

Project Vision

Macalester College stands on four pillars: academic excellence, civic engagement, internationalism and multiculturalism. The aim of the college is for these four pillars to be present in the lives of Macalester students and to interact to create graduates who are global citizens. We believe that in order to become good global citizens, in addition to acting on the four pillars, Macalester students need to better understand sustainability, which is defined by the Macalester Sustainability Plan Draft as the intersection between economics, equity, environment, and wellness (*Macalester College 2016 Sustainability Plan*).

Sustainability, however, is not currently a general educational requirement at Macalester and therefore is not always a part of students' experience here. We sought to help change this and thus in our project, we aimed to work with Facilities Services, Residential Life, and the Sustainability Office to increase sustainability education on campus using co-curricular methods. We approached this goal by working towards the installation of an interactive sustainability education tool in a prominent location on campus and by researching signage methodology to support future implementation of sustainable water usage signs in dorm bathrooms. The ultimate ideal is to not only make Macalester more sustainable, but also to show students that being a true global citizen necessitates sustainable actions. Improving sustainability education has the potential to benefit not only the current campus community, but to also ensure that after graduating Macalester, alumnus take these lessons with them and incorporate sustainability into their lives and work.

Our project has two proposed objectives that interact with and educate students in order to achieve our goals: an interactive stationary bike and dorm bathroom signs.

Part I: Interactive Bike

Goals

Our educational goal with the interactive stationary bike is for students unfamiliar with scientific units of energy to gain a practical understanding of the amount of energy we all use every day. According to data from the US Energy Information Agency, the average American uses approximately 250,500 Watts of energy daily. Unfortunately, most people have little concept of the magnitude of this number, largely because concepts like energy, power, electricity, and energy conversions are abstract and infrequently addressed. By pedaling a bike and producing an energy wattage visible on an energy meter, members of the Macalester community will become more aware of our individual energy consumption through physical, hands-on understanding. The signage accompanying the bike will encourage community members to consider the equity component of sustainability by comparing US energy usage to energy usage around the world. The bike is also designed to charge small electronic devices, such as cell phones.

Bike Design

The system is designed to convert rotational mechanical energy (produced by pedaling the bike) into electrical energy that can be used to charge electronic devices. As someone pedals the bike, the wheels turn. This rotational energy is captured by the system using a v-belt, a circular rubbery chain that goes over the outside of the wheel and then wraps around the end of a small 24 volt DC motor. As the wheel rotates, it turns the v-belt and the v-belt turns the motor, generating energy. Because our project is designed to charge small electronic devices, we also acquired an inverter to attach to the motor. The inverter changes the DC (direct current) power into AC (alternating current) power, since electronics are designed to use AC power. See Figure

1 for an example photograph of system layout. Finally, there is an attached energy monitor so that riders can see the amount of energy produced.

Results

This proposal has been well-received by the Macalester community. We have been fortunate enough to acquire the funding for the necessary mechanical parts as well as campus interest in displaying the interactive bike. The bike will be completed by the end of the semester. We originally wanted to unveil it on Earth Day, but due to complications ordering the motor and v-belt, the construction date was pushed back. The Campus Center has agreed to host the bike downstairs this year for three weeks as a pilot, and then potentially consider a longer period of time, depending on the nature of the campus community's reception of it. After experiencing our setback with the motor and v-belt arrival, we reached out to the Campus Center and received confirmation that they would still be willing to host the bike at a later date, now likely September 2016. We plan to have a bike unveiling in the Campus Center on its first day of display. Possible features of this unveiling will be advertisements in the Daily Piper and cafeteria table tents, candy, and a meet-and-greet event with Ken Moffett, Macalester's scientific instrumentation technician. The Sustainability Office has also agreed to store the bike and use it during future sustainability events.

