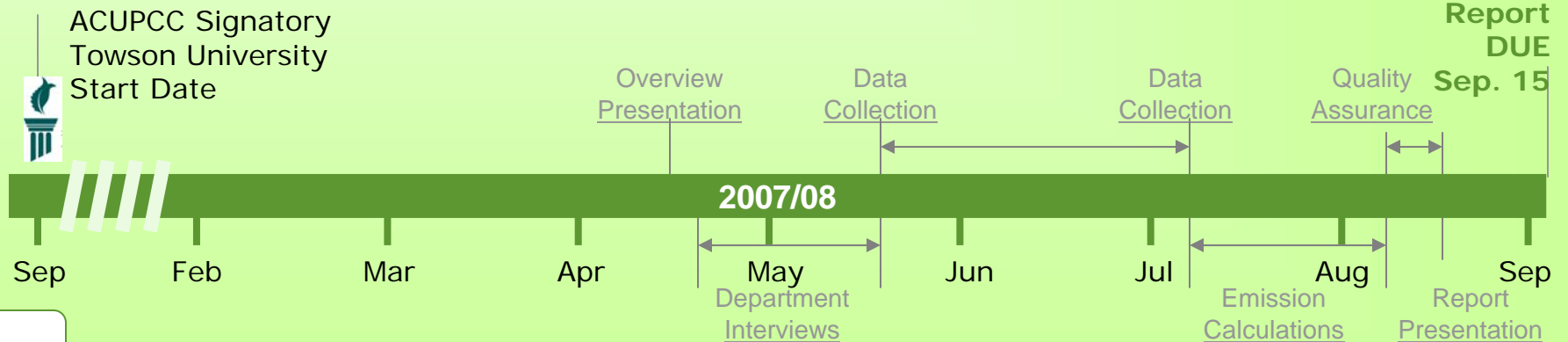
### Building Space Allocation



# Towson ACUPCC Timeline



## Year 1 – Greenhouse Gas Inventory Milestones



# Site and Source Emissions

## Purchased Electricity

- Coal, Nuclear, Natural Gas, and Renewable

## Stationary Sources

- Natural Gas: Heating
- Distillate Oil: Generator
- Propane: Cooking

## Transportation

- Student, Faculty and Staff Commuter Trips
- University Fleet Vehicles
- Athletics, Recruitment, Faculty & Staff Travel

## Refrig. & Chemicals

- HFC-134a: Chillers
- HCFC-22: Rooftop Units
- CO<sub>2</sub>: Fire Extinguishers, Carbonation

## Solid Waste

- Waste Sent to:
  - Landfill
  - Off Campus Incinerator

## Agriculture

- Synthetic Fertilizer
- Organic Fertilizer

# Carbon Footprint



# Footprint Calculation

## Data Collection



- Institutional Data
  - Jack Nye, Amie Voith
- Energy Data
  - LeRoy McKee (Energy Program Coordinator)
- University Transportation
  - Pat Brady, Pauletta Riley (Director – Finance/Support Services), Debra Boettcher (University Fleet Services Coordinator), Amie Voith
- Refrigeration and Chemical Data
  - Larry Holbrook (Director Environmental Health & Safety)
- Solid Waste Data
  - Gina Conroy, Jack Nye
- Agriculture Data
  - Paul Thomas (Manager- Landscape Services)

## Calculations

- Clean Air-Cool Planet Campus Carbon Calculator



# Emission Factors

- All results are reported in Carbon Dioxide Equivalents (eCO<sub>2</sub>)
  - Allows comparison of all types of greenhouse gases
  - Converted using respective global warming potential (GWP)
    - Measure of how much a given mass of GHG contributes to global warming
- Intergovernmental Panel on Climate Change (IPCC)
  - Provides the accepted values for GWPs

