Annual Report

CEG GreenTeam 2021/22

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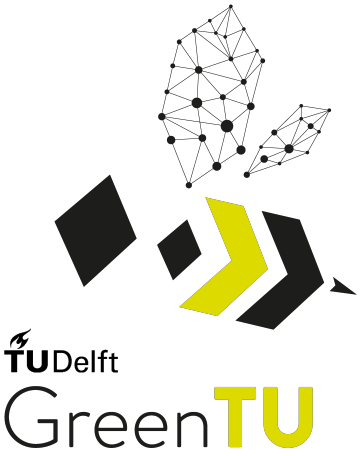
Period: October 2021 - July 2022



Acknowledgements

This report depicts the GreenTeam's approach and implementation towards a sustainable Faculty of Civil Engineering & Geo-sciences for the academic year 2021/2022. We would like to express its deepest appreciation to all those who provided us with the possibilities to carry out our work throughout the year. The team has achieved its goals for the year through the contributions and involvement of various individuals throughout the process.
First and foremost, the team would like to express its gratitude to the Dean of Civil Engineering and Geosciences, TU Delft for making this team possible and believing in us. The team would like to acknowledge with much appreciation the crucial role of the supervisor, Stijn Van Boxmeer for providing a lot of information and guidance to complete this task.

Special gratitude to the GreenTU's GreenTeam's Coordinator, Rosa Weinzierl, for contributing in stimulating suggestions and encouragement, crucial for this report.

Further the team wants to thank all the stakeholders involved for their time and insights. Special mention to the facility managers and staff at the university who provided the team with all the operational data with great interest. Last but not the least, kudos to the team for always supporting each other. The last one year could be described as a sweet experience that will be remembered always. It has been an absolute pleasure working with the Faculty and hope this report provides the starting step towards a more sustainable one!

We wish you a pleasant read!
Saraf, Akhilesh, Hamra & Noor
Delft, The Netherlands

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Introduction

This Annual report is created by the GreenTeam of the Faculty of Civil Engineering and Geosciences Faculty (CEG). THis is the second GreenTeam of CEG, which was set up with the sanction of the Faculty, to help promote and implement sustainability in terms of education, research, operation and communication within our Faculty. TU Delft affirms the following about the importance of sustainability in our society:

"TU Delft recognizes the imperative need to transition towards holistically sustainable systems, and this is underscored and omnipresent throughout research taking place within all the various faculties of the University."

Upon the approval of the Annual Report of the Faculty in August 2021, the new team was recruited, with one former continuing to the current team. The current team members include Saraf Nawar (Applied Earth Sciences), as the Chair and Education Portfolio coordinator, Akhilesh Soodan (Environmental Engineering), as the Research coordinator, Elenor (as the Operations Coordinator and Hamra Fathima (Construction Managem), as the PR & Communications Manager.

The external student assistant who worked together for the Education part of the portfolio is called Miki Hansen.

This report will document the work done by the team in terms of Education, Research, Operations and Communications, to stir up sustainability in the Faculty for the academic year 2021/2022. The different projects will be elaborated in Chapter 2. The plan of action for the next year of the GreenTeam CEG will be elaborated in Chapter 3. Chapter 4 will shed light to the suggested structure and proposed budget to be allocated to the upcoming teams for more efficient implementation of sustainability.

2

Annual Report

2.1. Education

In the last year's Report, the GreenTeam proposed some priorities in terms of the implementation of sustainability in Education. One of the biggest focus of the team was to assist in the successful integration of sustainability in courses that do not usually highlight the sustainability prospects intensely.

After a successful year of impelemnting 'De Groene Draad' project, as elaborated in the report of 2020/2021, the team wanted to continue looking at courses that had room for improvement. One such course was the Master Specialization Design and Integration at CEG.

2.1.1. Master Specialization Design and Integration

For the Masters Specialisation of Design and Integration (DI), the student assistant in question was tasked with integrating sustainability into the curriculum. She conducted interviews with instructors and a survey of current students to assess the current coverage and how they believe the coverage could be improved. The student survey was followed up with a group interview where they were asked to expand upon their responses to the survey.