Future Plans/Recommendations

We hope that bike construction and unveiling goes smoothly. Beyond that, we are optimistic that the bike will be well-received as an educational tool and that the Sustainability Office could loan it out to other departments on campus for events. For this project, we received the physical bike and technical assistance fairly quickly, but securing a place on campus for the bike and display was somewhat difficult. Part of this difficulty stemmed from lack of a clear

point person responsible for determining the use of various spaces on campus. For example, our group first considered displaying the bike in Smail Gallery of Olin-Rice, but it was unclear who we would have to talk to in order to make that happen. However, despite complications around bike location and part acquisition, we feel confident that it will become a useful sustainability education tool on campus. Further, its location within the Campus Center will likely allow us to target a crowd that is larger and more unfamiliar with energy use and conversions than the average Olin-Rice science major.

Part II: Educational Signs

Goals

The purpose of the educational signs in the Macalester dorms is to lower water consumption and waste, while also informing students and prompting them to think about their sustainable (or unsustainable) behaviors. The signs should help achieve this goal by offering students statistics on water usage and waste that will make them think critically about these issues. Living in a water-rich state like Minnesota, and not having to directly pay for water usage, many students have a disconnect to the realities of water sustainability. In truth, water prices are getting higher as the region's aquifers are being depleted (Metropolitan Council). Macalester College currently pays a nearly \$240,000 annual water bill, and that figure is increasing rapidly (Pumroy). The college has been working to make its water systems more efficient by installing low-flow appliances and making more efficient plumbing choices, but the college has now reached a point where nearly all institution-wide efficiency measures have been taken. Even while it appears that average water usage has decreased slightly, this has been due mostly to increased efficiencies (Figure 2). This means that water use reduction is now

dependant upon conservation efforts by smaller groups and individuals, which is where students come into the picture.

The signs are meant to educate students on the importance of water sustainability to reconnect them to the realities of their individual impacts. The signs will be placed on the doors of bathroom stalls, where they will be most visible to students in a place where there is a lot of water consumption from toilet, shower and sink usage.

Ideally, these signs would be permanent and consistently updated with content and design. If the signs were left unchanged, keeping them there permanently could cause students to become insensitive to them, thereby losing the effectiveness of the project. Residential Life has agreed to allow us to place the signs in dorms with the permission of Resident Assistants.

Results

Ideally the signs will inform students about water sustainability and cause them to reduce their personal water usage and waste. The water monitors in 30 Mac, along with our access to water billing data, should be able to verify whether or not the signage has this impact.

Due to challenges in the implementation process, we were unable to introduce the signs into the bathrooms. However, we are optimistic that the research we conducted on sign design and the connections we made with Residential Life will smooth the road for future implementation after more (and more accurate) water monitors are installed in dorms.

Signage Psychology

Determining the content of the educational signs was an important step in this part of the project because word choice can make or break its effectiveness. In the context of a college campus, it is important not to tell students what they should be doing or what they are doing wrong because psychology research shows that students are less likely to act sustainably when

they are asked to do so (Manning). In order for the signs to be effective, we worded them so that they informed students of straight-forward facts. Macalester students are generally critical thinkers and are aware of their effect on the global community. The signs are meant to make students think like global citizens and make individual choices, rather than be told what to do. Proposed signage is attached at the end of the document in Figures 3-8.

Challenges

The challenge of educating the Macalester community about sustainability appears to be entrenched in the bureaucratic processes of the campus. Although the departments and offices that we worked with were receptive to our ideas and goals and particular individuals went above and beyond to be helpful, it was somewhat difficult to coordinate our efforts with our partnerships. Just as the process of finding a space for the interactive bike proved challenging when it was unclear who was responsible for allocating and maintaining specific locations on campus, it was also challenging to figure out who to meet with about getting permission to put up sustainability education signs in the dorms and who had information that we needed about water monitoring. This difficulty is due in part to the fact that departments and offices on campus must coordinate with each other about certain issues, such as putting signs up in dorm bathrooms. This affects both Facilities Services and Residential Life, who must be involved in any sustainability projects implemented in the dorms.

Future Recommendations

In the future, the challenges stated above may be overcome by meeting with representatives of several departments and offices at once in order for communication to be clear and for people to have the opportunity to give their input to students working on projects like ours. This is a challenge in itself to get everyone together, but it would make the impact of

sustainability education on campus greater if more departments and offices get involved to work towards the same goal. Another solution to this issue may be the creation of database of projects to facilitate progress on various sustainability related initiatives.