## Carbon Equivalents

Gas	2007 IPCC GWP
Carbon Dioxide – CO <sub>2</sub>	1
Methane – CH <sub>4</sub>	25
Nitrous Oxide – N <sub>2</sub> O	298
Hydrofluorocarbon – HFC-134a	1300
Hydrofluorocarbon – HCFC-22	1700
Sulfur Hexafluoride – SF <sub>6</sub>	22,800

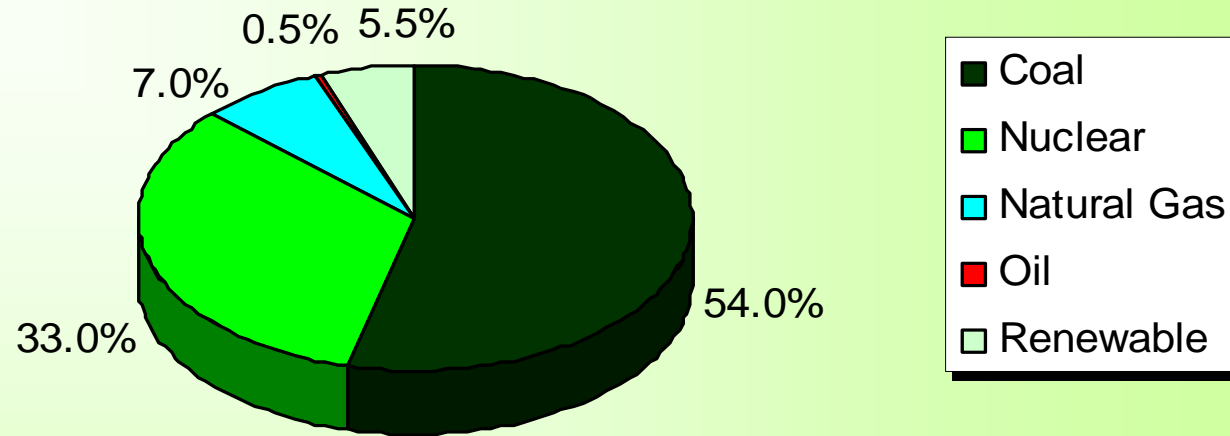
# Greenhouse Gas Emission Breakdown

- Purchased Electricity and On-Campus Stationary Sources consisting of natural gas, #2 fuel oil, and propane were responsible for **more than 70%** of Towson's total GHG emissions in 2007.

Source	Energy Consumed (MMBtu)	eCO <sub>2</sub> Emitted (Metric Tons)
Electricity	559,168	46,225
Stationary Sources	240,773	13,115
Transportation	308,031	24,524
Refrigerants	n/a	366
Solid Waste	n/a	2,116
Agriculture	n/a	24
<b>Total</b>	<b>1,107,972</b>	<b>86,390</b>

# Electricity Production

## Electricity Production Breakdown



- Renewable Energy:
  - Hydroelectric: 2.29%
  - Solid Waste: 1.64%
  - Wood/Biomass: 1.19%
  - Wind: 0.18%
  - Captured Methane Gas: 0.17%

