

ENERGY FINDINGS

Carbon Emissions and Remote Work at a Large University System

Shahan Ahmed¹, Michael J. Smart, Ph.D.¹, Robert B. Noland, Ph.D.¹¹ Bloustein School of Planning and Public Policy, Rutgers, The State University of New Jersey

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Findings

We report on an analysis of carbon emissions from commuting to a large multi-campus university system, Rutgers, the State University of New Jersey. This is derived from a campus survey to assess carbon emissions and various attitudes towards sustainability across a variety of domains. We report findings on carbon emissions associated with driving to the respective campuses and the modes used and perform an analysis of the potential effect of changing the university's remote work policy for staff. We find, unsurprisingly, that mandating additional days in the office increases commuting emissions.

1. QUESTIONS

We estimate the total carbon emissions associated with commuting to Rutgers, The State University of New Jersey. Rutgers is a large public land-grant institution, with a highly dispersed "Chancellor-led" system. Major campuses are located in New Brunswick, Newark, and Camden, as well as the statewide Rutgers Biomedical and Health Sciences (RBHS) unit. The New Brunswick flagship alone is a sprawling complex divided into five distinct sub-campuses (Busch, College Avenue, Cook, Douglass, and Livingston). Each campus has differing access to transit and the ability to walk or bicycle. Newark and Camden are largely urban campuses, while New Brunswick is a mix with some sub-campuses being inconvenient for modes other than driving. The medical school (RBHS) is especially dispersed. The university currently allows staff to work remotely two days per week, while faculty have no restrictions.

Our analysis focused only on commuting to each campus and only carbon emissions from driving (we do not consider emissions associated with transit). The carbon emissions from commuting fall under scope 3, i.e., upstream emissions as opposed to scope 1 (direct emissions controlled by the university) or scope 2 (indirect emissions, e.g. from purchasing electricity). Emissions associated with commuting are one of the largest sources for a university (Valls-Val and Bovea 2021). This is also true for Rutgers as previously documented (see fig. 2.2 in Rutgers, Office of the President, 2021).

We address three research questions:

1. How much carbon dioxide (CO₂) is generated by the commuting behaviors of students, faculty, and staff across these campuses?

2. How do changes in remote work policies affect direct CO₂ emissions?
3. What modes of travel are used at each campus?

We hypothesize that the multi-campus structure creates high baseline emissions as most commute by driving and that reducing remote work flexibility for staff will lead to a measurable increase in the university's carbon footprint.

2. METHODS

Data were derived from the 2024 Annual Sustainability Survey of Rutgers students, faculty, and staff (Rutgers University, Office of Climate Action, n.d.). This was sent via email in Fall 2024 and 11,867 responses were received out of a total university population of about 85,000. To estimate vehicle miles traveled (VMT), a GIS-based network analysis using an Origin-Destination matrix was employed. Origins were established by geocoding respondent ZIP codes to US Housing and Urban Development (HUD) population-weighted centroids, while destinations were defined by the primary parking facilities on each campus and sub-campus area (in New Brunswick). Distances were calculated for those identifying “Driving” (driving alone, carpooling, or ride-share) as their primary mode. The survey contained data on frequency of travel per week. We assumed students are on campus for 30 weeks (based on two 15-week semesters). Staff have vacation time (winter break and additional time off). We cannot say for certain how many weeks faculty are on campus, so we assume faculty and staff traveled to campus for 47 weeks. CO₂ was calculated using a conversion factor of 0.000251 metric tonnes per km (404 gm/miles) which is the national average in the US. Only 338 respondents reported using an EV to commute, less than four percent of our sample, and a minor limitation of our analysis.

Data was cleaned to remove outliers based on travel distance and frequency. Eighty respondents reporting over 20 trips per week were removed, less than 1% of total respondents. We also only included respondents residing in New Jersey, Pennsylvania, Delaware, New York, Connecticut, and Maryland, all states within reasonable commute distance. Data on travel mode were also collected and curated by examining those that selected “other”. Our final sample size was 8,638 respondents after removing incomplete surveys.

