Transportation Greenhouse Gas Emissions in Universities:
The Role of the American College and Universities Presidents' Climate Change Commitment
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Introduction

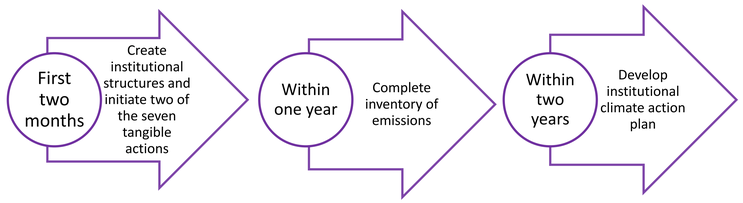
Institutions of higher education are increasingly interested in finding ways to reduce the negative externalities of their activities on the environment and on surrounding communities. Among many environmental concerns, the issue of climate change has received substantial attention in university communities; and as a result, pacts and commitments that set guidelines for campuses interested in reducing greenhouse gas emissions have recently emerged.

With the advent of the **American College and Universities Presidents' Climate Commitment (ACUPCC)** in 2006, the higher education sector in the United States became a pioneer in terms of commitment to achieving carbon neutrality, using its prominent position in communities to set an example to many other sectors in society at large *(1)*.

The Commitment

In 2010, the commitment had 673 signatories in all fifty states and the District of Columbia, encompassing over one third of all higher education students in the United States *(16)*. By joining the ACUPCC, signatories agree to the following general terms *(17)*:

- Conducting an **annual inventory** of all greenhouse gas emissions;
- Implementing **two or more** short-term **'tangible actions'** to reduce greenhouse gas emissions;
- Developing a customized **Climate Action Plan** to reach climate neutrality in operations;
- Making sustainability a part of the **educational experience** for all students;
- Making the action plan, inventory, and periodic progress **reports publicly available** to facilitate and accelerate progress for fellow institutions and society.
- The commitment also establishes a **timeline for implementation** and compliance with the terms of the pact, with the ongoing commitment to provide periodical reports on the institutions progress *(18)*.



ACUPCC Compliance Timeline

Tangible actions

a) 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.
b) Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.
c) Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.
d) Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.
e) Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.
f) Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.
g) Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste

Source: Clemson Area Transit

Objectives

- To characterize the role of tangible action *d* - the only transportation strategy mentioned in the ACUPCC;
- To evaluate this strategy's contribution to the goals of the pact in comparison with the other strategies proposed;
- And to offer recommendations that could lead to the enhancement of the transportation portion of the commitment.

Methodology

Research questions

Is the adoption of any of the tangible actions associated with the amount of carbon dioxide the institution emits? Does the adoption of tangible action *d* result in lower commuting emissions?

Data

Population	673	
Sample size	346	
Confidence interval	±3.68%	
Data sources for	Campus Emissions	ACUPCC Reporting System, 2010
	Campus Location	Census 2000 Glossary of Basic Geographic and Related Terms
	Campus Residents	The Carnegie Classification of Institutions of Higher Education™ 2010

Statistical Analyses

Testing for correlation

To test whether the gross greenhouse gas emissions of the sampled institutions were correlated to the adoption of any of the President's Commitment proposed tangible actions, **the correlation coefficient (Pearson's r) was calculated between tangible actions (independent variable) and gross emissions (dependent variable).**

Testing for significance

The relationship measured by Pearson's r was then tested for statistical significance. The critical areas considered for this t-test was ±1.96 (95 percent confidence) and ± 1.645 (90 percent confidence).

Testing the difference between sample means for significance

To test whether institutions that had adopted tangible action *d* (related to public transportation) presented lower commuting emissions than those that had other tangible actions in their mix of strategies. **The means of the commuting emission amounts of the two groups were calculated and compared for significance through a *Z test*.** Independent variables such as **campus location and share of students who live on campus are also expected to influence the level of commuting emissions** of a given institution; therefore additional tests on sample means for significance were conducted taking these factors into account.