# Transportation

## Towson



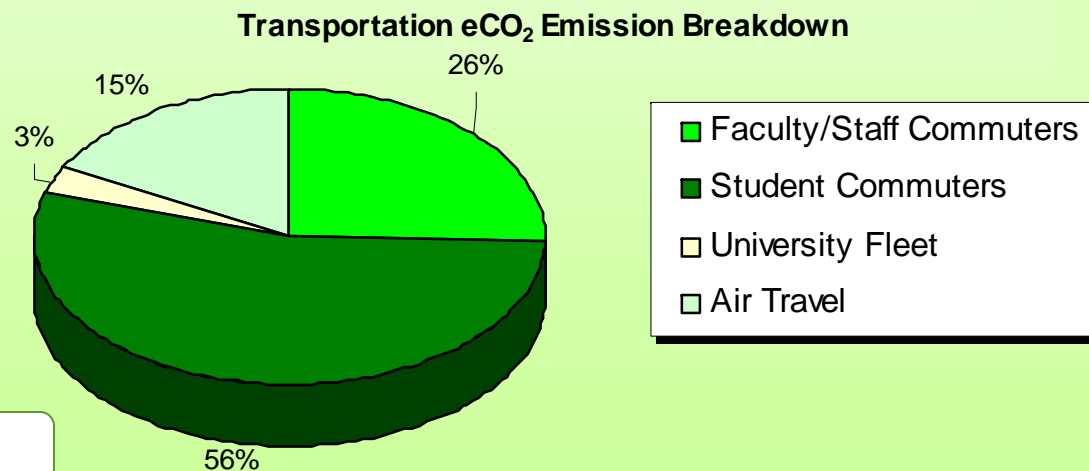
## 2007 School Year

- Commuter
    - Accounts for 82% of transportation emissions
    - 89% of students have parking passes
    - 75% of students drive to campus
    - 99% of Faculty & Staff drive to campus
  - University Fleet
    - Buses - Athletic/Academic Travel
      - 20,858 gallons of diesel
    - Faculty/Staff Travel
      - 60,800 gallons of gasoline
    - Landscaping/Grounds
      - 6,000 gallons of diesel
      - 6,000 gallons of gasoline
  - Air Travel
    - Most greenhouse gas intensive
    - 4,807,438 air miles
    - Faculty and staff business
    - Student and Athletics recruitment
- 3,567,078 gallons of gasoline consumed
- 24,542 metric tons eCO<sub>2</sub> emitted
- 28% of total eCO<sub>2</sub> emissions

# Transportation

- Transportation was responsible for **more than 28%** of the University's 2007 GHG emissions

Type of Transportation	Gasoline Consumption (gal)	Emissions (MT eCO <sub>2</sub> )
Faculty/Staff Commuters	720,792	6,444
Student Commuters	1,803,140	13,610
University Fleet	Gasoline: 60,800	754
	Diesel: 20,858	
Air Travel	961,488	3,735
Total	3,567,078	24,542



# Campus Refrigerants & Other Chemicals

## Towson



- Main refrigerants used:
  - 50% HCFC-22: Roof Top Units
  - 50% HFC-134a: Chillers
  - Release hydrofluorocarbons (HFC's)
  - High global warming potential
- Other chemicals used:
  - CH<sub>4</sub>: Chemistry Lecture Bottles
  - CO<sub>2</sub>: Fire Extinguishers, Carbonation, Pool Water Neutralization

## 2007 School Year

- 500 lbs of refrigerant replaced
- 366 metric tons of eCO<sub>2</sub> emitted
- Less than 1% of total eCO<sub>2</sub> emissions

# Solid Waste Disposal

## Towson



## 2007 School Year



- Handled by: Allied Waste
  - 90% of trash is sent to a landfill
  - 10% of trash is incinerated and the waste heat is used to generate electricity
- Total Maryland Recycling Act (MRA) Materials:
  - 877 short tons recycled
- Total Non-MRA Materials
  - 3,168 short tons recycled
  - Primarily construction and demolition debris
- 3,282 short tons of waste produced
- 2,116 metric tons of eCO<sub>2</sub> emitted
- 2% of total eCO<sub>2</sub> emissions

# Campus Agriculture

## Towson



## 2007 School Year

- Emissions from synthetic fertilizer
  - 15,850 lbs applied during fiscal year 2007
  - 33% nitrogen content
- Emissions from organic fertilizer
  - 10,400 lbs applied during fiscal year 2007
  - 7% nitrogen content
- Nitrogen content
  - Amount of nitrous oxide released after application on grounds and fields
- 24 metric tons of eCO<sub>2</sub> emitted
- Less than 1% of total eCO<sub>2</sub> emissions
- Forestry Offsets
  - 15.163 acres in easement
  - 620 metric tons of CO<sub>2</sub> sequestered

