CARBON NEUTRALITY IN DESIGN EDUCATION

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1. INTRODUCTION

As higher education transforms itself into a more sustainable environment, many institutions are joining alliances that strive for greener campuses. Steps like these show genuine interest in enabling more environmentally friendly organizations but they are frequently defined at strategic levels and do not necessarily envision a roadmap for curricular implementation. In the case of industrial design departments, special attention needs to be paid to resources used in day-to-day educational activities. Projects and assignments require significant quantities of paper, modeling supplies, adhesives, paint and other materials used in the creation of sketches, mock-ups and prototypes. After projects are completed and reviewed, most of these materials become waste and it is hard to recycle them efficiently. Model shops run energy-intensive machines, while offices and laboratories host computers, printers, scanners, and other electronic devices. When these resources are added to operational needs such as energy, lighting and water, departments end up with a significant environmental burden that is hard to sustain but can certainly be reduced if the proper strategies are adopted.

This paper narrates efforts made by the Industrial Design Department at Rochester Institute of Technology (RIT-ID) to become a carbon neutral academic unit. In order to achieve this, the department conducted an internal audit that determined its current footprint, followed by the exploration and implementation of more environmentally practices and materials. At the core of this effort lies the involvement of the whole RIT-ID community and its goal of turning the department into a more sustainable environment. As new strategies are adopted, RIT-ID's community is benefiting from a space that is more enjoyable and efficient, and curriculum is taking advantage of new assignments and methods that address relevant topics in design and sustainability. The value of this project is helpful not only for RIT-ID, but also to the future of design education and practice.

2. GREEN EFFORTS IN HIGHER EDUCATION

An increasing number of academic institutions are taking significant steps towards becoming more environmentally friendly. A common measure for monitoring an organization's environmental impact is carbon footprint, defined as "a measure of the exclusive total amount of carbon dioxide emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product."[1] In 2006, a group of university leaders created The American College and University Presidents' Climate Commitment (ACUPCC), which currently has over 600 affiliated schools[2] and is one of the most respected alliances for transforming greener campuses. ACUPCC has a diverse mix of academic institutions from around the world ranging from small to large and public to private, reflecting the strong interest of integrating sustainability into higher education.[3] ACUPCC offers guidelines that help institutions in gauging their current environmental footprint as well as to plan strategies to reduce it. Member institutions measure their environmental performance with the Sustainability Tracking, Assessment and Rating System (STARS);[4] a self-reporting framework organized in scopes three scopes:

Scope 1: Direct emissions from owned and controlled sources.
Scope 2: Emissions generated from purchased energy.
Scope 3: Other indirect emissions.

While achieving total carbon neutrality is virtually impossible for any institution,[5] the reports for each institution at the ACUPCC website provide insight to how different priorities and strategies can be combined in order to address specific environmental needs that academic institutions have. The "greening" of campuses is an important step in understanding how sustainability can be effectively integrated into large communities, since academic institutions are based as small communities themselves and offer insight into the same challenges and logistics that will affect larger scales.[6]

2.1 RIT'S PATH TOWARDS CARBON NEUTRALITY

Rochester Institute of Technology (RIT) is a private institution of higher education in upstate New York, USA. Founded in 1829 and occupying 1300 acres of land, RIT holds 18,000 students and 3,750 faculty and staff.[7] RIT offers undergraduate, graduate and doctorate degrees in a diverse set of disciplines that range from engineering and computing to fine and liberal arts. RIT's College of Imaging Arts and Sciences is home for the department of Industrial Design, which combines technical competence with creative design process and consistently ranks among the top ten programs in the US.[8] RIT-ID currently has 225 students between undergraduate and graduate levels, 5 full-time and 20 adjunct faculty. RIT is also home to the Golisano Institute for Sustainability, a multi-disciplinary academic unit devoted entirely to sustainability research, education and technology.