Although the signs were not implemented, all the work has been done for a future student to continue this project and work closely with Residential Life and Facilities Services to monitor and complete the project.

Conclusion

The goal of this project was to create educational opportunities that teach students the importance of sustainability and how to be global citizens. Sustainability education is an important part of global citizenship because it teaches people that everyone is connected and individual actions have effects across the globe. While Macalester students may have comfortable access to electricity and water, that is not the case in other parts of the local, national and international community. The interactive bike and the water sustainability signs will give Macalester students the opportunities to make informed choices and think more critically about their daily habits.

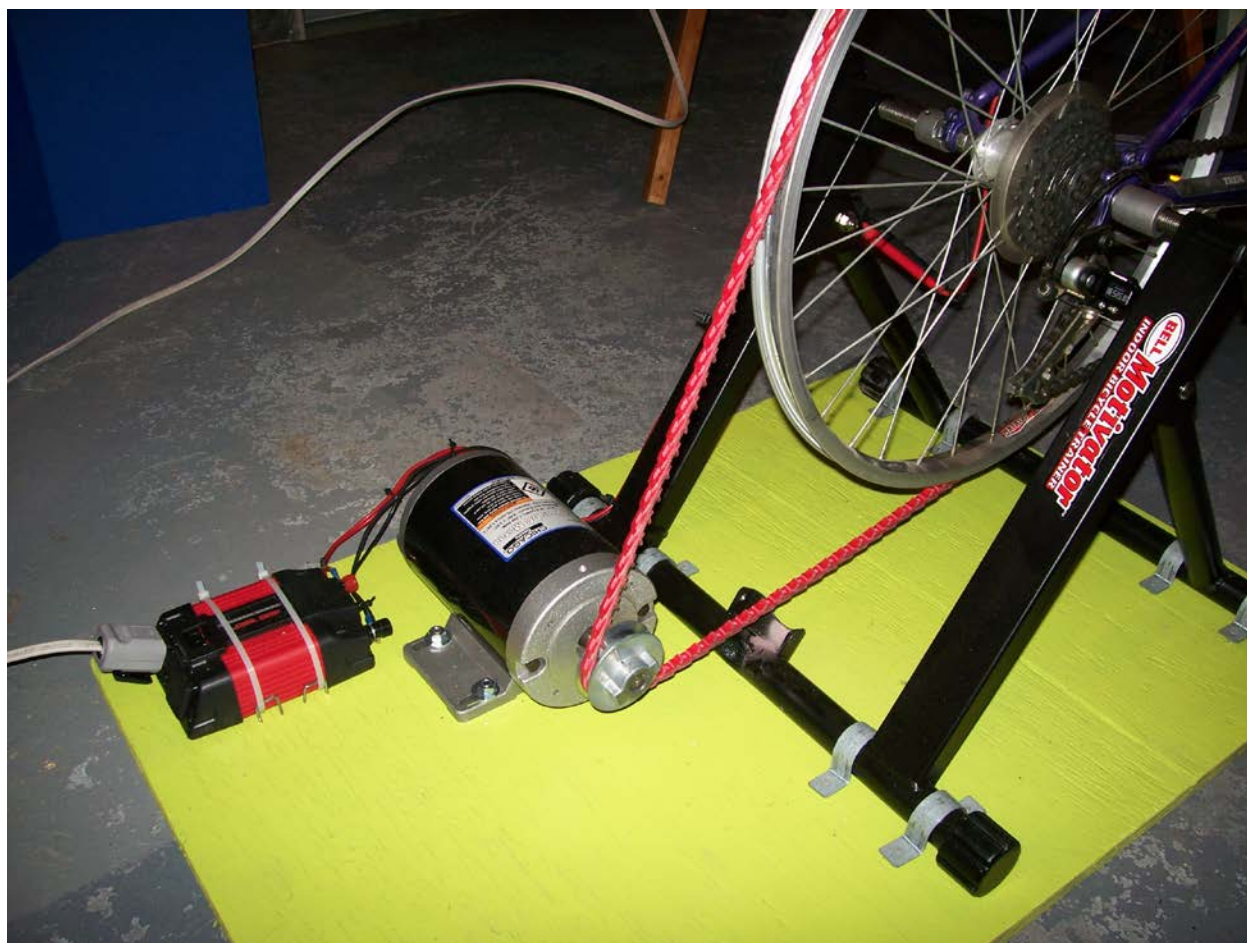


Figure 1.