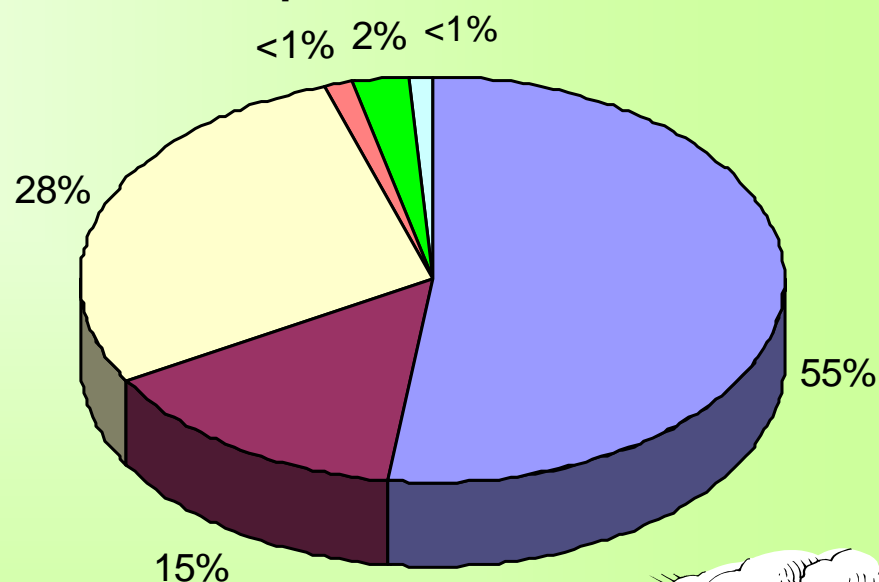
# Conclusion



# Towson's Carbon Footprint

- Towson emitted **86,390 metric tons** of eCO<sub>2</sub> in 2007
  - 4.37 metric tons of eCO<sub>2</sub> per student
  - 0.02 metric tons of eCO<sub>2</sub> per gross square foot

Towson's Carbon Footprint



- Main Contributors:
  - 70% Powering, Heating and Cooling Buildings
  - 28% Transportation



# Towson's Next Steps

## 1. GHG Inventory

- Submit to The Association for the Advancement of Sustainability in Higher Education (AASHE) by **September 15, 2008**
- Continue data input via CA-CP database
- **Annually submit** inventory to AASHE

## 2. Tangible Actions

- All new construction adheres to **LEED Silver** standard
- Provide and promote **public transportation** use
- Participate in the **Waste Minimization** component of the national **RecycleMania**
- Adopt three or more measures to **reduce waste**
  - Recycling program
  - Single stream recycling
  - Procuring \$210,000 of recycling containers

## 3. Action Plan

- Develop an action plan for **climate neutrality**
- Identify major greenhouse gas **emission sources** and general **reduction strategies**
- Devise a mechanism for **tracking progress** on goals and actions
- Incorporate climate neutrality and sustainability into **curriculum and other educational experiences** for students
- **Expand research** and other efforts to achieve climate neutrality
- Submit to AASHE by **September 15, 2009**