In 2009 RIT joined ACUPCC and committed to become a carbon neutral campus by 2030. This goal aligns with RIT's vision for sustainability of "addressing the challenge of sustainability in a comprehensive and interdisciplinary way through our academics, operations, and campus culture as a whole."[9] Important milestones towards this goal include a yearly assessment of RIT's carbon footprint and the elimination of disposable water bottle sales in campus.

3. RIT'S INDUSTRIAL DESIGN AND CARBON NEUTRALITY

Although RIT's commitment to ACUPCC is a key step in obtaining a more sustainable campus, a closer look at the assessment goals and guidelines provided limited insight for improving the operational and educational aspects of academic departments. Because of this, RIT's Industrial Design department decided to take a step further and define a roadmap towards carbon neutrality within the Institute's larger scope. The goal for this project is not only to align with RIT's sustainability commitment but also to explore ways of transforming design education into a more sustainable activity. This ongoing project includes four important stages: assessment, exploration and implementation, and re-assessment.

3.1 ASSESSMENT OF DEPARTMENT'S CURRENT FOOTPRINT

The first step in the project was to establish RIT-ID's current environmental impact as defined by the STARS protocol. This assessment focused only on scopes 2 and 3 since scope 1 relates to levels that affect RIT as a whole institute and cannot be controlled by individual departments. Collecting the data for these scopes involved two areas. The first one had to do with facilities, energy and water. RIT's Facilities Management office was essential in providing this information, since they manage energy and water consumption, trash collection, etc. The second area was the understanding of RIT-ID's community in terms of sustainability practices and behavior. For this purpose, a voluntary survey was distributed in order to obtain data on commuting, food, use of equipment and materials (see Figure 1). We had a total of 75 respondents, which is about one third of the RIT-ID population. Some highlights of the survey showed that most people walk or bike to campus and spend around 20 hours per week in the studio. It was also interesting to learn that most people use their own laptop computers to work as opposed to computers in labs.