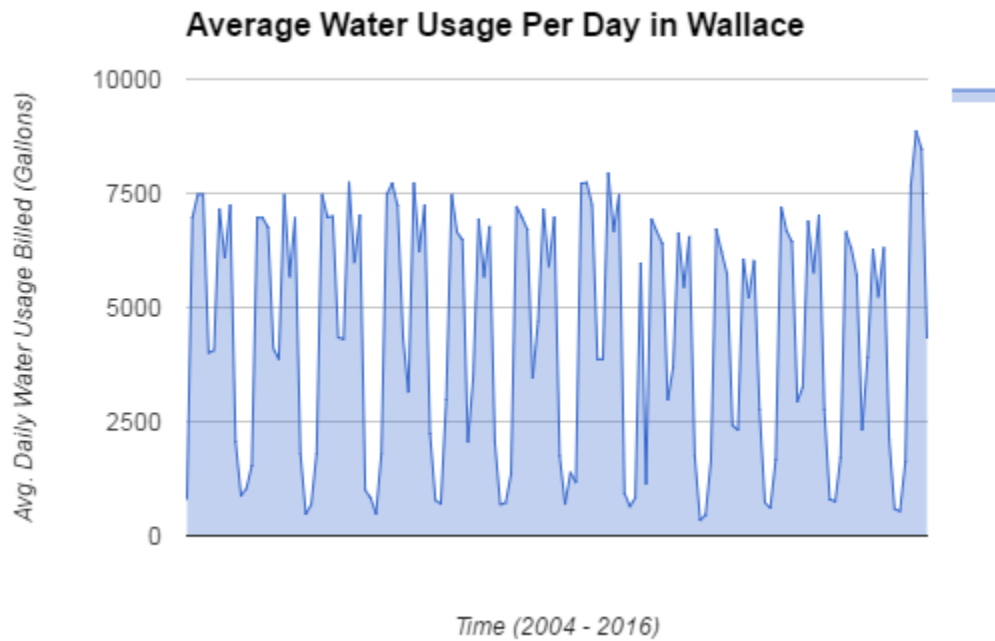


Figure 2.

