

Bamboo Pencil Maker

Project Motivation: Pencils are a common and universally used product with vast domestic and international markets. They are conventionally produced from wooden slats that are then machined into 12 pencil halves and filled with pencil lead. The Indian market alone consumes an estimated 1.5 billion pencils per year, with an annual growth of 20%. Rural communities do not currently benefit from pencil making or the market. Furthermore, wood is in short supply and its usage leads to deforestation. Bamboo is often grown as a reforestation crop; it grows quickly and produces strong, wood-like stalks. Bamboo-based pencils have been produced. They look and function like regular pencils, including sharpening. The challenge in using bamboo is that it is round in form, hollow, and thin-walled compared to solid timber. If pencils could be made in large numbers from bamboo, very large numbers of poor rural communities would benefit.



Bamboo stalks



Conventional manufacturing stages of pencils

Technical Description: A new approach for making the pencils is to use three identical parallelograms to form the hexagonal shape of the pencil and leaving a cavity for the lead. There is a need for an inexpensive tool set or small human-powered machine to produce these pieces that will yield a pencil that is 5.5mm thick x 185mm. Another tool set is needed to construct the pencils by gluing these parts together with the lead inserted. The daily production capacity should be 500 pieces per hour, and the tool set and machines for either application should cost less than \$500.

Community: The International Network for Bamboo and Rattan (INBAR) (www.inbar.int) is an international organization working through several NGOs for the benefit of poor rural communities. INBAR is interested in producing such machines to enable rural communities to leverage local bamboo resources and provide income-generating opportunities.

Project Status: An initial set of prototypes to produce conventional slats was developed in D-Lab: Design class in 2008, but the project was not completed.

Chlorine Generator

Project Motivation: More than 1 billion people lack access to safe drinking water. This unacceptable reality causes over 1.5 million deaths each year from water-borne diseases, with the vast majority of these deaths being among children under the age of five. Point-of-use water treatment has recently emerged as a promising approach within comprehensive water quality improvement strategies. Local chlorination can be a low-cost, rapidly implemented, and effective technology. However, treatment with chlorine presents supply chain challenges in many areas, and even though it is relatively low-cost, chlorination can consume 5-10% of a person's income in communities where the average income is \$1 a day. Local production of chlorine using the electrolysis of salt water has the potential to provide safe drinking water, while also eliminating the supply chain concerns that arise with other chlorine products.



A riverside scene on the Black Volta,
Ghana



Super capacitors



Using the Miox tungsten electrode chlorination pen in
Peru

Technical Description: There is a need for an affordable electrolysis-based chlorine generator that does not use batteries as an energy source, an alternative is a device that uses super capacitors to store energy. The device must be safe to use, durable enough for frequent use and treat a useful amount of water for household use.

Community: There are numerous communities that work in partnership with D-Lab throughout the world where this prototype can be field-tested. The potential for application of the project is virtually limitless, given the severity of the worldwide water crisis.

Project Status: This is a new project, although a related project was developed at IDDS 2010.

Soda Bottle Chipper

Project Motivation: The Brazilian union of catadores (wastepickers) currently sell plastic soda bottles made of PET to processors who cut them into flakes that are of a size that is useful to manufacturers. This is the first step of the PET recycling process; the chippers then sell the flakes to manufacturers that either pelletize the flakes or use flakes to make new products. The process is currently done on an industrial level; all the machines used are big and expensive. The challenge is to develop a low cost solution that would enable the catadores union to process the bottles themselves and then sell directly to the manufacturers.



PET soda bottle



Industrial plastic chipper



Samples of plastic flakes

Technical Description: There is a need for an inexpensive, easy-to-use, human-powered machine to produce flakes with a mean size of 12-16mm. The initial goal is to deploy a machine into a centrally located cooperative that would then serve a network of twenty other Sao Paulo recycling co-ops. The capacity of the machine needs to align with the throughput and financial resources of each of the recycling co-ops.