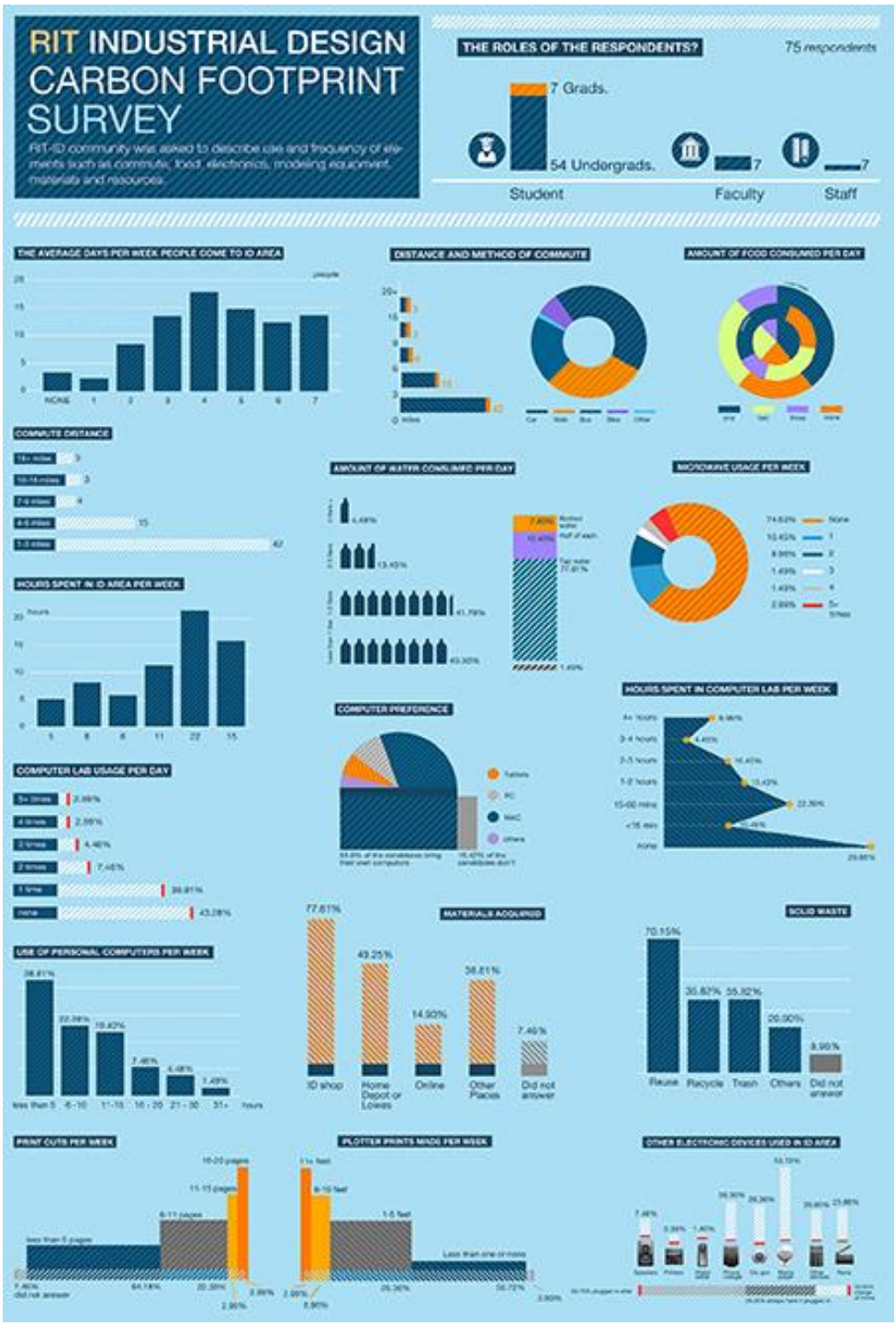

Figure 1. Results from survey administered to RIT-ID.

The data collected, which corresponds to the 2011-2012 academic year, helped in determining RIT-ID's total carbon footprint of **437.5 metric tons CO2** (see Figure 2). When dividing RIT-ID's footprint among the number of students, we obtain an average of 1.94 mtCO2 per ID student, which is 30% lower than RIT's student average of 2.81 mtCO2. While the reason for ID's average footprint being lower than the institute's is yet unclear, a possibility could be that other departments that have more energy intensive facilities (such as Nanotechnology, Mechanical and Industrial Engineering, to name a few) account for a higher amount of the total energy and water consumed.