The survey data were weighted using Fall 2024 institutional enrollment and human resources data to ensure results were population-representative for each campus and respondent group.

The university currently allows staff to work remotely two days per week. Our scenarios were constructed to examine a change in this policy. We modeled three scenarios of restricted remote work by calculating changes in

Table 1. Annual Commuting Emissions (Metric Tonnes) and VKT by Campus

Campus	Annual VKT	Annual CO ₂	Per Capita Emissions
New Brunswick	355,179,858	89,683	1.55
RBHS	110,083,827	27,796	1.73
Newark	79,163,946	19,989	1.47
Camden	42,423,024	10,712	1.53
Total	586,850,654	148,180	1.56

weekly trip frequencies for staff. Faculty are not affected by the current or any future policy, but since both are combined in our data, we apply the scenarios to those identified as faculty or staff.

To represent a marginal increase in weekly trips, scenario 1 adds 0.5 weekly trips for those currently making fewer than six trips. Scenario 2 represents changing the remote work policy to allow only one remote day per week which is a minimum of four trips per week for those currently making fewer than five (i.e., those currently traveling five days a week continue to do so). Scenario 3 is a complete removal of the remote work policy and thus is a minimum of five trips per week for those currently making fewer than five. These are all defined as round trips, i.e. from home to campus and back.

Our data did not separate faculty and staff categories. Since remote work policies only target staff (both administrative and research) rather than faculty (professorial and teaching staff), we adjusted the scenarios to isolate a “Staff Only” impact. This was achieved by multiplying the overall emission increase by campus-specific staff-to-faculty ratios (e.g., 56% staff in New Brunswick; 65% in RBHS). One limitation of our work is that we did not assess any emissions associated with working at home, including additional heating and cooling and extra non-work related travel while working at home.

Ahmed et al. (2026) provide full details on the survey and analysis.

3. FINDINGS

Commuting at Rutgers generates an estimated 148,180 metric tonnes of CO₂ annually from 586,850,654 vehicle kilometers traveled (see [Table 1](#)). This compares to about 300,000 metric tonnes of scope 1 emissions for Rutgers (Rutgers, Office of the President, 2021). The New Brunswick campus accounts for the largest share of commuting emissions, contributing 89,683 tonnes of CO₂ annually. Details in supplemental tables (Table A).

The mode choice of respondents is shown in the supplemental tables (Table B). Mode choice is dominated by driving, utilized by 73% of the total population. This preference is most pronounced among faculty and staff, 87% of whom drive to campus. In contrast, students show higher utilization

Table 2. Changes in CO₂ emissions (Metric Tonnes) based on remote work policy changes

Scenario	Combined Faculty/ Staff Increase	Staff-Only Increase	% Total Increase*
Scenario 1 (0.5 trips/week increase)	7,020	4,037	4.7%
Scenario 2 (Minimum 4 trips/week in person)	13,131	7,552	8.9%
Scenario 3 (Minimum 5 trips/week in person)	23,663	13,609	15.97%

* Total percent is based on commute emissions of all faculty, staff, and students.

of alternative modes: 14% walk or bicycle, and 13% use transit. Modal patterns vary significantly by campus; for example, 25% of the Newark population utilizes transit, whereas only 7% do so in New Brunswick.

In [Table 2](#) we show the results of various remote work policies, all of which are relative to the baseline in the survey. Currently, faculty and staff combined commute 3.75 trips per week on average (with a standard deviation of 1.9 and median of 3), after removing outliers.

Under Scenario 3, requiring a five-day on-site minimum, total commuting emissions would increase by nearly 16%. When isolating the impact to staff only—the population affected by university mandates would result in an additional 13,609 metric tonnes of CO₂ annually. Complete tables of results are shown in the supplemental material (Table C).

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SUPPLEMENTARY MATERIALS

Supplemental material - Gemini prompts

Download: <https://findingspress.org/article/162131-carbon-emissions-and-remote-work-at-a-large-university-system/attachment/344731.pdf>

Supplemental tables

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