2.1.2. Teacher interviews

some observations from the teacher interviews include:

- When asked to define sustainability, instructors often did not answer with a clear definition, and instead referred to their teaching philosophy, which may point to a lack of a uniform interpretation of/clear narrative about sustainability across the Masters track.
- Almost all of the goals of the classes mentioned by the instructors were related to the sustainability competencies found in literature. (Only one instructor addressed sustainability directly in the class goals.) Unconsciously, the instructors may be teaching concepts and skills that contribute to ESD (Education for Sustainable Development).
- All of the classes discussed had sustainability components embedded in the lectures or assignments
- When asked what they think are the most important things related to sustainability students should learn, the concepts and skills mentioned were: forecasting consequences; being an integrator of many different interests, which requires empathy, openness, and listening skills; life cycle mindset; social impact (inclusivity, accessbility, health); practical approach toward sustainability; developing sociotechnical systems to enable better sustainability; new frameworks for sustainability so that it is integrated in the beginning; changing companies' mindsets

- Instructors were all tuned into the idea that sustainability needs to be integrated since students will come into contact with sustainability no matter what in their career. However, the extent of explicit integration is still in question as one instructor argued that the students chose this masters and not another study like Industrial Ecology for a reason.

2.1.3. Student survey

Some observations from the students' survey include:

- When asked to define "sustainability," there was a focus on the technical aspects of reducing the carbon footprint of construction projects and hardly any references to society/ethics or economy
- Respondents believe sustainability coverage in the curriculum is quite or extremely important. (3 out of 5 respondents answered "4" (quite important) and the remaining 2 answered "5" (extremely important)
- They summarized the current coverage as: Sustainable finance during the course "Financial Engineering, "Energy transition plans during the course "Process Management," Environmental law during the course "Legal Governance."
- The topics they want to learn about are: Waste reduction, recycling of materials, law and regulations, circular economy, modelling courses related to sustainability, sustainable innovations for construction management, Wise waste cities/Smart cities, sustainable value estimation, decision-making, how to implement your sustainability views in the building cycle

2.1.4. Student group interview

Some observations from the student group interviews include:

- When asked about sustainability coverage in their earlier studies, they all agreed that the focus was on discipline-specific sustainability concepts. There was no general overview and no discussions about the meaning of sustainability. The coverage was solution-oriented rather than process-oriented.
- They believe that sustainability is somewhat integrated into the current curriculum. For instance, Financial Engineering covers sustainable finance, but the students remarked that it would be better if there was a separate course focusing on sustainable finance and circularity or if it the sustainability element was integrated throughout the class. They all agreed that Process Management integrates sustainability well as almost every paper talks about something sustainability-related). They felt that the learnings are relevant to sustainability because process design comes into play when you want to make change and sustainability is a new thing in construction. The Information systems class had surface-level coverage and they felt like it was simply added on.
- The students believe sustainability is relevant for all engineers and designers in the field because if you never learn about it you won't think about it when working and won't know how to integrate it into their work. In regards to the extent of coverage, they believe that it does not have to be in the forefront, but needs to be integrated properly. One student remarked that the outcome should be that the topic of sustainability is seen as something that is interesting and inspiring rather than an obligation or checklist item.
- They suggested sharing tips on how to learn more about sustainability (i.e. a list of sustainability-related courses from other faculties/universities) to lower the activation energy required.

Next, we worked on creating a framework for evaluating the current coverage. Instead of using a pre-existing set of competencies as the evaluation criteria, we developed a tailored set for the DI program. This was done by comparing the CME and DI learning goals against the EOP learning outcomes. By doing so, we were able to identify which EOP learning outcomes were relevant to the DI program and propose improvements to the existing DI learning goals to ensure improved integration of sustainability competencies. She used the EOP framework because it includes many of the competencies mentioned in other sources and has an engineering-specific scope. This process was informed by a literature review of ESD curriculum assessment tools and integration best practices/case studies.