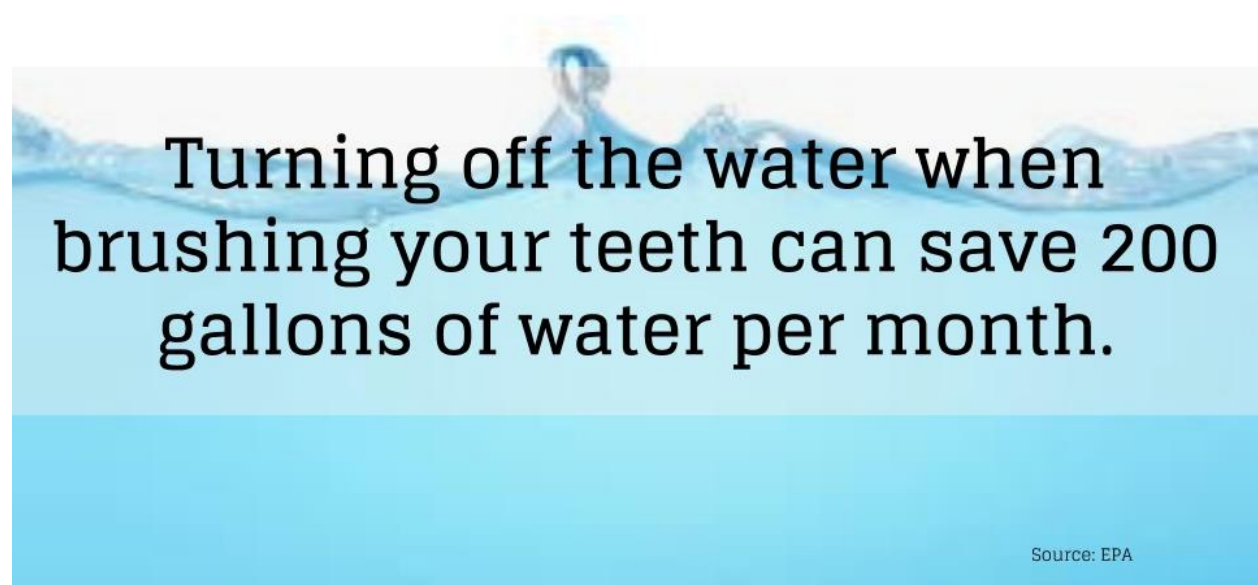


Figure 3.

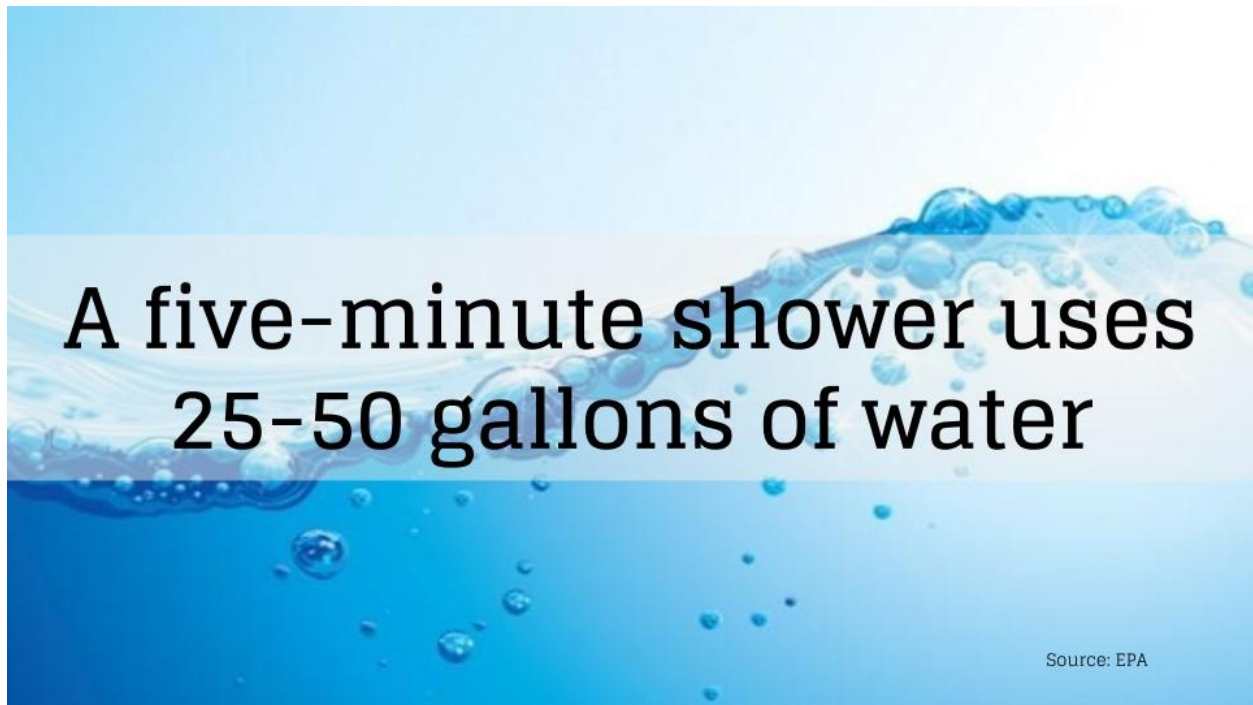


Figure 4.



Figure 5.

