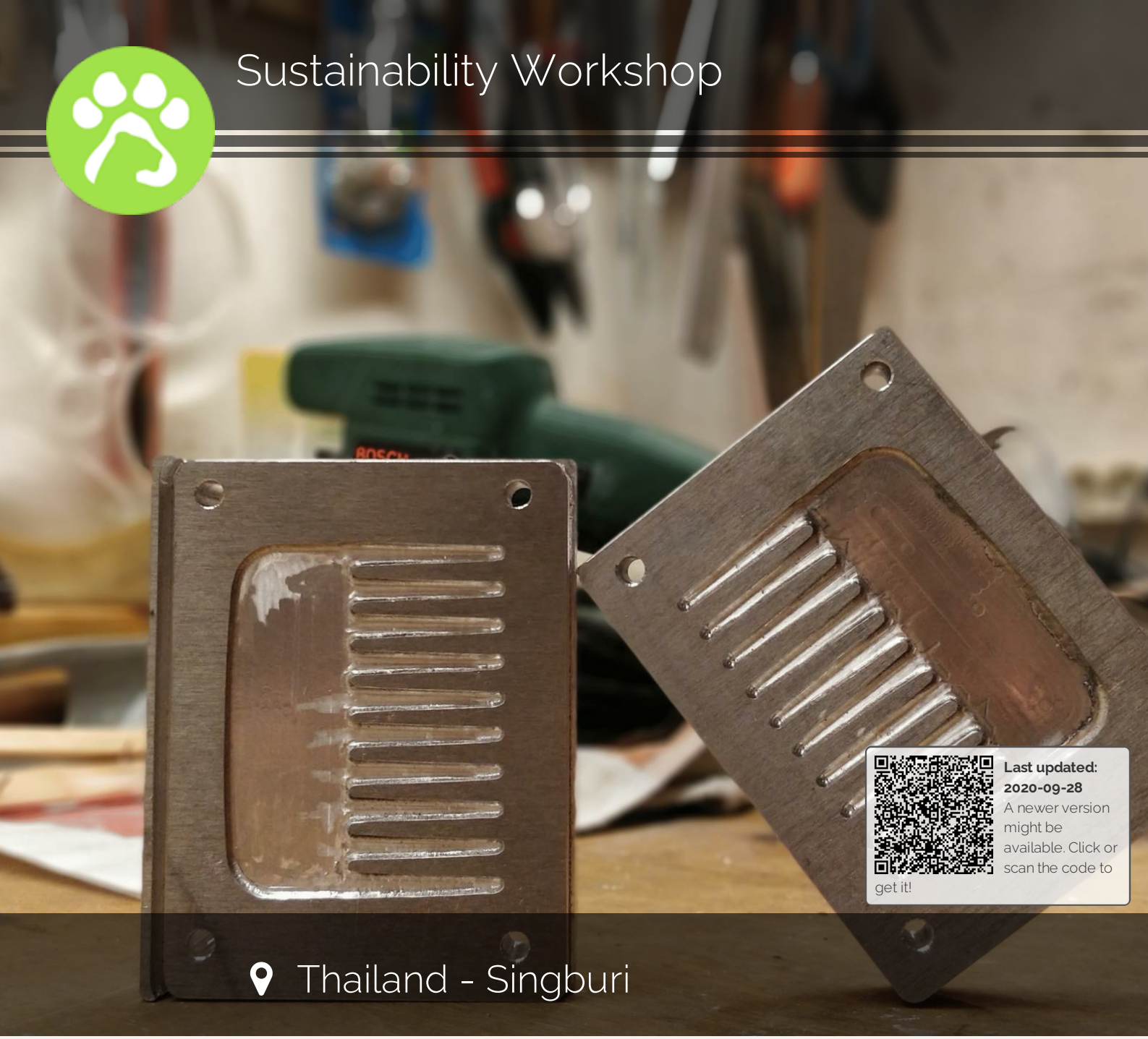
Sustainability Workshop



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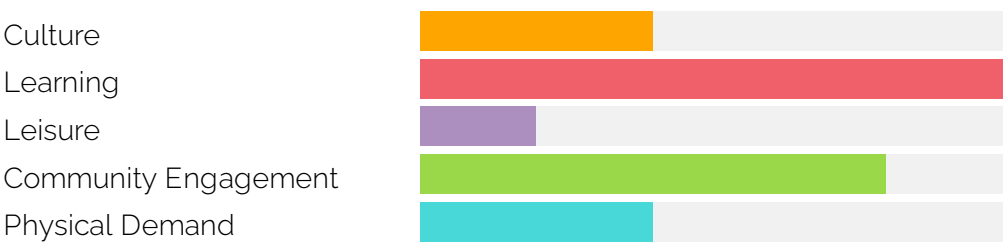
A newer version might be available. Click or scan the code to get it!