After assessing the learning goals, SA derived 9 key sustainability competencies:

- Reflection and Collaboration. Reflect on the norms and values underlying one's behaviors and judge the ethical, temporal and societal implications of one's own work, actions, and decisions. Understand and respect the needs, perspectives, and actions of others.
- Communication. Negotiate and champion environmental responsibility values with sound argumentation.
- Sustainability Fundamentals. Understand and explain environmental issues and key theories and concepts related to sustainable development and environmental responsibility.
- Systems thinking and Context awareness. Demonstrate whole system awareness (understand relationships between different subsystems) and an understanding of the context of the problem and solution.
- Thoughtful decision-making. Analyse problems and be able to make thoughtful decisions in the face of complex ethics or uncertainty with consideration of near and long-term effects.
- Design TMFAs. Apply innovative tools, methods, frameworks or models, and approaches (TMFAs) in creating integrated value-oriented designs that promote sustainable development.
- Evaluation. Evaluate sustainable impact using well-proven methods.
- Discipline-specific Innovations and Practices. Explain novel sustainable technologies and business models relevant to Construction Management Engineering. Understand industry sustainability metrics and practices.

Next, it was time to evaluate the curriculum. To get an overview of the SD coverage across the entire specialization, we reviewed course documents and videos from the specialization courses and noted down which competencies and topics are covered. This review also served as a pilot for the evaluation process and led to some revisions to the competencies and topics.

The next step will be to have the instructors and students assess the curriculum using surveys. This data will be used to create program curriculum maps and competency prevalence graphs, which provide an overview of the coverage across the entire specialization curriculum and will serve as discussion aides for a group workshop to be held in Fall 2022.

The plan is to continue the project in the fall to finish evaluating the curriculum and proposing concrete changes to the programme.

2.2. Research

This is the first time the team took up the Research portfolio and worked on a few projects in this domain.

2.2.1. Blue Engineering Workshop for PhD researchers

GreenTeam CEG is working towards organizing a 1 day workshop for the PhD students on Blue Engineering, a course which aims towards sustainability in the scientific society. Blue Engineering is a discussion based course which focuses on themes such as sustainability, technology assessment, engineers' responsibilities, neutrality of technology, decision-making as a group, power relation and diversity amongst other aspects. The course has been previously taught to Masters students in CEG (track Environmental Engineering) in Q1 2021-2022 and was highly regarded. The course can be immensely beneficial in development as a well rounded researcher. The concept of the course was developed by André Baier at TU Berlin more than 10 years ago and is currently being run at TU Delft and more than 10 other German universities.

In our survey among PhD candidates we found that more than 60 percent of PhD candidates want to do courses on sustainability and feel that it will be an added value to their education. Therefore, we wanted to introduce 'Blue Engineering' for PhDs in the form of a 1 day workshop that will touch upon themes that are highly relevant for young researchers and will cater to the needs of the PhD community. As a first step,

GreenTeamCEG wants to conduct an introductory workshop sometime in August/early September this year (dates need to be finalized) together with André Baier. Then in February 2023, a larger summit is expected to be organized which will have the workshops in which our PhDs participate. He is very supportive of the idea and offered to give a one-day workshop that fits our PhD community (he does workshops for people at all levels of engineering education). We would use the opportunity to get feedback form the PhD candidates and if the responses are positive would like to make this a 'permanent' offer as a GS course with someone from TU Delft as a lecturer and on the basis of what we develop with André.

Due to busy schedule of Andre, the event was postponed from the previously considered mid July. There will be a session organized during the Education Day on November 10th, followed by a summit in early 2023.

For more information on the course, check: `https://www.tu-berlin.de/menue/summer_university/old_versions/summer_university_term_3/blue_engineering`.

2.2.2. Development of Sustainability manual and test

Sustainability of engineering labs is of utmost importance if the target of green research needs to be achieved. Keeping this in mind, GreenTeamCEG has undertaken the task of development of a sustainability manual and sustainability test which sets a benchmark related to behaviour which are expected from the users of the TU laboratories before they actually enter a lab to perform experiments. The idea is to develop a very simple test and a manual which sets ideal lab practices and reminds the test takers on how to behave in a sustainable manner before they enter the lab and start the experimentation. It also helps in remove any doubts and resolving queries which the researchers and students might have related to handling of the waste and equipment efficiently in the labs.The test is expected to be taken by any member of the department (student, employees), who will have to read a sustainability manual for the lab (30 minute reading time) and pass mandatory sustainability test (20 minutes).

