



## What this Issue is All About **Biomass Briquetting**

This issue of our chapter newsletter is dedicated to providing an update on the work on the biomass fuel briquette.

A biomass fuel briquette utilizes agricultural, food, domestic, and commercial waste to create a briquette that can be used for cooking fires in place of wood.

Many thanks to Johannah Itescu, Pat Corcoran, Zan Smith, and Lee Hite for their contributions to the briquette development along with providing articles and support for this newsletter.



## this issue

- About this Special Briquette Issue **P.1**
- Biomass Chopping & Grinding **P.1**
- What We Learned on our 2010 Trip **P.2**
- The Challenges of Banana Waste **P.2**
- Briquette Press Progress **P.3**
- Plans for the 2011 Trip **P.3**
- All Africa Briquetting Conference **P.4**

## Progress in Biomass Chopping & Grinding

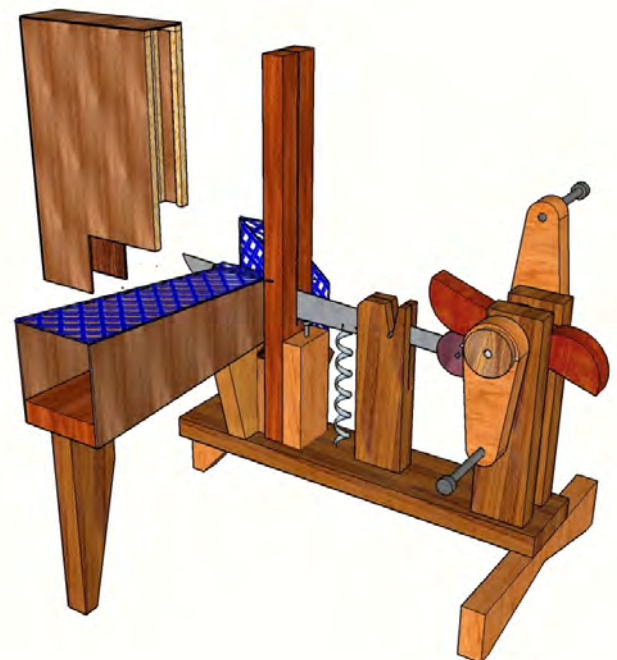
A big challenge with the briquette project is creating the pulp that goes into the briquettes. This requires shredding large amounts of leaves. It was initially thought that this could be easily done with a machete or a mortar and pestle, but after firsthand experience in Rwanda EWB found this may only be practical for individual households. Given EWB's goal of producing briquettes in small and large scale operations, a new method needed to be devised.

This led to experimentation with allowing the biomass material to break down naturally through composting. It also gave way to a concrete grinding mill akin to the type used to process wheat. This mill was produced by EWB's resident mad scientists, Lee Hite and Zan Smith, deep within the bowels of our research lab, aka Lee's basement. The mill was a very impressive contraption but it still did not grind banana leaves down into the form needed for briquette production.

Lee and Zan decided to attack the problem in two steps and developed the "Easy Biochop." This machine chops the stalk into small pieces using essentially an automated machete. Most importantly it is easily constructed with simple hand tools and does not require welding or tight tolerances like many of the briquette shredding

devices currently on the market. The unit works well with both wet and dry material. A single operator can easily operate the chopper while a second person adds feedstock. (Easy Biochop pictured below)

Once the materials are chopped they generally need to be ground into finer cornflake size pieces to make a quality briquette. This is achieved using the "Easy Biogrind" which uses a concrete drum with teeth and mirrored outer shell constructed from a simple concrete mold. Three options for grinding drum profiles make this an extremely flexible grinder.



## From Our 2010 Trip

During our trip to Rwanda in 2010, we began a technical and cultural assessment of biomass briquettes. We used a viewbook with each step in the briquette process to help our conversations.

### Gathering and Storing:

Banana trees are ubiquitous, but only harvested during the rainy season. Peels from starchy legumes, such as potatoes and cassava, are also widely available, but they prove to be very moist and difficult to burn. Biomass needs additional study specific to the seasonally available resources.

### Chopping and Grinding:

The machete and the mortar and pestle were used for processing the biomass. Both require significant manual effort. While this is not uncommon in villages such as Muhororo, this step could benefit from innovation.

