

THE OREGON STATE UNIVERSITY CALCULATOR

By Anna Kelly and Patrick Kelly

ACKNOWLEDGEMENTS

Santa Clara University made the original Carbon Footprint Calculator (Calculator) and made the code available to OSU. OSU Students Kimberley Melendez-Rivera and Julian Preciado, both under the guidance of OSU Prof. Rick Colwell, were crucial to the development of the Calculator. Ms. Melendez-Rivera identified carbon calculators developed by universities to offer their students a chance to estimate their individual carbon footprints. She selected one designed by Santa Clara University as most suitable for adaptation by OSU. Mr. Preciado modified the code for newer standards for energy use, for the Willamette valley, and for OSU.

Prof. Colwell from the College of Earth, Ocean, and Atmospheric Sciences wanted to offset his own travel-based carbon footprint, leading to the Calculator coming to OSU. He brought the idea to Dr. Sally Duncan, the coordinator of the Oregon State University Policy Analysis Laboratory (OPAL).

Dr. Duncan not only provided matching funds from OPAL to support development on this project, she provided the forum for communication. Dr. Duncan is committed to sustainability, and through networking, delegation, and hard work, is bridging the sustainability gaps between the university and the city at large. Dr. Duncan also provides students working with OPAL an OPAL staff member to help with organization, next steps, brainstorming, and general project facilitation. Ivan Kuletz of OPAL was assigned to this project and proved an invaluable resource in getting the Calculator finished and ready for hand-off.

In addition, this project could not have been successful without all of the students, staff, and faculty who piloted the Calculator and provided data for optimization. Thanks to Brandon Trelstad and his staff, Myrna and Marshall, who helped with data and web issues. Finally, thanks to all of the community partners who are committed to Corvallis sustainability and healthy communication and collaboration between the university and the city of Corvallis.

PURPOSE OF THE CALCULATOR

The Carbon Footprint Calculator is a web-based application that is set up like a survey and uses a framework of coefficients and modifiers garnered from the literature of CO₂e (carbon dioxide equivalents). The literature takes the usage of, for example, leaving a computer plugged in when it is turned off and makes a kWh to CO₂e conversion. When individuals take the survey-based calculator, they answer questions about their transportation, recreation, consumption, energy and heating, food, waste, and water usage. All of these categories come together to give the respondent one number at the end of the calculator. This number is the kgCO₂e that they emit, or their carbon footprint. The results section shows the respondent how their usage compares to that of individuals in different countries, and a breakdown of which categories of usage (transportation, recreation, etc.) contribute most heavily to their carbon footprint.

The purpose of the Calculator is to give individuals a way to estimate their energy consumption in the context of carbon dioxide equivalents, encouraging them to decrease their personal impact on the environment by decreasing their carbon footprint. The Calculator gives the respondent opportunities to decrease their carbon footprint immediately through the purchase of offsets. Offsets are the purchase of a service that will do something that will be equivalent to taking cars off of the road. For example, carbonfund.org is an organization for the purchase of offsets, and they have 24 tonnes of CO₂ priced at \$240 dollars. The money spend to offset will be spent on planting trees, building wind farms, energy efficiency upgrades, and the trading of renewable energy credits.

This model translates directly to what the OSU Calculator is doing. The offset section of OSU is locally based, with three options that are all in Corvallis. People can volunteer to be block captains with the Corvallis Sustainability Coalition, donate to the Greenbelt Land Trust, or change their behavior using Energize Corvallis. These options hit the critical points of “reduce what you can, offset what you can’t”.

The purpose of identifying local and community carbon offset opportunities is to provide reasonable and attainable options for individuals to attempt to reduce their net energy use/carbon footprint by contributing to or participating in programs that offer carbon offsets.

MODIFICATION PROCESS

After a round of surveys and live-testing with 48 respondents, the calculator was modified to better suit the needs of OSU, both in preferences for questions and in simplicity of user interface. The modifications had two phases.

First, the Office of Sustainability provided the Calculator with all of the energy usage data for the OSU campus; that information showed an enormous bug in the code of the Calculator, which has now been fixed over months of work. The second phase was the pilot program. The Calculator was piloted in two locations: the Beaver Community Fair and at the OSU Weatherization Workshop. Participants were asked if they wanted to know their carbon footprint, and then given a tablet on which to take the test and fill out a follow-up survey.

The survey results guided changes to the calculator that helped it better reflect the lifestyles and desires of the participants. In addition, the survey gave insight as to how individuals would best like to offset their carbon footprint. The options were to volunteer, to donate, and to change their behavior. Using these options, three organizations in Corvallis were chosen to reflect each type of offset. The organizations that were chosen for city collaboration are the Greenbelt Land Trust, the Corvallis Sustainability Coalition, and Energize Corvallis.