A meeting has also been conducted with the Safety, Health and Environment officer, TU Delft to discuss the ideas which will help make labs more sustainable and safe.

A pilot project has been taken up at the Waterlab in CEG faculty for which discussions with the researchers have been held to understand the problems which we are facing when it comes to sustainability. On the basis of the inputs by the researchers, a question bank for the sustainability exam and a sustainability manual are being developed. Graphical study material for the test needs to be developed.

2.2.3. Development of equipment sticker system

The energy wastage due to inessential turned ON appliances can be a major issue in the labs. Through discussions with the researchers, it was realized that it is extremely difficult to determine whether an equipment needs to be turned OFF or kept ON, especially when the working of the machine/set up is not clear. In order to make the equipment more sustainable, a sticker system has been proposed which helps a user understand what needs to be done with a specific equipment post usage or in case an equipment is found switched ON. The stickers will be pasted on the equipment and provide clear instruction on what needs to be done after the use.

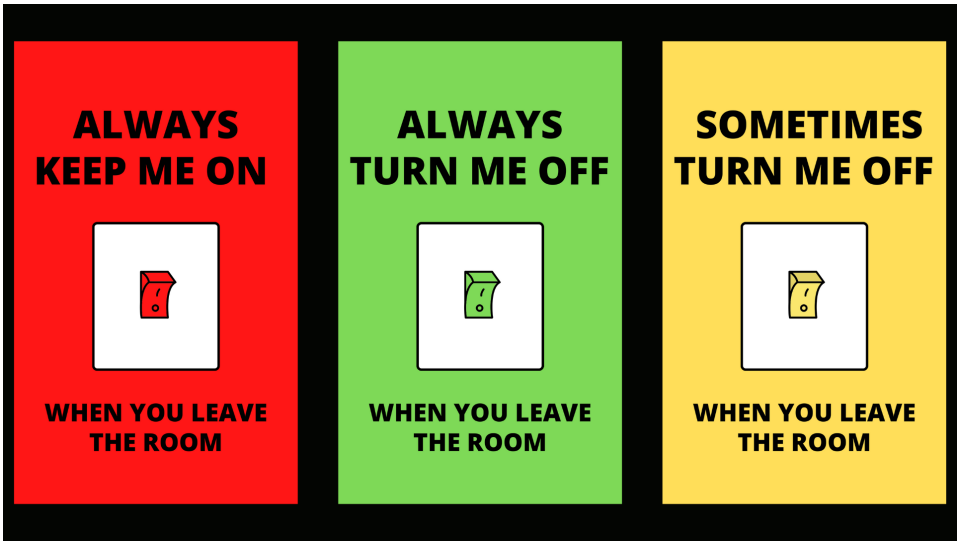

Figure 2.1

Last one to leave- Another sticker will be pasted on the doors of each lab and will be like a checklist for a person leaving the lab last to ensure that the energy wastage is kept to minimum.

