Engineering Intern—Sustainable Coconut Processing

Background

CocoAsenso is a social enterprise startup that is creating market and employment opportunities for remote coconut farmers in the Philippines. We are doing this by establishing a network of small-scale coconut processing facilities that increase efficiency in coconut value chains.

We have just begun operations of our first processing facility on the island of Samar, one of the poorest and largest coconut producing regions of the Philippines.

To date, we have received funding from the Philippine government, Bank of the Philippine Islands Foundation, DBS Foundation, Peace and Equity Foundation, Fair Trade USA and private investors. This engineering project is being funded by Lutheran World Relief and will prepare us to begin establishing expansion facilities by the end of this year.

A more detailed description of CocoAsenso's business model and engineering challenges are provided below, following the internship description (page four).

Dates

The dates for this position are flexible. However, the intern must be available for a minimum of two months between June and August 2018. A strong preference will be given to candidates who are available for at least three months. Ideally, the internship will start mid-June and finish mid-October (i.e., four months). The internship is full-time (40 hours per week).

Position Purpose

To lead the design, construction and installation of an integrated biomass energy system and improved coconut meat dryer for CocoAsenso's processing facilities.

- The biomass energy system will be based around charcoal production, gasification of charcoal (to produce syngas for generator) and heat recovery (to provide heat for coconut dryer and boiler).

- The dryer will be thermally tied into the biomass energy system. The dryer may be a cabinet dryer, conveyor dryer, fluidized bed dryer, or some other type of dryer that would be ideal for CocoAsenso's production of desiccated coconut.

If time allows, the intern will also contribute to designing plans for a desiccated coconut processing facility that is constructed primarily out of used shipping containers and meets international food safety standards.

The intern may also be asked to contribute to other engineering-related projects related to CocoAsenso's work.

Duties

- Research design options and review preliminary research and design work conducted by CocoAsenso and student volunteers
- Perform side experiments or pilot studies, if needed, to better understand equipment or material characteristics
- Complete design calculations, drawings and specifications for an optimal biomass energy system and coconut dryer
- Develop a construction schedule and budget for project delivery
- Supervise construction activities to ensure project is going as designed
- Make quick decisions or calculations regarding any material or process changes needed during the construction phase
- Check all materials, welds, equipment, plumbing etc. before operation
- Test each component for operability in process order to ensure working condition
- Complete any final design changes, construction or other required work necessary to operate the equipment
- Develop operation and maintenance documentation
- Enjoy a cold glass of tuba on us!

Qualifications

- Recent graduate, current graduate student, or current upper-level undergraduate student in Mechanical or Agricultural Engineering, or similar
- Strong skills in mechanical and thermal design and analysis
- Creative thinker and capable of creating frugal solutions with limited resources
- Passionate about hands-on work
- Experience with computer aided drawing such as AutoCAD, Sketchup, Microstation, etc. to generate technical designs
- Confident working in different cultural environments, respectful and sensitive of local culture
- Strong verbal and written communication skills
- Enjoys working both independently and as part of a team
- Passionate about sustainable development and poverty alleviation
- Enjoys working in a startup environment
- Comfortable living in very basic accommodations in a rural area of a developing country (project and living location are thirty minutes from the nearest ATM and two hours from the nearest full-service hospital)

Compensation

- All work-related expenses will be covered by CocoAsenso (international round-trip airfare, visa, room and board, local travel, etc.).
- Intern will also receive a stipend of $500 per month.
- Intern will be responsible for medical expenses, personal travel, etc.

Your Home in Paranas

Paranas is a small municipality located on the western coast of the Island of Samar. It is a beautiful verdant island dotted with coconut palms, spectacular coastline and the hum of rural life. There are limestone caves, cold springs, rivers, forest and beaches to explore. Very few tourists come to this remote region. The people of Samar are very friendly and curious as to why you have come to their island. It is not uncommon to be invited into people's homes and be offered a snack or glass of tuba (local coconut wine). Kids are the first to greet you in each town and people love to laugh and smile. The local language is Waray-Waray. However, English is widely spoken, which makes it even easier to interact with the Samareños.