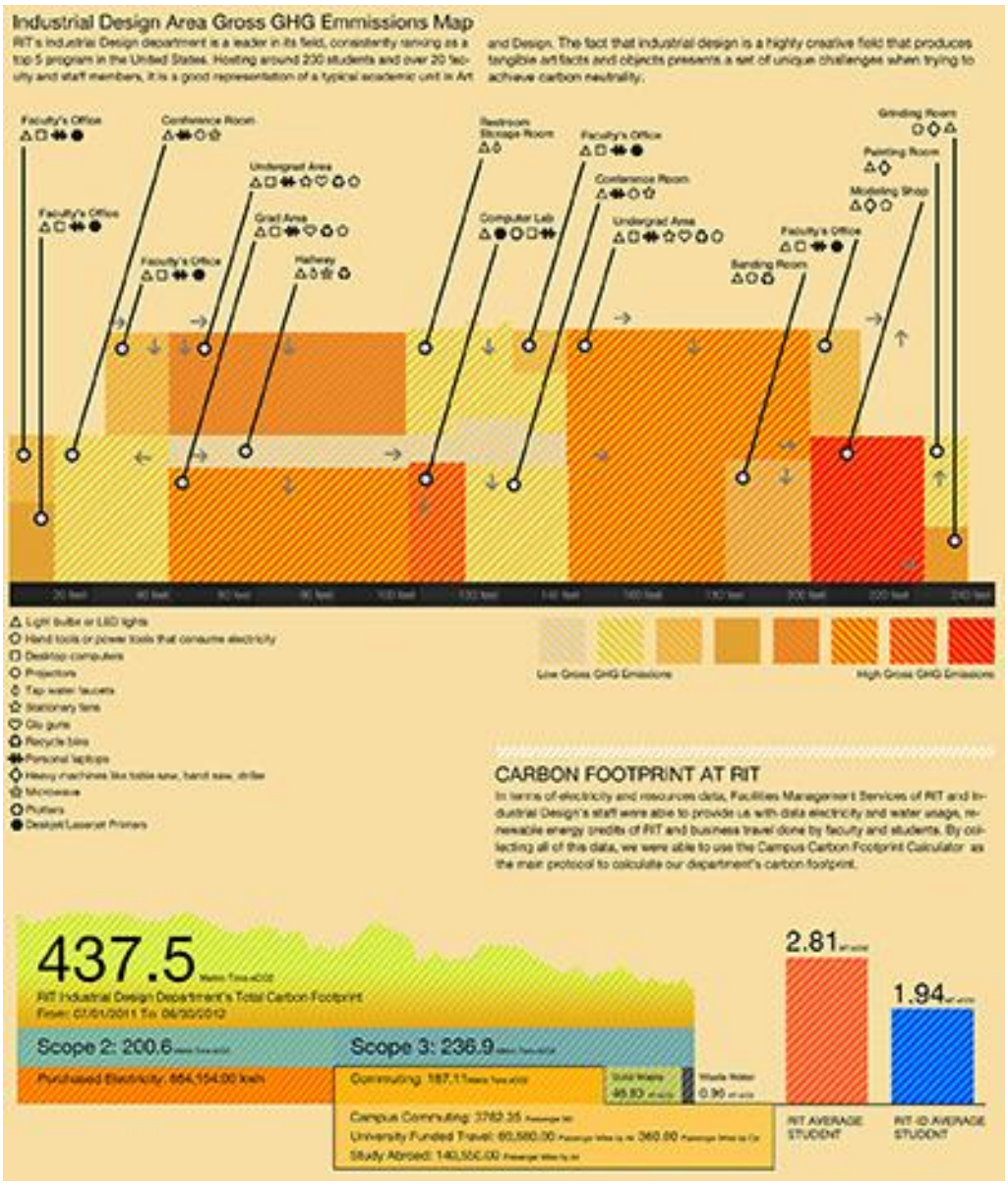

Figure 2. Carbon footprint assessment results.

An interesting finding from the assessment results is the difference between actual and perceived impact of certain practices. As this project was being established, several people in RIT-ID talked about the importance of finding better materials for model making as well as for minimizing use of paper in the studio. When looking at the break down of the total footprint, solid waste makes for just over 10% of the total environmental footprint (most of the impact comes from energy usage) so any changes in this area will have little impact in the final footprint of the department. Nevertheless, although materials and supplies do not have a significant impact in terms of environmental impact, their impact on how 'green' people perceive RIT-ID to be is huge and needs to be addressed.

3.2 EXPLORATION AND IMPLEMENTATION OF IMPROVED METHODS AND STRATEGIES

As more responsible methods and strategies are being explored at RIT-ID, it is important to make sure that they do not compromise educational experiences and also that everyone involved in and around the department embraces them. Following the survey used for calculating the current footprint, a brainstorming session titled “Let’s make a greener RIT-ID” was held to share ideas between faculty and students around the area of sustainability (see Figure 3). The session reinforced many of the items exposed in the survey but it also provided new and deeper insights. For example, when students were asked about why computer labs are not used as often, they commented that the spaces were not inviting and conducive to productive workflow. They also commented that going to “another room” was not practical when students were working on their projects in the studio. Another insight came from recycling, where students mentioned that the recycling bins didn’t provide enough information on good practices for recycling and because of this people prefer to throw everything in the trash in fear of ruining the process. But the most insightful outcome of the session was to hear students saying that while they value a more environmentally friendly culture in the studio, they felt that this is a way to achieve a cleaner, more inviting space and to have a studio that was enjoyable to work in. They said a more environmentally friendly department was a great way of improving the quality of life in the studio.