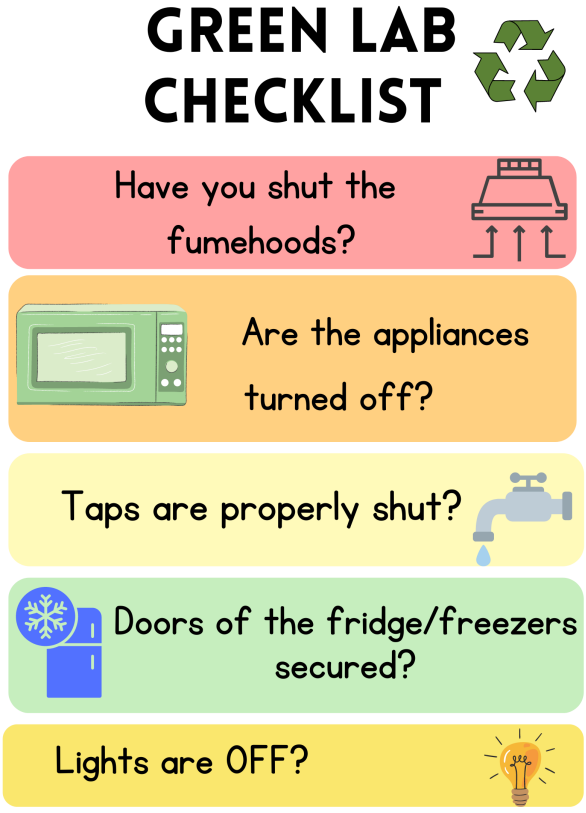

Figure 2.2

Current status- The proposal needs to be discussed with the lab manager of the water lab and inputs need to be incorporated in the design before implementing it.

2.2.4. Researcher Interviews

Having done a formal survey last year, this year unstructured interviews were organized with researchers from the Waterlab to gain a deeper understanding of the research related issues which affect sustainability of the labs. Key observations were:

- The biggest issue which was raised by all the researchers was the excess use of plastics. Each experiment requires multiple pipettes, cups, test-tubes and other plastic products. It could be ideal if some of the products such as plastic cups and bottles could be replaced by glassware, which can work equally good.
- There is an excess wastage of paper towels, often thrown away for no particular reason. Often wrong disposal bins are used to throw away a particular item, for example, paper towels being thrown in a strictly plastic disposal bin.
- In of the interviews it was suggested that a Lab Introduction- which is an orientation process before working in the labs should have a more stronger sustainability element so as to make the researchers better equipped to work sustainably.
- A researcher is willing to incorporate sustainability practices as long as it doesn't involve making modifications to their experimental setups. Hence, setting up sustainable objectives at the start of the research is a good approach.

2.2.5. Laboratory sustainability consultant

A US based professional laboratory sustainability consultant - MyGreenLab was approached to assist in possible lab specific improvements which will make the labs in the CEG faculty greener. The collaboration proposed by MyGreenLab included suggestion on improving the sustainability aspects of the labs, researcher training and providing a green certification. The quote for the proposal was 750 dollars per lab. An external consultant could provide a different perspective as well as share its rich experience to help decrease the footprint of the labs and hence, such collaboration could be considered in future.

2.3. Operations

This year for the operations portfolio an analysis was done of the use of computers at our faculty. The faculty buys computers for staff and on site use from Dell. Since the largest environmental impact computers have is due to the manufacturing process it is important to look at how the company is trying to improve this part of the process. Dell has made a sustainability pledge and uses recycled and reclaimed materials in their manufacturing process as much as is possible. This seems to come down to mostly using recycled materials in the encasing of the computers, and not for the working electrical parts in the computers. In 2019 the company announced its Vision for 2030 which focuses on how they want to become more sustainable. It includes goals like having at least half of every new product being made from recycled or renewable materials, running on at least 75 percent renewable energy and having a 50/50 male/female divide in their workforce with at least 40 percent women in leadership positions. It is promising to see that the company is not only focusing on their direct product and making that more sustainable, but also on other aspects of sustainability.

Currently about half the computers in the faculty are desktops and half are laptops. Desktops have the advantage that they are cheaper, whilst laptops are usually more sustainable because they need less energy to run and they are more flexible in use. The faculty wants to increase the use of laptops for these reasons, but as they have to pay for the computers themselves (the university does not pay for hardware for the faculties) this is a difficult transition to make. Due to this set up hardware is also kept as long as it is still working, which can cause problems for the ICT as sometimes software can no longer be easily run on old hardware. Right now new computers have a warranty of 4 years, after which the hardware is evaluated and thrown away if it is no longer up to the required standard for use. Although this does sometimes mean that computers that still work are thrown away.

The faculty's hardware is removed by a company called Argo 360. This company has a few different programs that focus on sustainability. They repurpose 71 percent of items and parts that they receive and the remaining equipment is recycled. They also employ workers who have a distance from the labour market in their factories. Overall this approach results in 3776 kg of CO2 saved, although it is unclear in what time frame or compared to what this number is referring. However, as far as getting rid of hardware goes, working together with this company seems like a good way to reduce environmental impact as they are able to reuse a lot of equipment and they also sell refurbished products back to consumers again.