Community: Rede CataSampa, <http://www.catasampa.org/>, is the local Sao Paulo chapter of the national Brazilian organization of catadores, <http://www.mncr.org.br/>. With an income of only two-thirds of the Brazilian minimum wage of \$10USD per day, catadores represents one of the most marginalized segments of Brazilian society.

Project Status: This is a new project.

Portable Pedal-Powered Washing Machine

Project Motivation: In Peru, many women earn their living by washing clothes. They go to one house and wash the clothes of the residents, then move on to the next house. They wash the clothes by hand, which limits the amount of laundry they can do each day. A portable, pedal-powered washing machine would allow them to wash more clothes with less effort, thus increasing their income.



The first D-Lab Bicilavadora



The second Bicilavadora, built at MayaPedal in Guatemala



A portable pedal-powered grinding wheel

Technical Description: The portable washer needs to quickly switch between a wheelbarrow-like, transport mode to a washing mode. In transport mode it needs to be easily moved by a small adult in an urban environment that includes well maintained sidewalks and rough unpaved back streets. It needs to be able to wash and wring out a range of clothing including jeans. The machine needs to increase productivity enough and be sufficiently inexpensive that it pays for itself in 6 months. Water will be supplied by hose or bucket at the washing location.

Community: PRISMA is a non-government organization in Peru that focuses on capacity building and micro-credit opportunities for the poor. LimaKids is a PRISMA project that works with homeless children and orphanages and is looking for business opportunities for young adults, with poor job prospects, to transition to supporting themselves through legal and dignified work.

Project Status: This is a new project.

Pine Needle Stove

Project Motivation: In the foothills of the Himalayas, forests of introduced pine trees have led to many environmental problems. The pine needles cause acidification of the soil, lead to excessive rainwater run-off and pose a risk of forest fires. The needles do, however, have a high energy content, and could be used as fuel for either cooking or heating.



Pine needle litter



Burning unprocessed pine needles

Technical Description: This project is to build a stove that uses pine needles as fuel. The stove may be used for cooking or heating (or both) and should be safe to use and cost less than \$15 to produce. The pine needles may be processed prior to use, however if this is the case, the design should include processing equipment as well.

Community: Avani develops and disseminates appropriate technologies in the Kumaon region of Uttaranchal, India. They also promote craft and farm-based livelihood opportunities in the area.

Project Status: This is a new project.

Vegetable Cutter

Project Motivation: The Sagrada Familia orphanage in Lima, Peru provides a home for nearly seven hundred children in the greater capital city area. Feeding such a large number of children is a daunting task for the orphanage's staff, and must be done on a daily basis. Despite this, the leader of the orphanage is looking to promote healthier diets by introducing more variety in meals. He now has the resources available to purchase and transport more vegetables to the orphanage but is looking for a faster way to prepare the large quantities of food. A more efficient cutter for vegetables would allow the orphanage to provide better nutrition for its children and help promote healthier lifestyles.



The kitchen at Sagrada Familia



Sagrada Familia compound



One of the children

Technical Description: Providing healthy options for the children requires quick preparation for large amounts of vegetables. Tools that would help cut and slice these vegetables would allow Sagrada Familia to provide these nutritious meals on a more regular basis to the children. For some perspective, if the staff wants to feed a salad to each of the children consisting of lettuce, three tomatoes and two carrots they would be required to wash and slice over 2100 tomatoes and 1400 carrots. The new cutting tool or mechanism would handle large quantities of food at one time, be capable of handling multiple types of vegetables, and provide a variety of cutting options (e.g. slicing, quartering). Ultimately, the machine must increase their vegetable or salad throughput.

Community: The Comunidad de Niños Sagrada Familia is an orphanage located in Ventinilla, Peru outside of Lima which houses and cares of children mainly from the Lima and Cuzco regions of the country. At the orphanage they learn values, attend school, do chores, and practice skills (baking, ceramics, and carpentry) which help them in the future.

Project Status: This is a new project.

MIT OpenCourseWare
<http://ocw.mit.edu>

EC.720J / 2.722J D-Lab II: Design
Spring 2010

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.