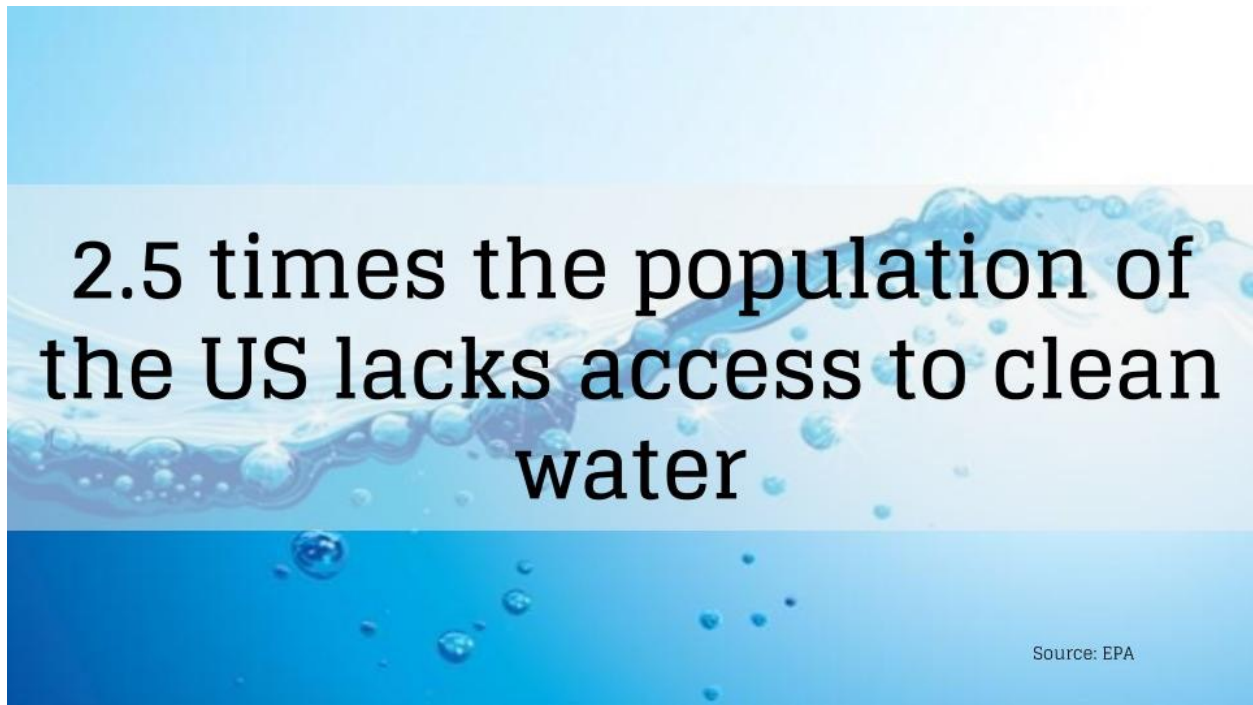


Figure 6.