At the moment the university's policy on computers is not to add value but to use the best practices from the existing market. Although an argument can easily be made that as a technical university we should not settle for this policy it is understandable and as a faculty of civil engineering our specialities are not directly applicable to improving computer hardware or software. What is a more concerning aspect of the current policies about computers is that students and staff have very different options for acquiring and using their computers. Students have to buy their own computer or use one that they already own, although this can cause problems when their old computers do not have the capacity required to run certain software that is necessary for their studies or if they have a non-compatible operating system (for example students who have apple computers which run OSX instead of windows cannot use most of the software directly and have to install windows on their macbooks). This often results in students using the laptop program, which allows them to buy laptops recommended by the university for their specific program at a discount, to buy a new laptop when they start studying. Staff, on the other hand, are bound by the COBO (Company Owned Business Only) principle which means that they have a computer which is only for their work and often they will end up having a private computer as well. Furthermore the work computers are to be purchased through the ICT department which can be a lengthy and bureaucratic process and prone to error. In the case of temporary workers this also results in hardware being purchased for them by the university which after they leave just ends up in cupboards even though these computers are still completely functional.

Currently there is some initiative being taken to improve the sustainability of the consumption of hardware at the faculty. For example the services of Argo 360 in getting rid of hardware and recycling or reusing it as much as possible. There is also only recycled paper being used in printers on campus, and the use of laptops being promoted instead of desktop computers. Furthermore there is already an idea to better support temporary workers in using their own computers for work so that the university can buy less hardware which will later go unused.

We also have a few suggestions based on the information that was gathered about the current situation concerning computers at the faculty. From the documents about Argo 360 it seems that they are only used by the faculty to get rid of staff owned or faculty owned hardware, and that they also collect and refurbish other electronic devices such as tablets and phones. However students also have laptops or other devices that are replaced once in a while, so it might be worth looking into an option for students to access the services of Argo 360 through the faculty as well. I cannot speak for everyone but personally if there was an easy option for me to get rid of my old, unused laptop easily through the university where I study every day of the week it would be an obvious choice to make. Furthermore it might be interesting to see if there could be an option for students and staff to buy refurbished laptops and devices instead of new ones, as this would greatly reduce the use of physical resources required in modern technology.

2.4. Communications and Events

To continue the efforts from the previous green team, their 'Green Guide: A Guide to Sustainable Living in Delft' was made accessible to the public and was promoted via the study associations and the instagram of the GreenTeam CEG. The Green Guide includes several sustainable companies and organizations in the Netherlands which help people to engage in society in a more sustainable manner. This includes food, travel, fashion and saving energy and reducing waste.

Social media was used as a medium to raise awareness about several issues. One such issue was about meat consumption and the positive impacts of veganism which was talked about while sharing meatless, sustainable cooking recipes, and promoting such existing pages. The 'Nationale Week Zonder Vlees', a week of eating

only vegetarian food was highlighted by several green teams around the faculty including us and was also implemented in many faculties, including the CEG.

Members of the green team were also involved in some events hosted by the GreenTU, such as the 'Nationale Boomfeestdag' on the 16th of March where we planted trees around the new Echo building. The 'Warmetruiendag' on the 11th of February was another event that fell in the category of sustainability.

As students but also as members of the GreenTeam CEG we also participated in the Student Maker Challenge between December and March 2022. We worked to solve the global water challenge of iron sludge waste turning it into textile dye by experimenting in the Water Lab using the resources at hand on a small scale. The final result was presented at the Water Summit 2022.

The main event hosted by the GreenTeam CEG this year was the Green Initiative on the 23rd of March. Hosted over several faculties by their respective green teams, on this day we organized two presentations including one lunch lecture. One of the organizations which took part were Reshirt Rotterdam, an inspiring student group start-up which upcycles discarded clothing. Through the presentation, we gained insight into their journey, their process and their future plans. The other was Fruitleather Rotterdam, a start-up which tackles the issue of food waste by converting rotting fruit into sustainable leather. The inspiring lecture led us through their achievements, process and goals, and even showcased some of their products for the students to see.