Geographic Classification	Geographic Description of Campus Location (2000 U.S. Census)
Urban	Urbanized area of 50,000 people or more
Small Urban	Urbanized cluster (densely settled area) of population between 2,500 and 49,999
Suburban	Urbanized area of population between 2,500 and 50,000
Rural	Areas with a population smaller than 2,500 people

Categories used, according to percentage of students residing on campus
Less than 25 percent
Between 25 and 49 percent
More than 50 percent

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Findings

1. In order to decrease bias, emissions amounts were normalized according to self-reported full-time student enrollment. Reports only accounted for carbon dioxide. After several tests, only three of the seven variables (tangible actions) showed satisfactory statistic significance for this population

Regression results for all tangible actions	Coefficients	t-statistic
Intercept	147.28	2.38
a (LEED Silver standard for new campus buildings)	28.62	0.7
b (policy for purchasing of energy-efficiency new appliance)	-123.21	-2.56**
c (offsetting of GHG emissions produced by air travel)	-9.62	-0.14
d (encouraging and providing access to public transportation)	-62.50	-1.64*
e (purchasing at least 15% of total electricity from renewable sources)	76.04	1.86*
f (supporting climate and sustainability shareholder proposals where endowment is invested)	-26.82	-0.41
g (waste minimization	-35.84	-0.96

****95 percent level of confidence** ***90 percent level of confidence**

The r calculations found a WEAK relationship between the variables; which can be said with significant levels of confidence in regards to the tangible actions related to purchasing of energy efficient appliances, providing access to public transit and acquiring electricity from renewable sources:

Adjusted R Square	0.017

2. All Z-tests failed to reject the null hypothesis of **NO STATISTICALLY SIGNIFICANT DIFFERENCE BETWEEN THE MEANS** of the institutions that adopted and those that did not adopt tangible action *d,* for all independent variables:

Entire sample	With tangible action *d*	Without tangible action *d*
Mean	1.328	1.367
Standard Error	0.124	0.123
Median	0.974	1.015
Standard Deviation	1.823	1.403
Count	216	130
Z (Critical)	±1.96	
Z(Obtained)	**-0.221**	

By location	Rural		Suburban		Small Urban		Urban	
	With *d*	Without *d*	With *d*	Without *d*	With *d*	Without *d*	With *d*	Without *d*
Mean	1.34	1.45	1.09	1.49	1.62	1.10	1.39	1.50
Median	1.34	0.98	0.98	1.22	0.71	0.78	0.98	1.25
Standard Deviation	0.52	1.40	0.71	1.38	3.53	0.85	1.75	1.81
Sample Variance	0.27	1.97	0.50	1.90	12.49	0.73	3.06	3.27
Count	4	10	63	37	25	41	124	42
Z obtained	**0.20**		**1.60**		**-0.71**		**0.36**	

By student residents	Less than 25%		25% to 49%		More than 50%	
	With *d*	Without *d*	With *d*	Without *d*	With *d*	Without *d*
Mean	1.22	1.52	1.57	0.95	0.88	0.91
Median	1.14	0.90	0.98	0.74	0.71	0.71
Standard Deviation	0.73	1.84	2.60	0.79	0.58	0.68
Sample Variance	0.53	3.38	6.77	0.63	0.34	0.46
Count	40.00	16.00	52.00	21.00	55.00	50.00
Z obtained	**0.61**		**-1.54**		**0.22**	

Conclusion

The encouragement and provision of access to public transit is a positive and important step, not only towards reduction of emissions but also towards more efficient land use patterns; but other strategies should also be encouraged in the terms of the commitment, to foster more aggressive actions to reduce transportation related emissions. Although all tangible action are intended to allow for very diverse institutions to find the best measures for their characteristics and needs, tangible action *d* is still considerably more vague in its formulation that the others.

The fact that tangible action *d* does not mention any other transportation demand tool reveals a gap in policy that can be filled by the addition of strategies that enjoyed positive results in diverse localities and environments, especially those that are not yet equipped to offer transit service. Moreover, the failure to identify correlations across the data set points to the need to carry further studies considering strategies to strengthen the policy. A possible remedy would be to lend more concreteness to the suggested tangible actions and set targets that are actually tangible. In order to accommodate the differences between institutions, targets can be set in percentages (such as fixated by tangible action *e*), or consider measurements like full time enrollment or built area.

Future research can investigate interesting aspects of the performance of institutions under the Presidents' Commitment, including longitudinal studies to test emission reductions over time; detailed studies of emissions from different operational sectors within the universities; and comparison of emissions from institutions in the pact compared to those that are not part of it.