Tacloban is the closest city (two hours away). It was devastated by one of the strongest typhoons ever recorded in 2014 (Typhoon Haiyan). However, a casual visitor today would not immediately notice the storm's damage. Manila and Cebu are short flights away from Tacloban (costing around $100 round-trip). From Cebu or Manila, you can fly to almost anywhere in SE Asia within four hours.

For Interested Applicants

Please read below to learn more about CocoAsenso and the engineering challenges you would be working on. Then click here to fill out our Google form application.

If the link above does not work, copy and paste this url:
https://bit.ly/cocoasenso-engineering-internship-application

Application Deadline

We are currently accepting and reviewing applications on a rolling basis. If the position is still listed on our website, we are still accepting applications.

CocoAsenso's Impact and Business Model

Challenges facing coconut farmers in the Philippines:

15 million Filipinos are dependent on coconut farming, and 60% of these farmers live in poverty (according to government statistics).

A major reason for the low incomes of coconut farmers is that most have little choice but to process their coconuts on their farms into a very low value product called copra (i.e., smoke-dried coconut meat used to produce a low quality oil). Average net income from copra production is around $620 per year.

The recent explosion in demand for high-value coconut products, particularly virgin coconut oil (VCO), presents opportunities for change. However, these products are almost always produced in large-scale factories located in industrialized regions. Therefore, the poorest coconut farmers, who live in remote regions, are excluded from opportunities to participate in high-value coconut markets.

CocoAsenso- a new model for coconut processing:

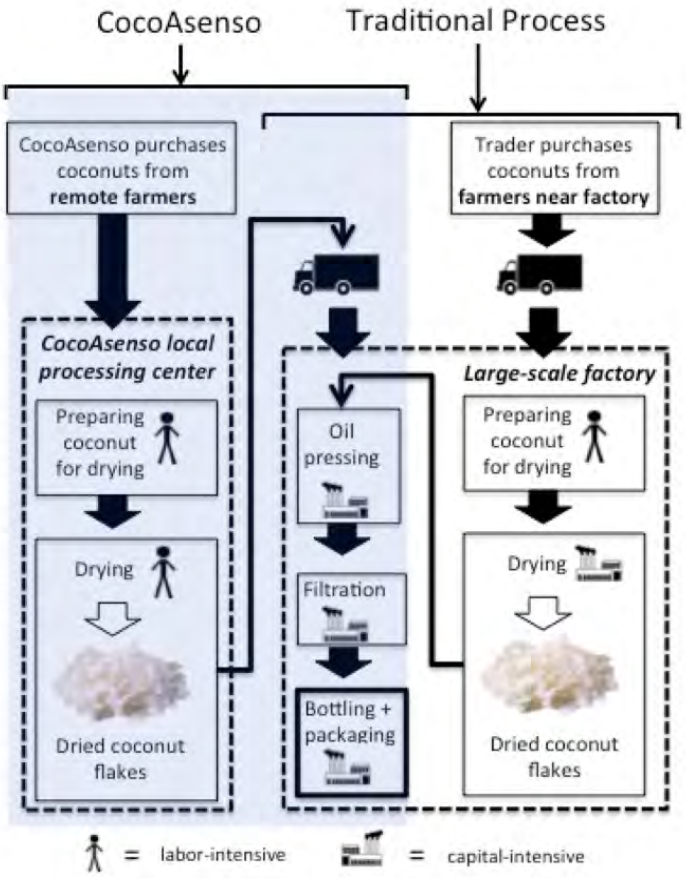
CocoAsenso has developed a value chain innovation to make VCO production more efficient and inclusive.

First, here's a little background on VCO production:
VCO is produced through a two-stage process. The first stage involves processing whole coconuts into desiccated coconut (DC), or dried flakes of coconut meat. The second stage involves expelling the oil from the DC (using a screw press) and filtering the oil. Currently, the entire process takes place in multimillion-dollar factories located in industrialized regions of the Philippines. Since factories are clustered in these industrialized regions, they compete heavily for nearby coconuts, which represent their number one cost of production. In more remote regions, coconuts are available at significantly lower prices, however transportation to the large factories is prohibitively expensive.