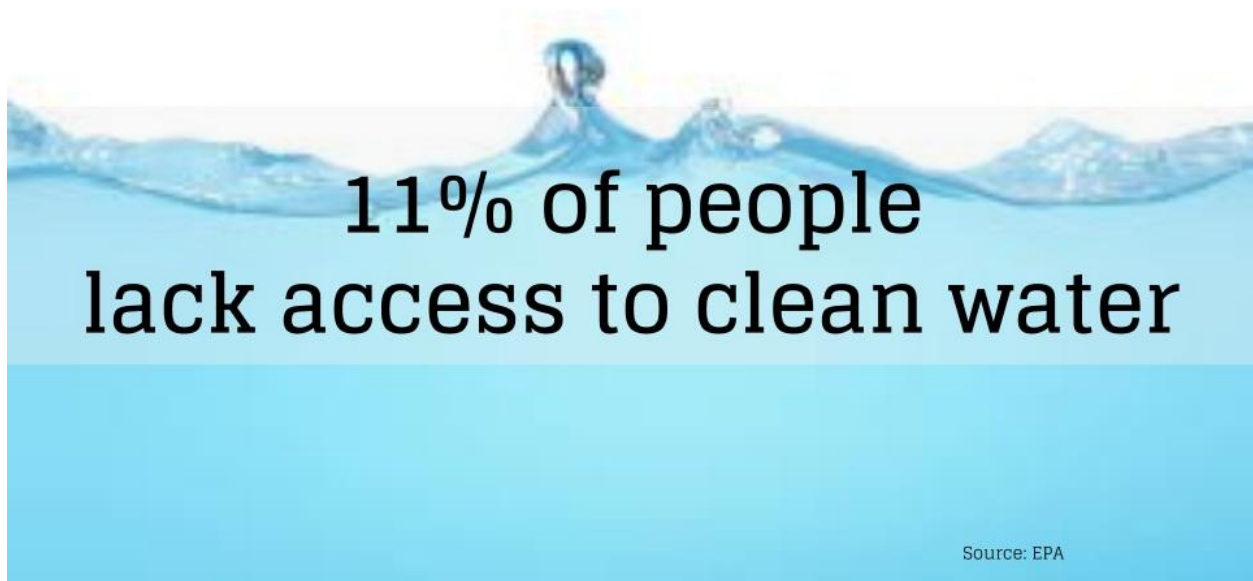


Figure 7.

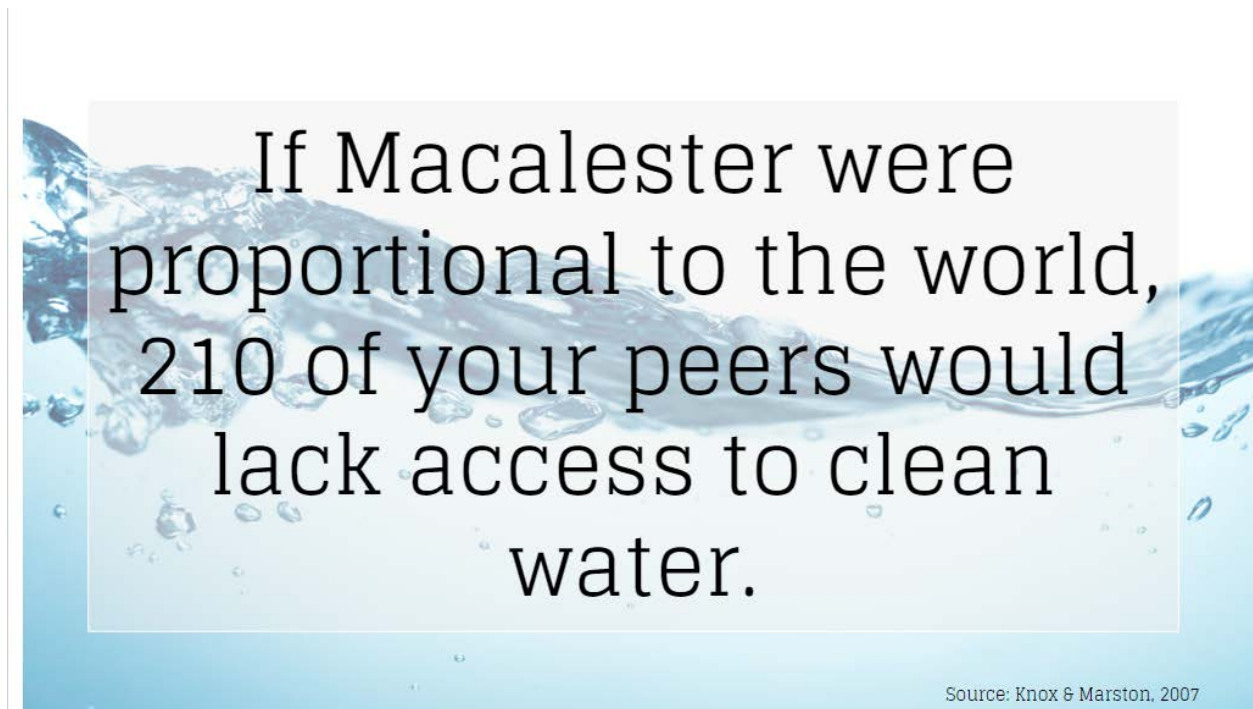


Figure 8.