Thailand - Singburi

What if we could use the trash of today to power workshops where young people can work on the solutions for tomorrow!

Following this question, we developed our own take at cleaning the environment and recycling. We collect and sort trash along local streets and rivers, then extract valuable plastic and use it to create new items. Along the way everybody can learn lots and lots about why recycling is so hard.



Program Description

Between 1950 and 2015 a total of 8.3 billion tons of plastic were produced, only about 6% of which were recycled. More than half was discarded into landfills or the environment where it will need more than 400 years to degrade. A 2015 OECD report only lists 2 out of 34 countries not using landfills for Municipal Waste Management anymore, namely Germany and Switzerland.

Yet, the high recycling quotas reported for many developed countries rather refer to recyclables being collected, not actually recycled. Much of what gets collected needs to be sorted further by hand. Therefore until 2017, about 56% of the world's plastic waste was shipped to China. Since in 2018 China imposed stricter regulations on importing contaminated waste, other Southeast Asian countries have filled in, mostly Malaysia, Thailand and Vietnam.

More than 8 million pieces of plastic make their way into the ocean every day, killing more than 100,000 marine mammals and more than one million birds every year. It is estimated that by 2050 there will be more plastic in oceans than fish. But besides the effects on the food chain and thus our health, recent studies have also shown negative impact of microplastic on Prochlorococcus, a species of bacteria doing photosynthesis. These microbes are responsible for about 10% of the oxygen we breathe and are of similar importance to us as rain forests. The chemicals leaching from plastic seem to reduce their growth and their ability to produce oxygen, thus adding a substantial factor to the rising CO^2 levels, worsening the climate change crisis.

A problem as global and interconnected as this, can not be solved on a local level. It needs an entire generation to build awareness; Starting with the realization, that the only effective way to reduce plastic pollution is, not to buy plastic items in the first place. This program strives to to add to such awareness, teach about the global waste management systems and their challenges, create a sense of worth of plastic in local communities and conduct research on small scale, low cost recycling.

Your Typical Day

While supporting the sustainability workshop, you will help us collecting trash and turning it into new items. We expect you to work Monday to Friday, up to 8 hours per day. In addition, we may ask you to help us out on weekends or evenings on an as-needed basis, as far as this fits with your itinerary and weekend travel plans.

You will get to know and work in the entire recycling process starting with collecting trash and ending with manufacturing new plastic items.

Depending on your knowledge, experience or duration of stay you may get more involved in our research and machine building projects.

The Recycling Process

The program is based on our sustainability campus on the Thai countryside. All facilities are built from clay and wood, following traditional techniques. The campus is home to our sorting station, storage facilities, the recycling workshop as well as our research lab. Our work follows a set procedure:

Step 1: Collecting

We head out into the neighbourhood, to local rivers, into closeby villages or the nearest town to collect waste along streets, canals or rivers. Much of the waste along streets gets carried into a canal by the wind, then washed into a river and finally makes its way into the ocean. Thus any item we collect is likely one less item that gets into the ocean.

While collecting we already sort into recyclables and waste. The latter one is disposed properly while we take the recyclables back to our sorting station.

Step 2: Washing & Sorting

For now, our recycling process can only handle the most commonly used kinds of plastic. Other recyclables we collect, such as cardboard glass or electronics, are handed to specialized recycling companies.

First we pre-sort the plastic. This also means taking apart items into their individual components. E.g removing caps and labels from bottles. Containers that are hard to wash on the inside are cut open. Next, all items are pre-washed to remove sand, food rests, algae and anything else that could cause problems later on when shredding the plastic.

Then the actual sorting starts. To be able to recycle the plastic, we need to carefully sort it by type. Different kinds of plastic, of which there are thousands, e.g. melt at different temperatures or are differently elastic. Sorting can be a real challenge as only some items are properly labeled as in what kind of plastic they are made from. We are working to develop a simple device that can help us determine the kind of plastic used, but while we develop and train it, sorting needs to be done by hand. This is no different from how Western waste is treated once shipped to Asia.

To help us recognize the various kinds of plastic, the central element of our sorting station is the example gallery. Every item we identify for the first time gets added. When we collect the same item again - e.g. a plastic bag of a certain brand, a coffee cup from a certain store etc. - we can use the example gallery as reference. At the same time we are creating a growing museum of contemporary plastic waste, displaying the variety of use cases and highlighting popular usages. A piece of art, one could say.

Step 3: Storage, Shredding & Washing

After determining the type of plastic, items of one kind of plastic get sorted by color and added to storage. Once we collected enough items of one kind and color, we shred the plastic into fingernail-sized flakes. These get washed extensively to remove any left dirt, stickers, glue (imagine labels glued to a bottle or box) and biological contamination (mold, bacteria).