Here's the opportunity:
VCO factories do not necessarily need coconuts. What they need is a reliable supply of high-quality DC at a low-price. With the right technology, DC can be viabely produced in small-scale factories located in remote regions--and it is seven times cheaper to transport DC to VCO factories than whole coconuts.

Here's what we are doing:
CocoAsenso is establishing a network of town-level DC processing centers in remote regions of the Philippines. Coconuts will be purchased directly from local farmers who will also be employed in the labor-intensive production process (each facility will source from 200 to 600 farmers). DC will be sold to VCO manufacturers for cheaper than they can make it themselves (enabled by lower cost coconuts, transportation and labor). CocoAsenso will also produce some of its own VCO at a central facility (initially through a toll processing arrangement with an existing VCO manufacturer).

Over time, we envision our coconut processing centers to evolve into farmer engagement hubs where we will use the strong relationships we have built with local farmers to promote improved coconut production practices, farming of crops between coconut trees and access to financial services.



Value chain structure of CocoAsenso vs. traditional processors.

CocoAsenso's first processing facility in Paranas, Samar.
Click here for more images.

Our Engineering Challenges

To be successful in the highly competitive coconut processing industry, our small-scale desiccated coconut processing facilities need to be as efficient as possible. The construction of our first facility was recently completed and it is able to meet basic market requirements (price and quality). However, this facility is not nearly as efficient as it could be. Before beginning construction of our second facility (which is planned for early 2019), we need to develop a more efficient energy system and coconut dryer.

Biomass Energy System

Our processing facilities are well positioned to utilize cheap agricultural waste generated by coconut plantations for meeting all of our energy needs. In addition to hopefully saving us money on our electricity bill, this will also make us more resilient to the frequent power outages that occur during typhoon season and it will give us more flexibility in where we locate our facilities (i.e., we won't need to locate them near power lines).

We have three potential sources of biomass:

- coconut shell
- coconut husk
- coconut fronds

We have three energy needs:

- electricity
- hot air for coconut drying oven
- steam for blancher

There are clearly many ways that we could utilize coconut biomass to meet our energy needs. The question is, what would an optimal system look like?

Considerations for an optimal biomass energy system (in order of importance):

1. Is able to consistently meet our energy needs
2. Economical to operate. (This likely means as little combustion of coconut shell or coconut shell charcoal as possible.)
3. Cheap/simple construction and maintenance
4. Expensive-to-ship components available within the Philippines
5. Short start-up times (ideally less than 1.5 hours)
6. Uses 20' or 40' shipping containers for any large structures (our future facilities will be constructed primarily out of used shipping containers to facilitate typhoon resistance, the ability to relocate facility if necessary and lower construction costs)