Figure 2.3: The Green Initiative

(a) Reshirt

(b) Fruitleather Rotterdam

Figure 2.4: Presentations by sustainable companies on the Green Initiative day

The events of the Green Initiative witnessed the engagement of over 50 students and was well received by the audience.

To close up the academic year, we are aiming for an online campaign addressing our faculty's and university's most important sustainable issues, setting a realistic goal for the next few years, and talking about the future of the green team. A lot can be achieved in the field of sustainability from just awareness of the issues that we face everyday, and it is often the first step towards change. This is why it is important to remain vocal and active about the effects of our faculty towards the environment and in turn foster and implement ideas for a greener world.

3

Plan of Action & Future of the Team

After a discussion with the Faculty Secretary, Stijn van Boxmeer, the GreenTeam has decided to continue to the next academic year with 3 members, working 4-5 hours a week. This year, the focus will be put into Education, Research and Communications. For the portfolio of Operations, the Faculty management, as well as CRE will take the prime responsibilities.

This year, the two members from the previous GreenTeam will continue and a new member will be recruited for the role of Communications manager. The names of the continuing team members are Akhilesh Soodhan and Saraf Nawar. The recruitment for the third team member will proceed through the Faculty communications and other channels and will have to be finalized as soon as the GreenTeam kicks off.

3.1. Education

GreenTeam will have to maintain communication with Hans Welleman, the Director of Education for the Faculty of CEG, to stay in loop with the current state and scope of the team in the education files of the Faculty. This means, at least one meeting every month should be planned between the team (or the Education portfolio responsible) and Hans Welleman, in presence of Stijn van Boxmeer, to reflect on education. The priorities can be set accordingly. The team will also have a monthly or bi-monthly meeting with Monika Roeling, the new coordinator of Education of TU Delft to look for the possible areas of improvement and involvement to be implemented in the Faculty. One topic of interest for the team of next year will be open education resources, which can be discussed in detail after consultation with Hans and the Faculty.

3.2. Research

GreenTeam will be maintaining communication with Giovanni Bertotti, Director of Graduate School in order to discuss possible training opportunities for the researchers in order to boost sustainability in research. We hope to organize a bi-monthly meeting with Giovanni Bertotti and Stijn van Boxmeer to help organize training sessions and work on further course of action. Discussions will be taken up with Merle de Kreuk to find solutions for reducing waste (plastics and energy) and propose creation of a sustainable lab entry exam for researchers in the WaterLab, CEG. Contact to be re-established with Annemarie Vonk, HSE-advisor Stevin area including CitG to develop the combined health and sustainability manual.

3.3. Operations

The lead will be taken by GreenTU in terms of Operations and in the presence of Nikki van Oppenraay, the GreenTeams Operation Coordinator from GreenTU, Stijn van Boxmeer and Imre van der Beek, the facility manager, one monthly meeting will be held with the GreenTeam to discuss the prospect and possibility of the different projects in terms of operations in the Faculty. This is because, it made more sense for the management to take up these responsibilities than the GreenTeam, as some central executions are more sustainable for the long term when realized by the management, and the Faculty, instead of by the team itself.

3.4. Communications, Events and Social Media

This year the focus of the team will involve talking about both the carbon emissions and the carbon footprint of the Faculty and the research involved here. The team will also put its energy on events where the students can be reached better, and a stronger impact can be made, to interest not only people who are already focused on sustainability, but also on those who need to be educated or are less active in the green world. This can be ensured by making a presence or portraying a sustainable aspect in already existing events of the different study associations and disputes, where all members are invited.

3.5. Update meeting with Employees/Management Team

The team finds it important to be known to the employees of the Faculty, so that implementation or accessibility of information remains easy for them. That is why, the team would propose to have a yearly meeting talking about the progress and plans of the faculty and the GreenTeam, in terms of Sustainability, ensuring the expectations are well known and the information is well-circulated.

Proposed Starting Date: As soon as possible
Term: December 2022 - August 2023