After drying in the sun, these flakes go back into storage. Some kinds of plastic are hygroscopic, which means they will attract humidity from the air and get wet; Just like salt. That's why we need to store these flakes in airtight containers.

Step 4: Production

Flakes of one type and one or multiple colors get melted in the injection machine and injected into a mould or extruded from the extrusion machine to create new items. Some items might end up with rough edges that need smoothing or unnecessary parts to cut off. In the end, all items need to be marked with the proper recycling symbols specifying what kind of plastic we used to make it easier later on to recycle them again.

Other activities

Creating Awareness

From time to time we want to approach locals, e.g. by hosting exchange events. People can hand in their plastic waste and we give them useful items we produced in the workshop in exchange. We hope this helps in creating awareness for the value of plastic as a resource and the fact that plastic trash still has value, as well as to encourage them to separate waste on a household level.

Updating / Extending the Facts Wall

Besides the example gallery, the facts wall is the second key visual to inspire people to think or discuss about recycling. Picture a room sized wall on which we keep painting more and more numbers and facts about recycling. Came across an interesting fact? Found a difference between recycling systems in different countries that made you ponder? Grab a brush, add it to the wall. Start a discussion about it with your peers. Share your experience or learn from theirs.

Working on Tooling

Our recycling machines and processes are constantly being improved. That requires lots of work for simple yet time consuming tasks such as polishing new moulds. But also creative or technical input is important. If you're good at CAD design, embedded programming etc, please bring your laptop; From time to time we may need your help.

Our goal is to work out robust processes and simple to build machines, using only locally available parts. We're building on top of the designs developed in the Precious Plastic project, adapting them to work with parts we find on Asian scrap yards or small hardware stores. Unlike the original machines, we're less focused on crafting individual pieces of art but rather on increasing throughput while lowering cost for making moulds up to the point where locals could run profitable small scale production companies, running on plastic trash.

Filming / Photography

Sharing our results with the world is just as important as producing them in the first place. If you are good at producing visuals, we'd be excited to have you. If possible, please bring your laptop and camera to help us educate many more people about recycling and its challenges.

Current and Future Research & Projects

All of our research will be published open source and is meant to support other research teams, recycling or cleanup projects, but also small businesses across Southeast Asia and potentially Africa.

Differentiation of Plastic

This is our current main research project. Telling apart different kinds of plastic can be quite hard and not much research on the subject is public. Western universities are currently working on recycling robot arms, that - same as our example gallery - memorize common trash items and sort them automatically. A procedure that already hits its limit once items look alike, e.g. coffee cups of a major chain as there are paper cups and plastic cups that are visually similar.

Other issues for the robot arm are composite trash items. E.g. a napkin stuffed into a coffee cup, aluminium lids on yoghurt cups that are not fully ripped off or multiple items in a single (trash) bag.

The other popular approach is near infrared spectroscopy. First Western recycling plants already use it after shredding and washing plastic. Flakes are running down a massive slide. Individual shreds pass a scanner shining light at them and measuring the spectrum of light reflected from the plastic. Compressed air targetedly shoots out certain flakes.

Such machines are huge and cost hundreds of thousands of Euros. In a typical workflow each machine sorts out exactly one kind of plastic. The leftover flakes pass to another machine, then another, then another etc. This requires massive facilities and substantial funds. Which imposes an issue in Southeast Asian countries, where much of the trash of developed countries actually ends up.

That's why we've set out to develop a new kind of detection system. Instead of analyzing the full spectrum of reflected light, we built a discrete spectrometer, focusing on few important wavelengths. The prototype seems promising. But before we can fully use it, we need to scan tens of thousands of common items to collect training data for our AI that later on will do the actual work.

There is not much research on the topic publicly available. Most developments have been done by commercial machine manufacturers. We assume that publishing our collected data can be of substantial benefit to the research community.

Our device, once fully working, should cost below 100 Euros to manufacture.The first version will be connected to any laptop or computer, later revisions should be standalone and portable. The device is meant to support recycling efforts in low income countries and cleanup projects worldwide. We are already getting inquiries and interest from the international recycling community.

Working with Ocean Plastic

The more time plastic spent in the sun, be it in the ocean, in a river or along a street, it starts deteriorating. This is a challenge for recycling it, as new object might be less sturdy and break faster. Even brands that currently claim to use Ocean Plastic e.g. for making parts of shoes, are often playing with terminology and actually refer to plastic that was on the way to the ocean, instead of having been removed from the ocean.

