Carbon Neutrality Action Plan – Executive Summary

The purpose of this document is to present an Executive Summary version of a viable action plan for achieving climate neutrality at Rowan University (RU) by 2029. The document has been divided into 4 sections. Section 1 provides an introduction and overview of a proposed schedule for implementing key policy, tactical and strategic actions that will enable the campus to become climate neutral with respect to carbon dioxide impacts. It also includes a growing student population consistent with the student population found in the RU Campus Master Plan. We have provided an estimated equivalent kWh/student use in the years in which new key actions are implemented. Kilowatthours (kWh) are the metric for energy use employed in this proposal. Section 2 provides calculated estimates what the University's predicted carbon emissions would be in 2029, if no climate neutrality actions take place (A business as usual scenario). This section can be used to identify the present and future sources of the University's carbon emissions. Section 3 provides a summary of how reductions in carbon emissions are planned to be achieved between the present and 2029, assuming the schedule described in section 1 is adopted by the campus and administration and is followed. The section provides an overview of key measures whereby carbon reductions may be obtained. The final section is provided as a summary list of key parameters, estimates, and assumptions used to generate the values in this plan and the underlying modeling it represents. All energy and carbon estimates are based on the best available information, including a recently completed carbon inventory, standard engineering calculation methods and future estimates based upon available University documents (e.g., the master plan).

This action plan is part of the President's Climate Commitment (http://www.presidentsclimatecommitment.org). President Farish was the first university president to sign the Climate Commitment in State of New Jersey. The ultimate result of the commitment will be to make RU climate neutral (i.e., zero net carbon emissions) in the not too distant future. The commitment involves:

1. Establishing an institutional structure to oversee the development and implementation of a climate action program;
2. Completing an emissions inventory within one year;
3. Establishing a climate action plan that includes a target date and interim milestones for becoming climate neutral within two years;
4. Taking immediate steps to reduce greenhouse gas emissions by implementing at least two of a list of seven tangible actions while the climate action plan is being developed;
5. Establishing a plan for integrating sustainability into the curriculum and making it a part of the educational experience; and
6. Making the inventory, climate action plan, and progress reports publicly available.

Items 1, 2, and 4 above have been completed. Items 3 and 5 are due on September 15, 2009. The purpose of this document is to provide our preliminary recommendations regarding item 3, and provide a framework for the continued development and refinement of an economically

achievable climate neutrality action plan for RU. Faculty, staff, and student comments and suggestions will be gathered for the rest of this semester and until the end of May in order to inform the initial draft plan that will be submitted in September. That revised plan will be submitted September 15 and will represent a serious commitment on the part of our University. However, it is understand that such an aggressive and ambitious set of actions will inevitably be modified over time in response to faculty, staff, and student input and changing environmental, economic and technologic conditions (e.g., in climate science and energy/ control technologies).