# Questions and Answers



# Appendix A: Carbon Equivalents

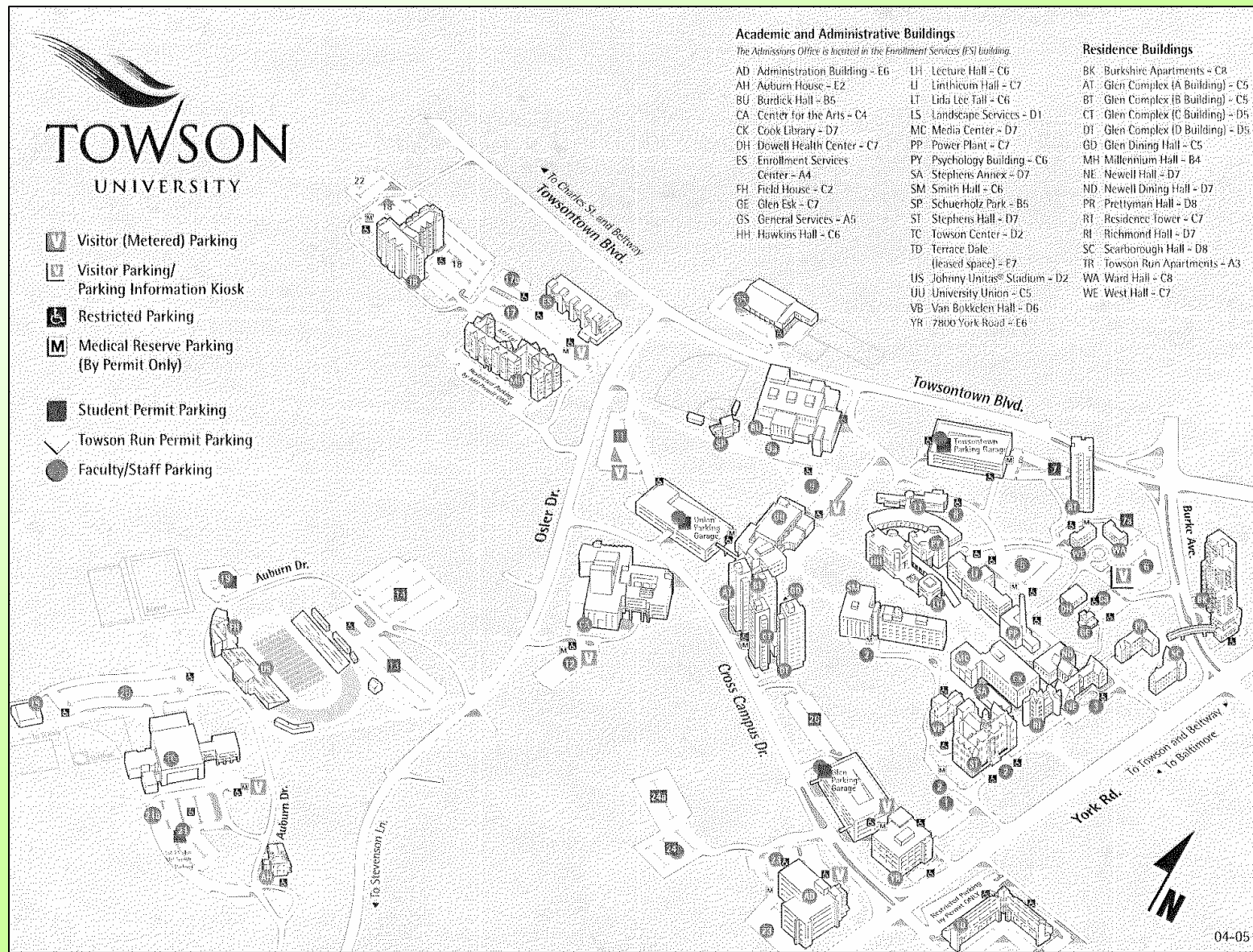
- The EPA's Greenhouse Gas Equivalencies Calculator was used to convert Towson's emissions.
- Towson's 2007 emissions is equivalent to:
  - The amount of greenhouse gases produced *annually* by **15,822 passenger vehicles**
  - The emissions from burning **451 railcars' worth of coal**
- To offset Towson's total emissions:
  - **~14,875 football fields** would have to be filled completely with pine trees



# Appendix B: ACUPCC Tangible Action Items

#	Yes	No	Tangible Action Item	Description
1	X		Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.	Adopting LEED Silver standard for new campus construction via Towson Construction Standards.
2		X	Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.	
3		X	Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.	
4	X		Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.	Provide subsidized campus shuttle buses and para-transit buses for the campus community.
5		X	Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.	
6		X	Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.	
7	X		Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.	Established a campus recycling program, a campus surplus department, and a system to review and approve placement of new campus trash containers.