**Burning Briquettes:** The stoves observed were not designed to prevent the emission of smoke or escape of heat. One rocket stove, a small efficient stove, was seen at the orphanage but was not used. Similar stoves can be shaped out of locally available clay by artisans, as suggested by villagers in Muhororo.

The laws against cutting down trees for burning and the interest in small business enterprises might make briquetting a viable option.



EWB-GCP has been exploring using banana plant waste as a biomass fuel. We tested banana leaves, stalks & stems, blackened skins, banana fruit (the mushy part), and combinations with sawdust, wood chips, paper pulp from newspaper and maple tree leaves. **Many thanks go to the Krohn Conservatory for keeping us stocked with banana materials.**

The banana plant in addition to being a ubiquitous fruit, has a long list of amazing qualities. Unfortunately, the very qualities that contribute to making this a unique plant work against the successful use as a biomass fuel briquette.



**ENGINEERS WITHOUT BORDERS-USA**  
**GREATER CINCINNATI PROFESSIONAL CHAPTER**

## Exploring Banana Waste For Fuel

**Banana plant properties that make it useful for many products work against it for use in biomass briquettes**

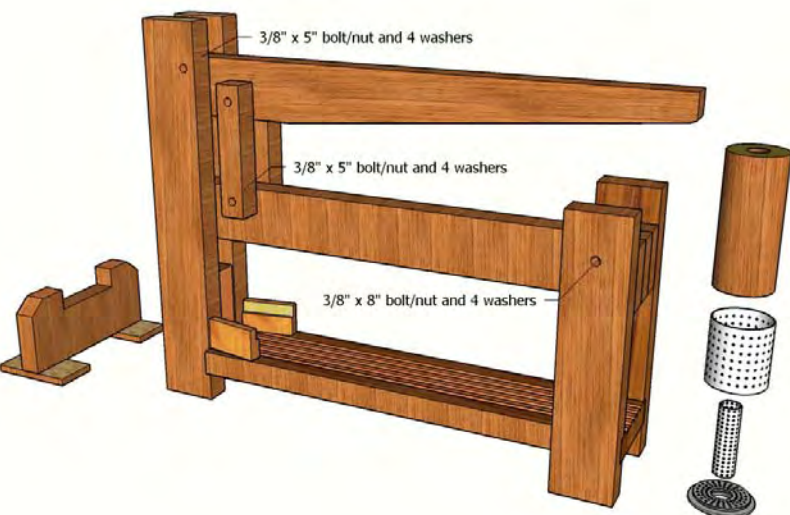
other biomass is added to the fiber mixture, water release is further impeded.

Superior strength allows it to be used for printing money, rope cordage, yarns, tea bags and shoes. The fiber has a beautiful sheen and is not easily crumpled making it ideal for wedding gowns, handbags, wall hangings and table mats. This strength inhibits the fiber from easily breaking and requires cutting into small sections for the biomass prep. A specially designed grinder was necessary to release the fibers from dried banana fronds.

Biomass fuel briquettes from the waste products of the banana plant (stalk, leaf & stem) are possible but may not be practical because of the natural qualities of the banana plant. It may be more productive to harvest and sell the fibers from the stalk than to make fuel briquettes.

The banana plant has a natural antimicrobial and antibacterial substance that allows the leaf to be used as a hygienic dining plate. Efforts to release the fibers from the plant waste required composting which is seriously impeded by this antimicrobial and antibacterial quality.

The banana fiber contains numerous capillary tubes allowing it to absorb water better than cotton fiber and to release water more rapidly. This quality makes it an ideal fabric as it can quickly absorb perspiration yet remains dry to the touch. The fibers are used for natural water purification and bioremediation. Unfortunately, when the fibers are packed tightly into a fuel briquette, the water release is very slow and it is nearly impossible to completely air dry the briquette. If



## Briquette Press Development & Sharing

The past year and half has given way to a number of briquette press designs. Our first press consisted of a few pieces of scrap lumber nailed together, but now has evolved into seven different designs created for various applications.

One of the earliest and most compact of these designs involved a caulk gun but the reality of the materials on

ground in Rwanda and the lack of the village Home Depot forced us to look into simpler presses.

This led to our take on the large compound lever press. This press had been designed and successfully implemented to employ large numbers of people. Given the name, it is no surprise the press is over eight feet long. As handy as it is, a large press is not a practi-

cal appliance for the average home-briquetting operation.