Figure 3. Pictures from “Let’s make a greener RIT-ID” brainstorming session.

Along with gathering the voice of RIT-ID, we have explored improved materials used in our design process. In terms of visualization, a comparison was done between traditional ideation sketches (using paper and markers) and digital sketches (using tablets). During the sketching phase, participants noticed that digital sketches allowed them to generate ideas faster and were not afraid to “mess up” the sketches as they could undo steps if needed. They also noticed that paper sketching felt more limited because of the paper size. But they agreed that sketching on paper is a lot more convenient and there’s no need for having an electronic device handy. Another interesting aspect for the sketching comparison was how to present them in a critique. Traditional sketches are often hanged in the wall in a grid pattern. This makes it easy for people to look at multiple sketches simultaneously and to rearrange them as needed. Digital sketches tend to be shown one by one as a slideshow. In trying to level out the type of interaction with the sketches, the digital sketches were displayed as thumbnails’ grid. Even with this layout, people didn’t feel as comfortable with the digital sketches and did not interact with them as naturally as they did with the paper sketches. A big question for this comparison also lies in the embedded energy needed to produce large amounts of paper, markers, and to recycle them, versus the energy needed to manufacture, run, maintain and recycle tablets, computers, projectors, etc. Future steps in this project plan on comparing these two models in more detail.

In terms of physical models, the design studio is always filled with piles of mock-ups made out of foam, cardboard, and other materials that are hard to reuse and dispose of. Urethane foam, for example, is manufactured out of chemical components that are not recyclable. Some of the materials that we explored include clay and plaster (see Figure 4). Made out of organic content, they are malleable and reusable but they are not as rigid or lightweight as foam, limiting their applications. We also tested wood composites such as MDF and plywood. While these materials are made out of renewable components, they also take longer to shape, can put more demand on tools and machines, and are not easy to recycle. After experimenting with several materials it is evident that it will be impossible to find a single material that works in every situation and we need to combine materials that are appropriate for the job while good for the environment. As for urethane foam, we identified a more environmentally friendly alternative from Coastal Enterprises called Precision Board Plus that is made out of 23.9% rapidly renewable content and is an approved material for LEED certified building construction.[10] While this foam is not recyclable, it is a significant improvement over the traditional urethane foam and it has a slightly lower cost, which is also an important consideration. The new foam has been implemented in the model shop with great success, and an added benefit is that its smoother texture allows us to purchase boards with less density while obtaining the same surface finish than with traditional urethane foam.

Figure 4. Testing of more environmentally friendly materials for model making.

3.2.1 ADDITIONAL INITIATIVES

In order to further reduce RIT-ID's carbon footprint, a series of initiatives are being implemented across the department:

- LIGHTING: Traditional fluorescent lighting has been substituted with energy-efficient LED bulbs, as part of a campus-wide effort in phasing out energy-intensive lighting. While this is a short-term solution for improved lighting, a long-term plan is to add more natural lighting to the studio.

- PAPERLESS DOCUMENTATION: RIT-ID is encouraging faculty and students to minimize the use of paper and to distribute course documentation digitally. This action not only reduces the amount of paper used but it also allows for faculty to have syllabi, handouts and other course documentation in MyCourses, RIT's online course management system, so that students can access it easily when logging in to any computer.

- IMPROVED RECYCLING METHODS: Recycling is an effective method for recuperating useful materials and reducing volume of trash to go into landfills. It is also a challenging practice to implement. RIT's current recycling rate is about 38.5% of the total waste stream.[11] RIT recently transitioned to a single-stream recycling system. This has been very helpful in reducing complexity for the RIT community. RIT-ID in particular has added additional number of recycling bins given the large amount of waste that the studio produces.