# Appendix C: Towson's Campus



# Appendix D: Assumptions

- Electric Generation Fuel Mix
  - 0.48% oil used according to data
    - Entered 0.24% for residual and 0.24% for distillate as there was no distinction from the plant information
  - Numbers given add to 99.99%
    - Natural gas was 6.99% rounded up to 7% to make the total 100%
  - No column for captured methane gas, therefore added the 0.17% to the 'waste to energy' column
- Travel
  - Diesel bus estimate mpg: MCI J4500 coach (best selling coach) 5-9 mpg with all seats filled (<http://www.mcicoach.com/goGreen>). Used an average of 10 mpg for all bus calculations.
  - Used 22.1 mpg for all personal/fleet vehicle travel
  - A mpg ratio of 5 mpg (Boeing) was used to convert air miles to gasoline consumed
- Agriculture
  - Weighted average used to calculate synthetic/organic fertilizer %N<sub>2</sub>
- Waste
  - Per Allied Waste Management, 90% of waste is sent to a landfill and the remaining 10% is sent to an incinerator in which the waste heat is used to generate electricity.
- Offsets
  - Used the average carbon density of US forestland of 40.9 metric tons of eCO<sub>2</sub> per acre to estimate the amount of eCO<sub>2</sub> sequestered by the 15.163 acres of forest in easement ([www.epa.gov/cleanenergy/energy-resources/refs.html](http://www.epa.gov/cleanenergy/energy-resources/refs.html) - acres of forest preserved from deforestation)