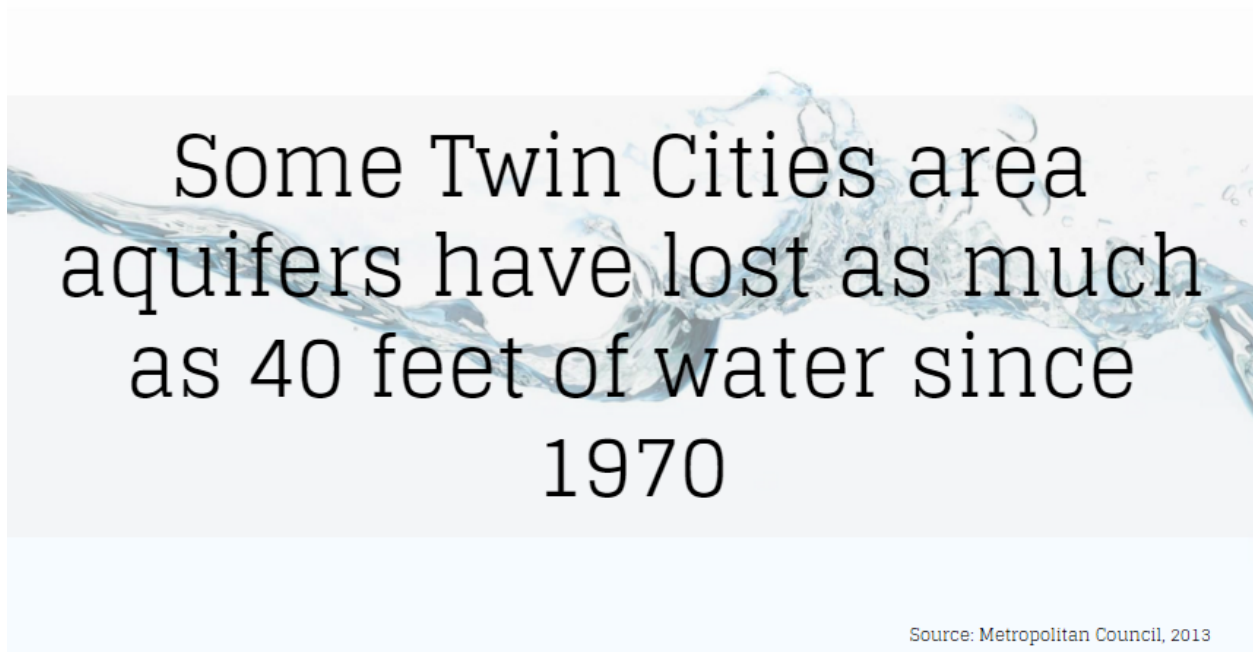


Figure 9.

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Appendix

Partnerships

We are extremely grateful to all of our project partners. We literally could not have done it without them. For the bike project, Mac Bike was kind enough to gift us a bike frame, significantly lowering project costs, as well as provide mechanical insight. The Sustainability Office has supported this project through a grant from the Small Project Fund, as well as offering to store and display the bike during sustainability office events. Isaiah Sonnenfeld and Andy Williams (the Operations Manager and the Assistant Director of the Campus Center, respectively) facilitated the bike's planned three-week stay in the campus center. Professor James Doyle of the Physics Department helped us connect with relevant people and resources in the science departments. Finally, we are incredibly lucky to have had the guidance and support of Macalester's Scientific Instrumentation Manager, Kenneth Moffett. Ken has kindly shared his tremendous mechanical knowledge, helping us decide which parts were appropriate to order and taking the lead position on bike construction. Ken has been an integral part of the project.

We are also grateful to those who partnered with us on the signage project. Various member of the Facilities Department, including Mike Pumroy, who offered to give us access to Macalester's water billing statements in order to provide us with insight into the current situation and give us suggestions as to how to proceed with this part of our project. Professor Christie Manning has been an excellent source as an expert in the psychology of sustainability. She assisted us in the particular word choice of the educational signs so that they would be appropriate and effective in a college setting.

We are encouraged by the help and support we have received, as it suggests that across the Macalester community, members of many departments are concerned with improving sustainability efforts on campus.