1. Carbon Neutrality Actions and Year(s) Implemented

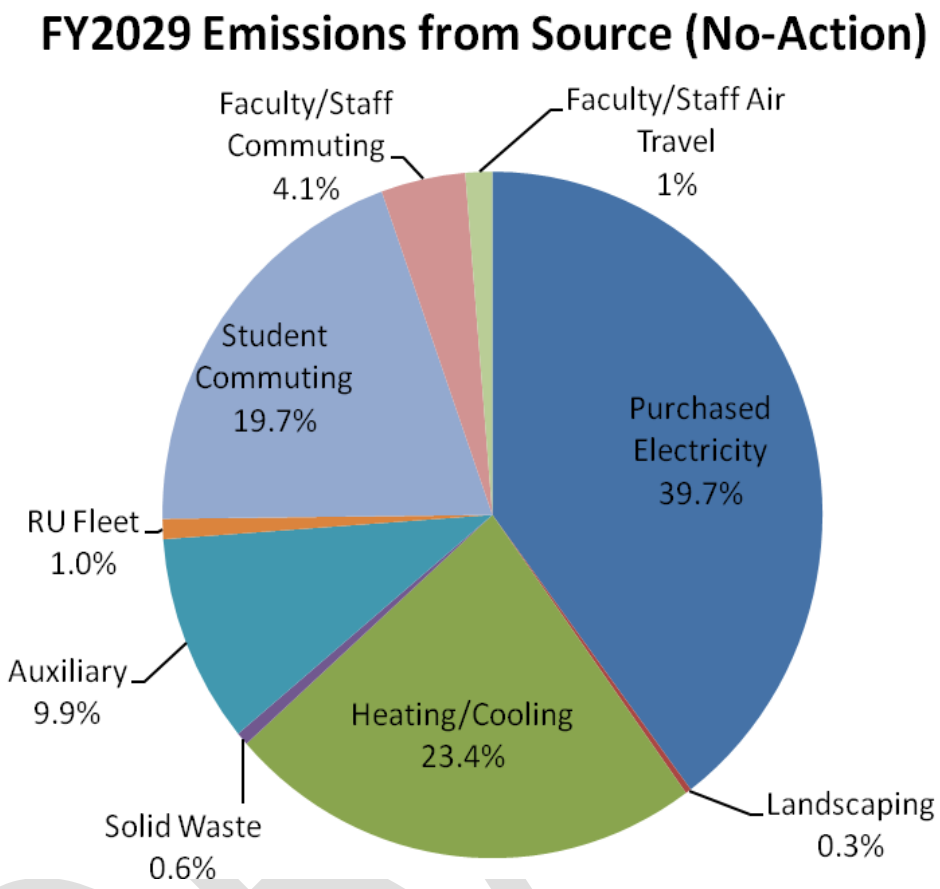
Table 1 shown on the following page represents a proposed scenario of thirty aggressive measures that, if implemented, can achieve carbon neutrality for RU. For each carbon neutrality (CN) action an estimated date for implementation (a future year) as well as estimated impacts that these proposed activities would have on our carbon footprint (represented as equivalent kWh per student). Some of these activities and policies are self explanatory but w have provided a brief summary description of each in the Appendix to this proposed plan. In essence the plan represents the total elimination of carbon emissions from all campus facilities (buildings, energy usage, transport on and off campus – including commuters and employee travel, etc.). The plan calls for recognition of the major efforts we have already taken to reduce our emissions and improve our efficient use of energy by keeping the new cogeneration facility in operation until the end of its service life and gradually improving the efficiency of all new and existing buildings. As shown below in measures 4, 8, 11, 19, 21, 24 and 29 we present a systematic improvement in building energy utilization efficiency with some measures attacking existing buildings and others targeted at the new buildings associated with the campus expansion needed to accommodate a growing student and faculty population. These measures move aggressively from the current building policy that all new buildings are LEED certified (at the Silver level) to Gold (2015), then Platinum (2020), then to carbon neutral (2025) and finally carbon negative (2029). This includes conversion of our entire fleet of buildings (old and new) ultimately to geothermal HVAC powered by renewable energy sources. Similar measures are proposed for our energy supply, ultimately moving off of natural gas in 2029 as we become entirely dependent upon renewable energy sources and the grid. It is recognized in the plan that it may be impossible to totally free ourselves from carbon generation in the next two decades based upon potential limitations in technology and or economics of alternatives, so we have proposed REC trading and arbitrage from our campus PV systems to secure carbon offsets for commuters, faculty and staff to assure we will achieve our goal even if carbon neutral transport does not become a reality over this planning horizon. The current plan includes the construction of a 30 MW Photovoltaic power plant on the West Campus and involvement in an NJHEPS offshore wind consortium for the purchase of additional renewable energy generated

electricity. Please consult the appendix for a more detailed description of the proposed measures in the plan.

Table 1 – Carbon Neutrality Plan Measures

CN Measures	Year Implemented	Student Population (FTE)	Total Energy* / Student (kWh/student)
1. Wind Renewable Credits	2009	9,212	18027
2. Building Metering and Energy Audits	2011	10,291	
3. Integrating sustainability into curriculum			13945
4. Increase Energy Efficiency of old buildings	2012	10,831	
5. PV system on West Campus 10 MW			
6. Recycling on Campus (1st Phase)			10605
7. Buying offsets for air travel and rental cars	2013	11,370	10636
8. LEED Gold Certification for new buildings	2015	12,449	
9. All students to live on or near campus			
10. Students/faculty/staff buy offsets to cover commuting			
11. New buildings geothermal HVAC			7509
12. Initial Conversion Rowan University Fleet	2016	12,988	
13. Replanting of forests			
14. Recycling on Campus (2nd Phase)			7664
15. NJHEPS Wind Consortium 25 MW	2017	13,527	5589
16. LEDs for all Campus lighting	2018	14,067	4205
17. Promoting alternative vehicles and transportation on campus	2019	14,606	4464
18. Recycling on Campus (3rd Phase)	2020	15,146	
19. LEED Platinum Certification for all new buildings			
20. PV system on West Campus next 10 MW			3732
21. Begin refit old buildings with Geothermal	2021	15,685	3990
22. Begin Phase out Co-gen plant	2024	17,303	
23. Recycling on Campus (4th Phase)			4667
24. All new buildings are zero emission	2025	17,842	3872
25. West Campus Composting Facility	2026	18,382	4088
26. Close-to-Zero Waste Campus	2028	19,461	
27. PV system on West Campus next 10 MW			3868
28. Co-gen Plant is Phased out of service	2029	20,000	
29. All new buildings have Negative Carbon Footprint			
30. Geothermal HVAC for all RU Buildings			0