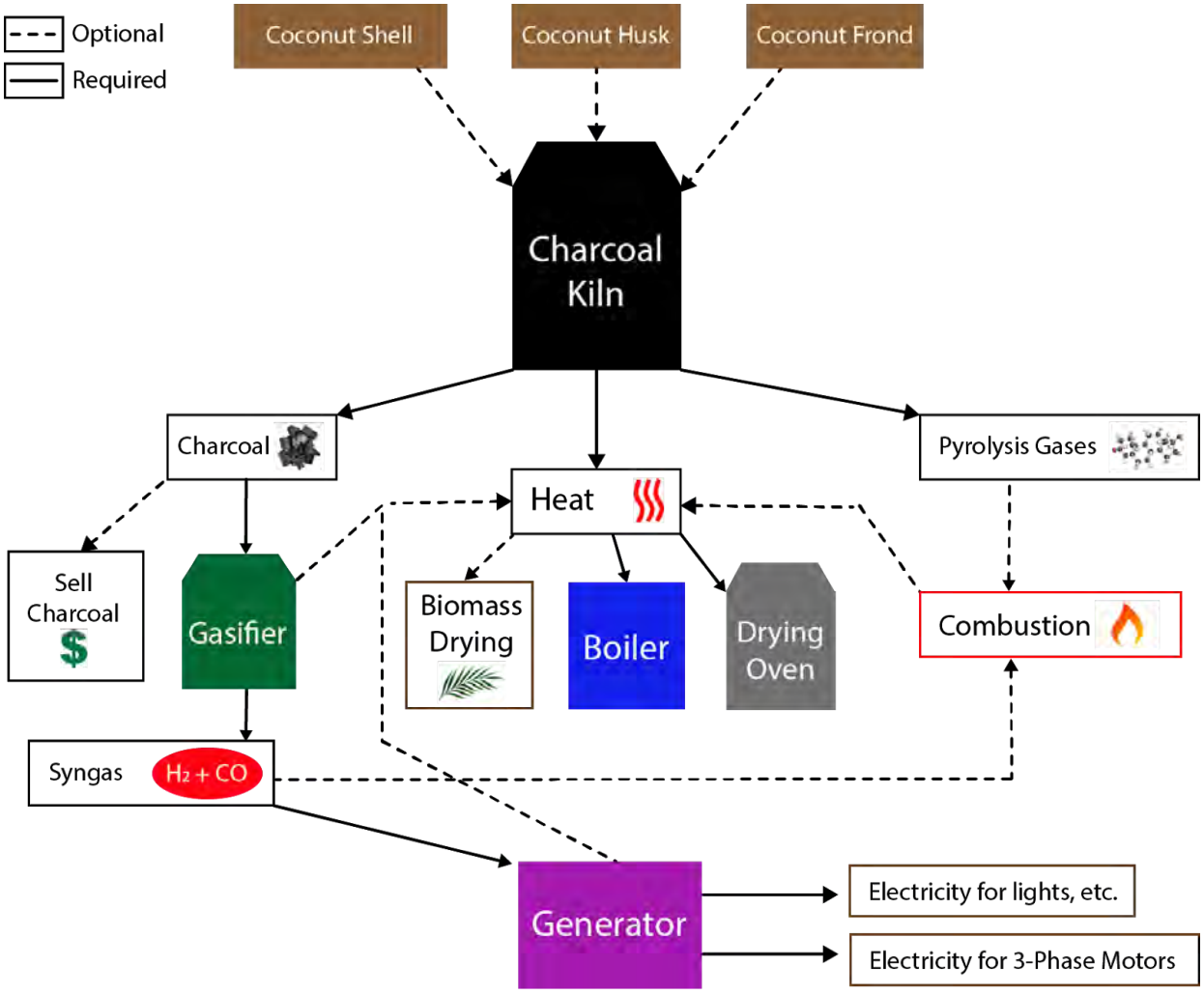
Current idea for energy system:

Our current idea consists of two-parts. The first part of the system would involve charcoal production (from coconut husk, fronds or shell), which would provide some of the heat needed for our processing activities. The second part of the system would involve gasifying the charcoal and using the syngas to run a generator (some of the syngas could also be combusted to provide additional heat). See below for process flow diagram.