- MATERIALS SWAP EVENT: RIT's IDSA Student Chapter organizes a "materials swap" event, where students put on their desks materials and supplies that they don't use anymore so that they can swap/trade among each other. This activity highlights the idea of reusing materials rather that tossing away, while also reinforcing congeniality around the studio.

- SUSTAINABILITY-RELATED PROJECTS: RIT-ID has shown a significant increase of student projects and faculty research focusing on sustainability. These projects address environmental, social and economical issues, as part of the Triple Bottom Line model.[12] Various courses offered in the department address topics such as Sustainable Electronics and E-Waste prevention, Sustainable Sanitation and Water Filtration for the developing world, Global Education, Emergency Healthcare, Sustainable Packaging, and Design for local communities. Many of these projects are setup as inter-disciplinary collaborations, allowing students to address design problems from multiple perspectives and to benefit from different areas of expertise. Students embrace these projects and often comment that they want to see sustainability as a core component of the curriculum, so that it's offered throughout the curriculum instead of just in specific courses.

3.3 FUTURE STEPS

The results that this project has produced are already benefiting our department in a very positive way and the department is eager to continue adopting practices that are more responsible and sustainable. As this project keeps moving forward there are a number of goals that we look forward to achieving:

- ANNUAL ASSESSMENT: RIT-ID is planning on having a carbon footprint assessment every two years in order to monitor the progress of the department's environmental performance.
- CURRICULUM INTEGRATION: Starting Fall 2013, RIT is transitioning from quarters to semesters. RIT-ID is taking advantage of this curricular adjustment to integrate in a more formal way topics, courses and collaborations that address sustainable needs.
- MATERIALS AND PROCESSES: This project has identified a lot of potential in continue defining new approaches for industrial design processes that are more environmentally friendly. While we have been able to implement some materials, we acknowledge potential for covering a wider range of materials, methods and processes that are more responsible and effective.
- DISEMMINATION: the findings obtained from this project will be made available to the public as means of websites, publications and case studies.
- OUTREACH: We acknowledge that many design schools around the world are taking significant steps towards more sustainable environments. RIT-ID plans on connecting with organizations such as Partnership for Academic Leadership in Sustainability (PALS), in order to enhance discussion, collaboration and sharing of sustainable practices and intelligence.

4. CONCLUSION

The path towards a carbon neutral Industrial Design department at RIT is providing us with important insights on how to integrate sustainability into design education but it is also making us learn more about who we are and what motivates us as a community. While achieving carbon neutrality is a challenging goal, we already notice significant improvements in the way that our department operates and behaves.

We have learned that for a task as complex as this one, we need to divide our goals into smaller, more manageable areas, that can be addressed are addressed in short and mid-term time frames.

No matter how we divide this workload, it is important to maintain an integrated vision of our objectives, since academic institutions tend to look at sustainability efforts as compartmentalized components.[13] On one hand there is curriculum and research, where faculty and students address sustainability issues, and on the other hand there is the operation of the institution. These two components often work independently from each other but the goal of every academic unit should be to integrate them as one large eco-system. It is key to obtain a balance between engaging faculty and students in projects that address sustainability and teach effective eco-tools, but also to operate in a way that maximizes resources and reduces waste of materials. A direct connection between campus operations and curriculum is key in achieving true sustainability in design education.[14]

ACKNOWLEDGEMENTS

We would like to thank everyone at RIT's Industrial Design department for their insights and interest in this project. We particularly want to thank Rick Auburn, ID model shop technician, for connecting us to the right people around campus and for always suggesting, testing and implementing greener initiatives in the studio. We would also like to thank Enid Cardinal, Schuyler Matteson and everyone at Golisano Institute for Sustainability as well as Jim Shelton and Dave Harris at Facilities Management.

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