We learned that such a large press was not necessary and began to create smaller designs that were just as effective but used less material and were simpler to build.

During this process, the Muhororo orphanage was able to construct their own press at their woodshop based off of plans that we sent them. This press was used by the 2010 EWB-GCP team while they were on the ground in Rwanda to test different mixes and was extremely beneficial in the assessment.

The most recent design is the small single lever press. It is easy to build, compact, and uses very little material. The design can be found on [http://home.fuse.net/engineering/ewb\\_project.htm](http://home.fuse.net/engineering/ewb_project.htm) along with the other press designs.

## For Our 2011 Trip

During the EWB-GCP water implementation trip to Rwanda this summer, we will continue the assessment of biomass .



We formed a partnership with the Kigali Institute of Science and Technology (KIST). Leading up to the trip, we will be working with a briquette team at KIST to investigate formulations based on biomass available in the region. During the trip, we will meet with KIST and the Rwanda Ministry of Infrastructure and Energy to discuss the feasibility of biomass briquetting from a technical and cultural standpoint. We hope the ministry meeting will help make briquette information available in villages all over Rwanda.

Last year, the travel team introduced the press design. This year, we plan to introduce the Easy Biochop design to improve the briquette process by reducing the intensive machete work required to manually chop the leaves down to size.

We will gauge the need and interest for biomass briquettes as an alternative to burning wood and assess the Easy Biochop design as built in Muhororo.

## From the First "All Africa" Briquette Producers' Conference

The conference began a process of developing a briquette producers' network, so that lessons learned regarding briquette production and usage could be shared among the countries/groups.

An excellent list of briquetting recommendations resulted from the conference. The conference report can be obtained by contacting the Legacy Foundation.



<http://www.legacyfound.org/>

Briquette Quality depends on:

- Composition of the Materials (dryness and selection)
- Preparation of Materials/Mixing
- Type of Stove Used
- Heat of the briquette to allow for maximum combustion

More conference information is on page 4 of this issue.



## You Can Help

Engineers Without Borders is made up of caring people from diverse professional backgrounds. There are always needs for volunteers with health care, language, shipping, clerical, writing, financial, agricultural, computer, social service, safety, marketing, and many other skills. Please go to: [www.ewbgcp.org](http://www.ewbgcp.org) to find out about our general meeting on the second Saturday of each month.

## First “All Africa” Briquette Producers’ Conference in Tanzania, Nov. 2010

Participating countries included Kenya, Mozambique, Chad, Ethiopia, Rwanda, Burkina Faso, Sudan, Botswana, the DRC and South Africa.

Biomass Briquetting Issues Discussed:

- Why do some briquettes smoke and others don’t?
- What recipes are people using and why?
- Should briquettes be standardized?
- What are some of the better storing and drying techniques?
- How were the groups formed? What is the group organization procedure?
- If establishing a business, what are some of the best ways to market briquettes?
- Is it enough to be a production group for the groups’ own usage of briquettes or is it necessary to sell briquettes?

More information on the conference can be found on page 3 of this issue.

The “All Africa” Briquette Producers’ Workshop provided an opportunity to assess the impact and progress of the original Training of Trainers conducted in 2009. Sponsored by the Legacy Foundation through a grant from the McKnight Foundation the conference is part of a three-year project to support environmental conservation in East Africa through establishment of biomass briquette small businesses.

EWB-GCP did not participate in the conference but has been coordinating with the Legacy Foundation and using what was learned to help with our work in Rwanda.

Our thanks go to the Legacy Foundation for their excellent coaching and mentoring on all aspects of biomass briquetting.



## ENGINEERS WITHOUT BORDERS-USA GREATER CINCINNATI PROFESSIONAL CHAPTER

EWB is a non-profit 501(c)(3) organization. Your contribution is tax deductible.

US Organization: [www.ewb-usa.org](http://www.ewb-usa.org)  
Cincinnati Chapter: [www.ewbgcp.org](http://www.ewbgcp.org)  
Email: [ewbgcp@hotmail.com](mailto:ewbgcp@hotmail.com)

Engineers Without Borders Greater Cincinnati Professional Chapter is a non-profit humanitarian organization established to partner with developing communities worldwide in order to improve their quality of life.