# Appendix E: Assumptions (Continued)

## Commuter Travel

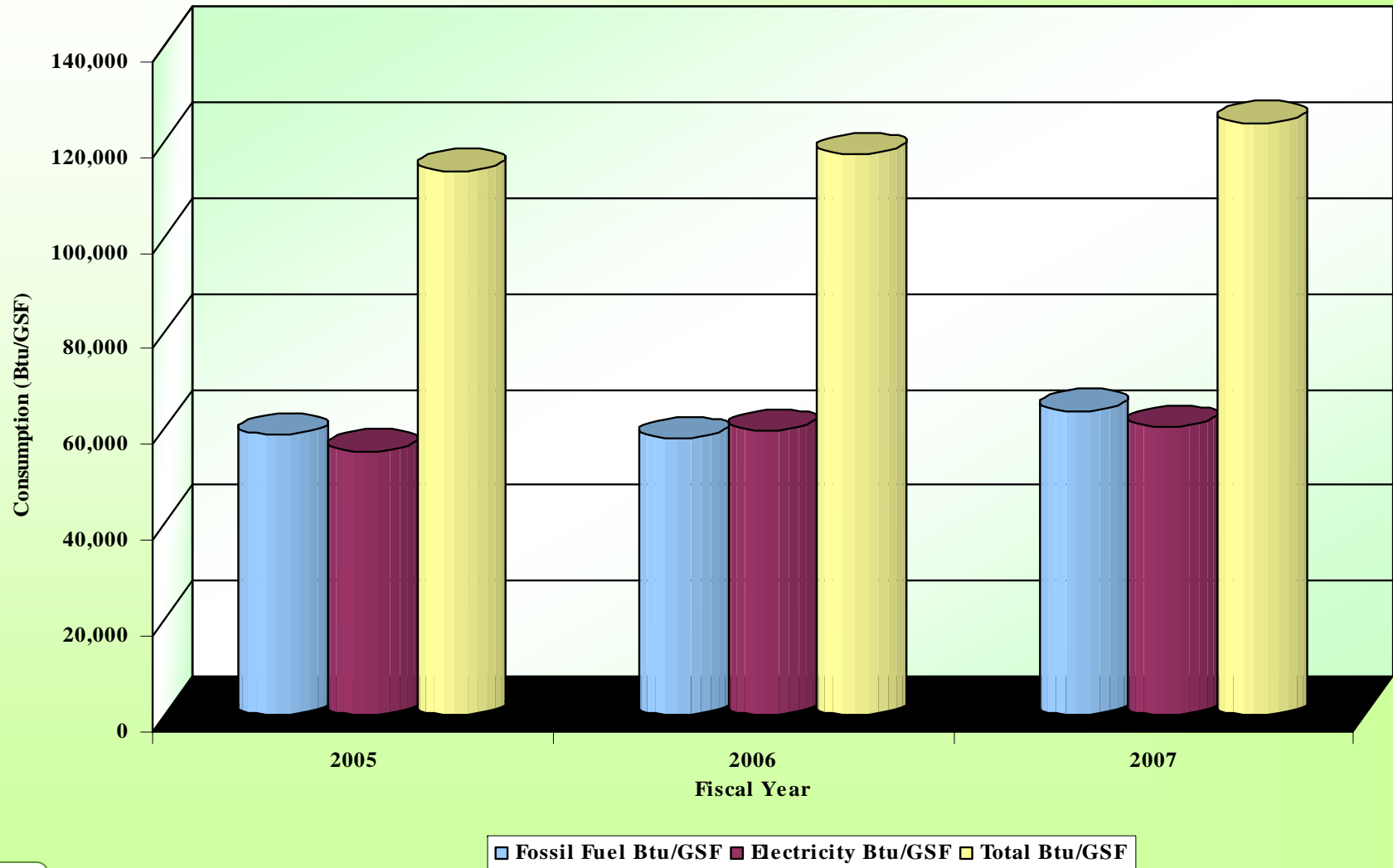
- Personal Vehicle Travel

- 15,537 parking passes sold, 17,422 students (.5 part time students) =  $15,537/17,422 = 89\%$  of students have cars on campus. 75% of undergraduate student population commutes; applied same percentage to summer school students (<http://www.towson.edu/main/admissions/transfer/newstudents/commuterinformation.asp>)
- No way to accurately estimate carpooling so in this case no students, faculty, or staff carpool
- 15 mile radius is the cutoff (top 50 most occurring zip codes) Students live between 0 and 15 miles from campus and averages to 7.5 miles one way attributing to 15 miles round trip
- Students make 1 trip 160 days of the year (16 weeks per semester x 2 semesters x 5 days a week) at an average distance of 15 miles round trip
- Summer School Students make 1 trip 30 days (10 weeks of summer school x 3 days a week) of the year at the same average distance of 15 miles round trip.
- 99% of faculty and staff drive and make 1 trip 240 days of the year (48 weeks – 4 weeks vacation x 5 days a week) at a weighted average distance of 22 miles round trip