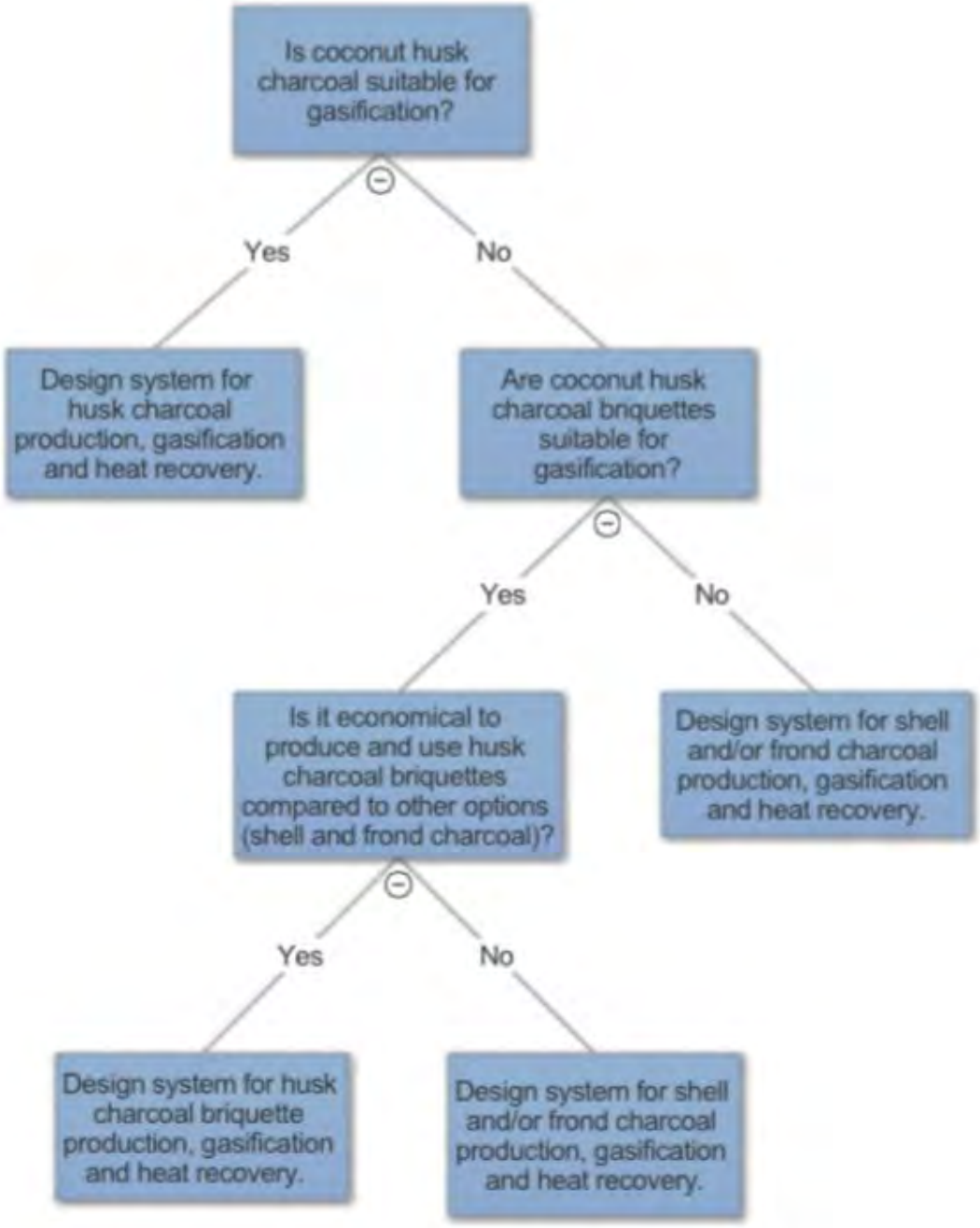
Why are we thinking about first producing charcoal and then gasifying it instead of simply gasifying raw biomass to meet all of our energy needs?:

1. By gasifying charcoal instead of raw biomass, our gasification system can be simpler in design and we will not have to worry as much about volatile gases damaging our generator.
2. Our processing activities require a lot of heat. Therefore we should be able to make good use of the heat and/or pyrolysis gases from charcoal production (i.e., we will not be wasting much energy of the biomass by first converting it into charcoal).

Note that this is an early idea and that we are very happy to consider alternatives.



Current idea for thermal process flow.



Decision tree for biomass selection.

Desiccated Coconut Dryer

We are currently using a locally-manufactured cabinet dryer for the production of our desiccated coconut. It is one of only a few commercially-available dryers for small-scale desiccated coconut production. Our dryer is able to produce desiccated coconut that meets our quality specifications. However, the dryer is far from being ideal and we would like to design something better.


Our current dryer.

Weaknesses of current dryer:

- Requires three full-time operators
- Lacks insulation
- Lacks mechanism for discharging humid air during drying
- Difficult to clean
- Cannot be easily expanded to accommodate increased production

We would like to develop a fluidized bed dryer, conveyor dryer, rotary drum dryer or improved cabinet dryer that improves on the weaknesses of our current dryer.

The intern will consult with experienced coconut processing engineers in designing the dryer.