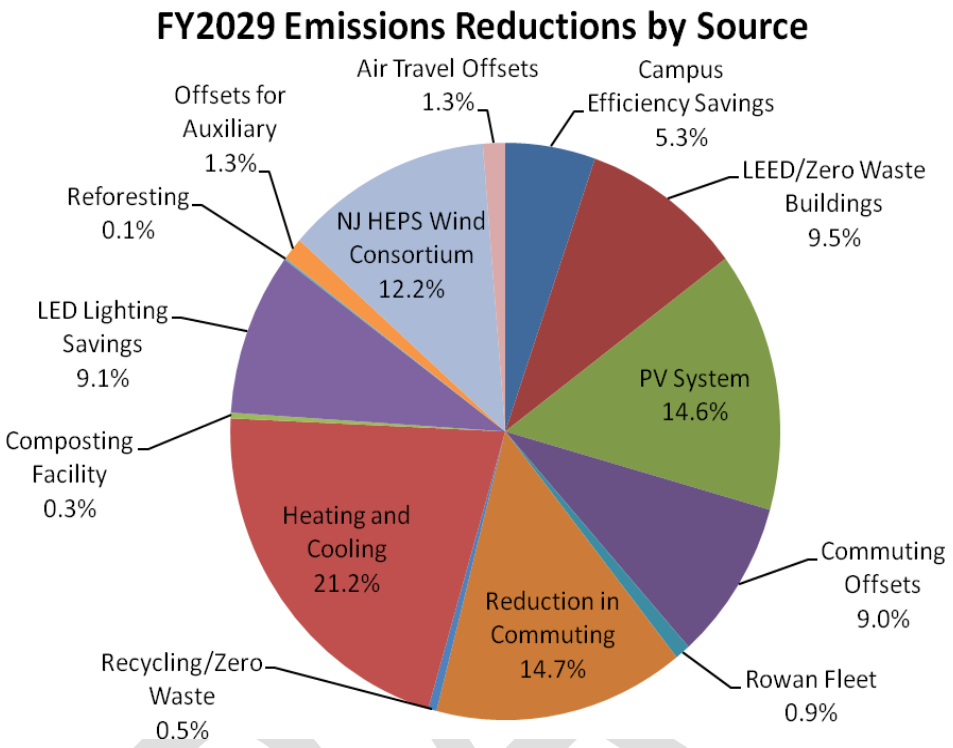
2. FY2029 Estimates for Emissions and Campus Information (No Action) - These graphs illustrate a business as usual scenario if we follow current strategies with proposed expansion.



FY2029 Emissions and Percentages		
Item	**Emissions MT Co2**	**%**
Purchased Electricity	61431	39.7
Landscaping	434	0.3
Heating/Cooling	36107	23.4
Solid Waste	949	0.6
Auxiliary	15249	9.9
RU Fleet	1471	1.0
Student Commuting	30498	19.7
Faculty/Staff Commuting	6386	4.1
Faculty/Staff Air Travel	2032	1.3
Total	154559	100.0

FY2029 Campus Information	
Students (FTE)	20000
Students	23306
Faculty + Staff	3356
Faculty	1372
Staff	1984
Facilities Vehicles	220
Building (ft^2)	4395050

3. FY2029 Estimate for Emissions Reductions by Carbon Neutrality Actions - These graphs illustrate the reductions in carbon emissions (by measure) that would be achieved if we implement the proposed climate neutrality plan in this document.