A few technical changes were made to the OSU Calculator. The most drastic change was the modification of the baseline carbon footprint that any individual would have as a member of the university community. The methodology document, started by Santa Clara University and maintained by Oregon State University student workers, did not explain how the baseline was calculated, and so the process was examined from the beginning. Data was collected from OSU on energy consumption, and the baseline was changed to be the total energy usage of the university divided by the population, minus on-campus dormitory housing. The new baseline is much smaller than the previous baseline, but is also easier to read and interpret by future coders. In addition, some questions were removed or condensed. For example, there was a question about pet ownership in

the original Calculator that speculatively equated the impact of pet ownership with the impact of car ownership. However, the source that supported the question was not peer reviewed, and the claim was made by just one study. Therefore the question was removed. The exact questions in the Calculator, as well as the math that supports them, can be found in the supporting methodology document.

In addition to technical changes and offset opportunities, the process for finding a permanent home for the Calculator has begun. Currently, the OSU Office of Sustainability is working to develop a hosting platform, and there is some hope that the code will be easily adapted into Drupal, which is the OSU preferred web development platform. The Office of Sustainability has also engaged with the Calculator team about the construction of a database, but no concrete plans are in the works.

CARBON OFFSET OPPORTUNITIES

Greenbelt Land Trust has created a landing page just for the Calculator where individuals who choose to donate to GLT can link to the donation portal immediately after taking the Calculator, thereby offsetting their carbon emissions. GLT is also collecting data about the individuals that donate, in the form of their carbon footprint score and their demographics. This information will be sent to OSU on an annual basis. Maintenance for it is still in the planning stage.

Thirty-six percent of survey respondents indicated that they wanted to volunteer their time to local environmental groups. This mission will be accomplished through a partnership with the Corvallis Sustainability Coalition. The Corvallis Sustainability Coalition thinks that the best role for our Calculator participants is to have them volunteer as Block Captains. The block captain program is how people in Corvallis find out about recycling, composting, and trash rules, as well as general environmental and waste management information. The participants will be linked to the volunteer page, and they will be put in contact with Annette Mills and her correspondents at the Corvallis Sustainability Coalition to receive the materials that they will be responsible for disseminating throughout their communities.

Finally, the survey responses indicated that the majority (81%) of participants who identify as “students” prefer to change their behavior to reduce their carbon footprint. Energize Corvallis’ program “Campuses Take Charge” is currently not operational, but the Corvallis-wide program “Communities Take Charge” still gives participants the opportunity to fill their “shopping cart” with actions such as turning off the lights when they leave a room, filling their dishwasher completely prior to running them, and other energy savings behaviors. The Calculator will link to the sign-up page to give participants the opportunity to change their behavior in a structured way that lets them see their results and track their offset emissions.

The Office of Sustainability is working with the Calculator on hosting the tool. Brandon Trelstad and the Calculator workers are putting together a plan with the university IT department to give the Calculator a safe home where it will be maintained. Training for maintenance workers will ideally begin soon.

NEXT STEPS

This Calculator has changed considerably from the original template provided by SCU. The background of the Calculator reflects Corvallis, and many of the questions have been changed to

better represent the needs and desires of our students. We have connected with local partners and the University to increase the extent to which the Calculator is integrated with the community, but there is still more to do. The next steps of this calculator focus on research needs, hosting requirements, code changes, code maintenance, offset program maintenance and finally, further integration with the City of Corvallis.

RESEARCH

More research is needed in order to make the Calculator fully robust and scientific. The projects that can be done will vary based on researcher-interest, but this section will attempt to list out all of the ideas that have been proposed during planning meetings for the calculator.

One of the questions that has arisen multiple times is “how do we know how much carbon the available opportunities will offset?” This is a good place to start. A project that quantifies activism volunteer work at the local level, audits the Greenbelt Land Trust activities for carbon reduction, and uses data from Energize Corvallis into the Calculator would make the OSU Calculator more robust and more scientifically based. Our offset program participants were chosen based on reputation, and not based on carbon reduction.

Having real usage data behind the calculator could make it more fun and useful to the respondent. The next group to work on the calculator could talk with local organizations, such as Energize Corvallis, that may be able to provide averages of usage from utility billing data. Another resource available to students is the Energy Trust of Oregon, located in Portland. Energy Trust might be willing to provide utility billing data to student researchers, if the project can be mutually fulfilling.

Another project that would increase robustness of the Calculator would be to assess the usefulness of using carbon footprint in terms of CO₂e for measuring environmental impact. Is there a better way to identify a person’s impact? What is the balance between the questions that highly impact a person’s carbon footprint (e.g. riding in airplanes) and those that are fun to answer (e.g. sporting events)? These are questions that were not answered during this phase of the Calculator development.