One possible solution we read about could be adding antioxidants to the plastic. We have not yet verified this yet. But given that our long term goal is to reduce the amount of plastic in the ocean by incentivizing locals to use the plastic washed up along beaches, we need to test this extensively. The solution could lie in additives, adjustments to our recycling process or adjustments to the design of our products.

Making our Workshop Mobile

One of the best ways to direct attention to recycling and the worth of plastic it to show it to people first hand. That's why we would like to create a mobile version of our workshop. That may mean modifications to our machines to make them easier to transport but also smaller versions of our example gallery and the facts wall, as both are essential to convey the extent to how we currently use plastic.

Recycling with Students

We would like to invite school classes or offer a holiday activity for children where they bring a few items of common household waste, we sort and clean them together and make them into new items. Preferably items that children use frequently. Our current idea is to make rulers, as kids need them in class anyway and it's an item they use up to multiple times a day. What better reminder that plastic trash is not worthless.

And after all, one of the most powerful triggers to change the behaviour of adults, e.g. when encouraging them to separate trash on a household level, is to fascinate their children and let them do the convincing work ;)

We are currently working on low cost approaches to creating ruler moulds. This is especially challenging as these need to be very precise, unlike other objects.

Creator Spaces

Over the past two decades a myriad of studies and meta-studies have outlined the declining interest of students in natural sciences, natural history and engineering. But when we ourselves observed children and gave them simple tools and construction materials, such as wood, nails and hammers, pretty much all age groups produced surprising results. On the other hand, when quizzed about their favorite subjects in school, math or physics ranked low.

We believe that students get deterred from natural sciences due to the theoretical approach in schools. So we want to give them room to experiment, to build and to invent. First on our campus, later possibly at local schools where we want to create open workspaces outfitted with different tools and materials encouraging young inventors to try whatever comes to their mind.

A key component could be 3D printing. Plastic for a 3D printer needs to be of high quality and purity and its technically challenging to turn it into filament - essentially a long string of plastic - that then gets fed into a printer like garn into a sewing machine. This will be a challenge for us to produce, yet possible.

Access to 3D printers would allow them to construct and plan their inventions first on a computer and then create even complex objects in reality. Failed attempts run through our recycling process again and can later on be turned into new filament, teaching the idea of a circular economy from the start.

Effective recycling starts way before we dispose of something. It starts when an engineer first thinks of a new product and designs it to be easy to repair or to disassemble. It starts when materials in a product are clearly labeled and chosen with the recycling process in mind. It starts when decision makers greenlight offering spare parts and publishing repair guides or companies take back used products and re-use the resources to create new products.

Creator Spaces are meant to tackle both issues at once: Inspiring young people to become the engineers of tomorrow, while raising their awareness for sustainable design.

Creator spaces are a part of the program that, once established, needs to spread to as many different places as possible to indeed reach a whole generation. That needs a lot of helping hands supervising and guiding young creatives as well as a lot of recycled plastic to power them.

Alternative Recycling Methods

First successful attempts have been done to turn styrofoam into activated carbon and to use microorganisms to decompose plastic and turn it into useful substances. Interestingly, both of these stunning results were produced by teenagers, not corporations. Both show that there are many more possibilities to recycle the unrecyclable. We will research on both of these as well as other promising fields.

Non-Plastic-Related Research

We also would like to research on other areas of research consumption, that could affect our recycling process but are not directly related to recycling. Such as making solar collectors from old refrigerator parts. We could use the hot water when cleaning plastic flakes but also for other purposes, such as hot showers in our accommodation.

Program Duration & Availability

Min duration (weeks): 1

Aims & Objectives

- Learn about recycling, the current challenges, why developed countries are not doing better than developing countries and what you can improve once you're back home
- Help clean along local roads, canals and rivers to prevent plastic from getting into the ocean and create awareness in the local community for the importance of cleanliness
- Help us develop or produce new items from recycled plastic to create awareness in the local community for the worth of old plastic and inspire them to recycle
- Develop our current workshop further or support or research

Schedule

Monday to Friday

- Join our activities such as collecting, sorting, cleaning or scanning plastic trash.
- Help us manufacture new items from old recycled plastic
- Work on new machines, moulds or techniques

This schedule can be changed and/or amended depending on weather conditions, local conditions and unforeseen circumstances.

Starting Dates

During 2019

This program starts every week.

During 2020

This program starts every week.

Participant Criteria & Requirements

Minimum age:	-
Maximum age:	-
Minimum English level:	Basic
CRB required:	On Signup
Passport copy required:	No
Resume copy required:	No
Required qualification:	None

Additional Requirements

There are no further requirements for this program.

Additional Equipment

Required

- Sturdy shoes and long pants for when we're collecting plastic along the river

Optional

- Laptop, if you are good with CAD modelling, programming, photo/video editing etc