FY2029 Emissions Reductions and Percentages		
Item	**Emissions MT CO2**	**%**
Efficiency Savings	8207	5.29
LEED/Zero Waste Buildings	14747	9.50
PV System	22651	14.59
Commuting Offsets	14011	9.02
Rowan Fleet	1398	0.90
Reduction in Commuting	22874	14.73
Recycling/Zero Waste	768	0.49
Heating and Cooling	32924	21.21
Composting Facility	490	0.32
LED Lighting Savings	14165	9.12
Reforesting	140	0.09
Offsets for Auxiliary	1982	1.28
NJHEPS Wind Consortium	18876	12.16
Air Travel Offsets	2032	1.31
Total	155265	100.00

4. Parameters, Estimates, and Assumptions – In this section we provide the starting year inputs and ending year targets for key parameters. In addition, we have listed key assumptions so that these can be reviewed and critiqued by the broader campus community.

	Item	FY2008	FY2029
Units are MT of CO2	Purchased Electricity	26598	61431
	Heating/Cooling	0	36107
	Auxiliary	18778	15249
	RU Fleet	837	1471
	Student Commuting	13205	30498
	Faculty/Staff Commuting	2765	6386
	Faculty/Staff Air Travel	880	2032
	Landscaping	247	434
	Solid Waste	411	949
	Renewable Credits	8310	0
	Total	55411	154559
Units Vary	Students (FTE)	8673	20000
	Students	10091	23306.25
	Faculty + Staff	1453	3356
	Faculty	594	1372
	Staff	859	1984
	Facilities Vehicles	125	220
	Building ft^2	2500000	4395050

Assumptions Inherent in Model Calculations for the Base Case Reduction Scenario

- Student Enrollment will reach 20,000 FTE in FY2029 (FTE is Full-Time-Equivalents)
- Building Area will continue to grow at the rate specified in the 2007 Master Plan estimates for 2015
- Lighting demand makes up approximately 40% of purchased electricity on campus
- Old buildings on campus will not be replaced
- A West Campus PV system and/or wind power will cover all of the electricity needs for campus by 2029
- All students and faculty will either live on/near campus or pay for commuting offsets by 2029
- The Co-gen will continue to run at full capacity and the boilers will run to accommodate new buildings on campus until Geothermal is installed
- The electricity provided by Atlantic City Electric will remain at the same fuel mix as it was in FY2008 and will not continue to get greener

- Geothermal heating and cooling will provided 5 units of heating for every one unit of electricity
- Recycling on campus will continue to increase until the campus is near zero waste

Appendix

1. Wind renewable energy credits – The purchase of wind renewable energy credits is currently being undertaken by Rowan University. Rowan has purchased these credits in varying amounts for several years (amount varies due to market for these credits) and has been recognized by the EPA for the past three years for our purchases.
2. Building metering and energy audits – This measure involves installing energy meters in buildings where none currently exist and monitoring data concerning the energy uses of buildings on campus. Data will be utilized to develop energy profiles and energy audits will be conducted to identify energy conservation measures that can be utilized and carbon reduction opportunities for the current buildings on campus.
3. Incorporating sustainability into the curriculum – Recently an Ad Hoc Senate committee was created to develop recommendations for incorporating sustainability into the curriculum for all students on campus. This measure is still being discussed and planned but already has strong support from many faculty on campus. This measure will give students a better understanding of sustainability and current/future developments in sustainability while at Rowan University and perhaps students will put into practice what they have learned.
4. Increase energy efficiency of old buildings – This measure is the continuation of the buildings metering and energy audits. After analyzing the collected data and energy profiles, actions will be taken to make the current buildings on campus more energy efficient and reduce carbon emissions.
5. PV system on West Campus 10 MW (1) – This measure is the first of three installments of photovoltaic's on West Campus. As Rowan Campus and enrollments grow more energy will be required. West Campus presents an opportunity for green energy in the form of solar energy due to the space available for a photovoltaic system and then two later upgrades/additions to the system as needed.
6. Recycling on campus (1) – This measure is the first of four increases to the recycling efforts at Rowan University. By increasing/augmenting the recycling on campus, the carbon emissions associated with landfilling or incinerating the waste produced by Rowan University will decrease over the course of the 4 recycling measures.
7. Buying offsets for air travel and rental cars – The carbon emissions associated with airline travel and rental car usage by faculty and staff at Rowan University can be negated by buying offsets when these methods of transportation are used. A little extra cost and the participation of the faculty and staff would be required to make this measure effective.