HOSTING REQUIREMENTS

The OSU Calculator is ready for further development. A permanent host is necessary, and Brandon Trelstad at the OSU Office of Sustainability has been our primary contact for this goal. There are two things necessary for the hosting and long-term viability of the Calculator. The first goal is finding a proper place for the Calculator to be hosted as its own website. This site would need to be accessible by OPAL, Rick Colwell, and those who work on the Calculator for code changes and maintenance. The second goal is also to get a database put together so that the Calculator saves the records of the users in order to help with OSU and Corvallis sustainability planning. This future database will need to be prepared to receive yearly updates from Greenbelt Land Trust, as is detailed in the offset program maintenance section.

CODE CHANGES

The code may need to be put into Drupal so that the Calculator will have the same look and feel as other OSU web applications. The user experience could be improved, as well as graphics, wording, and interface. Many survey respondents indicated that they wanted to have a better food and calorie calculator built into the Calculator so that they could more accurately answer the questions. On

December 15, 2014, Google released the number of grams of CO₂ emitted from regular searching; this would be a good addition in the future for the Calculator.

In addition to code additions and major overhauls (like moving to Drupal) there are still issues between the code base and the maintenance document. The document was contradictory to the code when we received both, which led us down quite a few rabbit holes. The coder on this portion of the project, PK, thinks that the document should be used to outline the purpose of the code and the structure, and instead the code should be well commented and all of the numbers changed to variables. In addition, the units throughout the code (e.g. CO₂_e, kWh, etc.) need to be labeled within the code. This would eliminate disagreements between the maintenance document and the code base, leading to separate functions for each document.

MAINTENANCE

There is quite a lot of yearly maintenance that will need to be done to ensure that the Calculator works correctly. The OSU Office of Sustainability has yearly energy data that they shared with us in order to get the energy and heating tabs working correctly. The coefficients will need to be updated for the dorms and for the overall baseline each year, as is detailed in the methodology documentation. In addition, regular check-ups will need to be conducted with the offset partners.

OFFSET PROGRAM MAINTENANCE

Greenbelt Land Trust's liaison is Jessica McDonald. She can be reached at jessica@greenbeltlandtrust.org, and made the landing page for the donations. She is the only person from Greenbelt Land Trust that we have communicated with. She has a plan to send the data from the donations each year to OSU. It should be arranged that the information from Greenbelt Land Trust gets integrated with the OSU hosting facility. We should also keep open communication with Greenbelt Land Trust and see if people are choosing to donate to offset their carbon footprint.

The Corvallis Sustainability Coalition's block captain program will not keep any records for us in digital form. The contact person for the Corvallis Sustainability Coalition is Annette Mills, who can be reached at amills@virginiavillageproductions.com. Annette is a facilitator, and has been vital in finding resources for how to get people involved as volunteers. We will need to keep in contact with her, and come up with a plan to see if the Calculator is directing more volunteers into the Corvallis Sustainability Coalition.

Energize Corvallis is currently changing some of their programs, but the initial program for collaboration, Communities Take Charge, is still active. The contact person is Carly Lettero. She can be reached at Carly.Lettero@oregonstate.edu. Carly should be contacted and a flag should be added to their records indicating if an individual came across their program as a result of the Calculator.

For the offset programs, it is very likely that those working on the Calculator in the future will want to seek out more ways to offset, or change the current options. A recommendation is to have no more than 1 or 2 per type of offset, so that the Calculator does not become a list of local community organizations. Instead, care should be taken to ensure that the offset programs represented by the Calculator are used by the community and are relevant to the sustainability goals of Corvallis and of the University.

CORVALLIS INTEGRATION

Most importantly, the OSU Calculator needs to have another option in the first tab for all Corvallis residents that are unaffiliated with the university. Currently, the Calculator is only applicable to students, faculty, and staff. The end goal of this project is to have a fully functional Calculator for all of Corvallis.

Corvallis is a highly ranked sustainable city, we have multiple solar farms across the state, and we have a huge university full of cars and intense energy usage. This Calculator is meant to help provide information about the factors that lead to a high carbon footprint and to provide opportunities to offset usage.

CONCLUSION

The OSU Carbon Footprint Calculator will serve to increase the already environmentally conscious community of the City of Corvallis and serve to show other University towns how to integrate University resources for the benefit of the city at large. The offset availability while the respondent's carbon footprint score is still fresh in their mind will serve to bridge the gap between knowledge and action, and will overall decrease the carbon footprint of Corvallis and Oregon State University.

This Calculator uses local data and customized questions that seek to find a balance between the factors that influence a carbon footprint most, and those that keep the respondent interested in the process of customizing their lives.