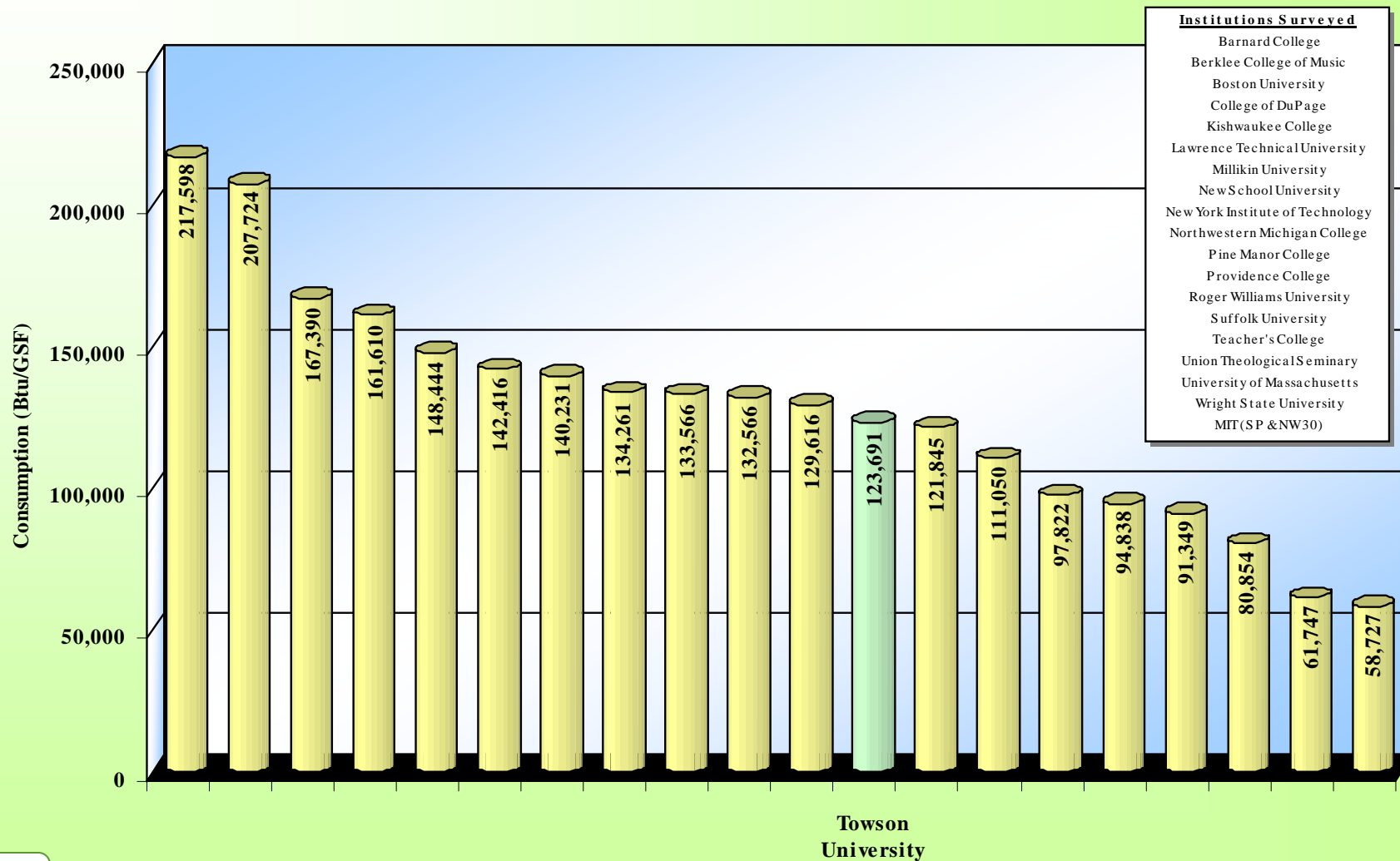
- Public Transportation – Maryland Transportation Authority (MTA)

- Those taking mass transit are purchasing discount passes, round trip mileage from survey taken at sales office
- Daily round trip distance per phone conversation on 7/28/08 with MTA customer service.
  - 200 student passes sold, 1 trip daily, 160 days of the year, 9 miles round trip
  - Summer School Students make 1 trip 30 days of the year, 9 miles round trip
  - 8 faculty/staff passes, 1 trip daily, 240 days of the year, 17.3 miles round trip

# Appendix F: Energy Consumption (Btu/GSF)



# Appendix G: Comparative Indices-Consumption (Btu/GSF)



\* According to The Commercial Building Energy Consumption Survey (CBECS) the Average Site EUI (Kbtu/SqFt) for Colleges and Universities is 120 Kbtu/SqFt

# Appendix H: AASHE Reporting

- Must report to AASHE by September 15, 2008
- Reporting to AASHE:
  - Results from CA-CP Campus Carbon Calculator
  - Allows for benchmarking of all schools completing inventories
- To Access the ACUPCC reporting tool visit:
  - <http://www.aashe.org/pcc/reports/>
  - Need username and password to access account