8. LEED Gold Certification for all new buildings – Two buildings at Rowan University already have LEED Certification. The first building is the Education Building which is LEED Certified and the second is the Samuel H. Jones Innovation Center at the South Jersey Technology Park which is LEED Silver Certified. By continuing this trend and setting a standard for all new buildings at Rowan University to be LEED Gold, the carbon emissions associated with new buildings will be much lower than with buildings that are not LEED Certified.
9. All students to live on or near campus – With the completion of the Rowan Boulevard Project and other future projects concerning student housing, more students than ever before will be able to live on or close to campus. By encouraging and making it possible for students to live closer to campus, the carbon emissions for student commuting will decrease.
10. Student/Faculty/Staff buy offsets to cover commuting – To compensate for the carbon emission of commuting students/faculty/staff, which encompass a fairly large portion of the total carbon emissions for Rowan University, offsets will be purchased by students, faculty, and staff to cover the carbon emissions associated with their vehicle and travel distance.
11. All new buildings geothermal heating/cooling – To reach the goal of carbon neutrality, Rowan University needs to find a better way to heat and cool its buildings. By implementing geothermal heating/cooling for new buildings on campus, the Co-gen plant will not need to be expanded in the future. Geothermal heating/cooling will use electricity instead of natural gas to heat and cool buildings more efficiently. The electricity usage will be green because of the implementation of PV systems on West Campus and a possible offshore wind consortium.
12. Initial conversion of Rowan University fleet (1) – This measure is the first of two which will seek to purchase greener vehicles as the current Rowan University fleet becomes obsolete.
13. Replanting of forests – With the decrease of commuters, and the future building of parking garages on campus, many parking lots on campus will no longer be required. These lots can be removed and new trees planted to provide a small offset of carbon emissions.
14. Recycling on campus (2) – This is the second of four measures to increase recycling efforts on campus.
15. NJ HEPs offshore wind consortium (25 MW) – This measure involves the possibility of forming a consortium of Universities to build offshore wind turbines and purchase the electricity produced from the wind turbines at a set price.
16. LEDs for all campus lighting – This measure involves the replacing all of the lighting on campus with LEDs which would have significant carbon emission savings for campus.
17. Promoting alternative vehicles and transportation on campus (2) – This measure is the second of two measures, the first being the initial conversion of the Rowan fleet. With this measure, the rest of the Rowan University fleet will be replaced with greener vehicles and at this time Rowan Campus will have better facilities to accommodate greener modes of transportation.
18. Recycling on campus (3) – This is the third of four measures to increase recycling efforts on campus.

19. LEED Platinum Certification for all new buildings – By raising the standard on campus from LEED Gold to LEED Platinum for all new buildings, the carbon emission associated with new buildings will keep decreasing.
20. PV system on West Campus additional 10 MW (2) – This measure is the second of three measures for implementing and expanding PV on West Campus. The current system will be increased by 10 MWs.
21. Begin refitting old buildings with geothermal heating/cooling – With all of the new buildings using geothermal heating/cooling; the old buildings on campus (which use the Co-gen) will undergo retrofit to use geothermal for their heating and cooling needs.
22. Phase out of Co-gen plant – Once the retrofitting of the old buildings commences the phasing out of the Co-gen plant will begin.
23. Recycling on campus (4) – This is the fourth of four measures to increase recycling efforts on campus.
24. All new buildings are Zero Emission Buildings – By raising the standard on campus from LEED Platinum to Zero Emission Buildings, new buildings on campus will not produce any additional carbon emissions.
25. West Campus composting facility – This measure involves the construction of a composting facility on West Campus that will take in food waste from the Students Center and yard waste from landscaping to produce compost that can be used on Rowan Campus or sold.
26. Close-to-zero waste campus – After increasing recycling efforts on campus and installing a composting facility, Rowan University will become a close-to-zero waste campus. This means that the University will have 90% or more of its generated waste not end up at an incinerator or landfill.
27. PV system on West Campus additional 10 MW (3) – This measure is the third of three measures for implementing and expanding PV on West Campus. The current system will be increased by an additional 10 MWs.
28. Co-gen Plant is phased out – At the time this measure is implemented, the Co-gen plant will have reached its expected lifespan and Rowan University will be switching to geothermal heating/cooling for its buildings.
29. All new buildings are Negative Carbon Footprint – This measure raises building standards on Rowan Campus from Zero Emission Buildings to Negative Carbon Footprint buildings. New buildings will not only have zero carbon emissions but actually help reduce the carbon emissions on campus by producing more clean energy then they use.
30. Geothermal heating/cooling for all buildings on campus – By the end of the expected lifespan of the Co-gen plant, the plant will be retired and geothermal heating/cooling will be used for all buildings on Rowan Campus. At this time Rowan University will have met the expectations of the Presidents Climate Commitment and become a carbon neutral campus.