IMPACT REPORT

BURN DESIGN LAB 2019-20

burn
DESIGN LAB

FROM THE EXECUTIVE DIRECTOR

Dear Friends of Burn Design Lab,

I hope that despite the COVID-19 pandemic, you and your loved ones are doing well. Here at Burn Design Lab we are mindful of both our supporters and of those we are striving to benefit with our work. This pandemic impacts everyone, and so we are continuing to do all that we can to "bring people together to help the world breathe easier"

The last four years since Burn Design Lab became independent of our sister organization, Burn Manufacturing, have been both rewarding and challenging. Our three stove projects and programs include the Improved Shea Roaster project, the Extended Life Stove project, and the Cookstove Testing Program. In addition to these efforts, through our network of volunteers, we are working with two cookstove organizations - one in Uganda and one in Guatemala – to increase production at their factories. Both of these projects are in the conceptual stage with the goal of applying appropriate levels of technology to greatly increase the capacity of both stove factories.

At times like these, we ask ourselves, why are we doing what we are doing? For me, the answer always brings me back to the women and children that these products will benefit. Recently we had an extensive user survey done to get a better understanding of the needs, preferences, and concerns of the women making hand-crafted shea butter. They appreciate that making hand-crafted shea butter gives them a livelihood, but at the same time, they are afraid of what it's doing to their long-term health. Fulera Imoro, while processing shea at the Tuntieya Processing Center outside of Tamale, shared with us that she's "worried this job will give me lung infections due to the smoke I am exposed to." Her coworker Zeliya Yakubu said, "my eyes ache a lot at night due to the smoke." We heard more responses just like these from every partner cooperative.

These projects are not easy; they take time, effort, and in the era of COVID, much perseverance. Never the less, when we hear comments like these from women just doing their best to provide for their families, it renews our conviction that we are doing the right thing and are striving for a worthy goal.

Despite the difficulties of the COVID pandemic, our mission remains the same – to see that people everywhere can cook their meals without jeopardizing their health or the environment. To fulfill this mission, we are working as closely as ever with our partners and colleagues in countries about side of the U.S.

We are most grateful for your partnership in this work, and you can be assured that the women, children, and men that our products serve are hugely grateful as well.

PAUL MEANS

CONTENTS

Cover: Abdul Fatawu (left) seated with Samata Nayi (right), the Assistant Magazia of the Gubdanda Shea Butter Center.

BURN DESIGN LAB'S HISTORY

According to the World Health Organization, three billion people around the world cook their food and heat their homes with open fires and solid biomass fuels. This system of cooking negatively affects the health, environments, and livelihoods of those in low- and middle- income countries without access to reliable and sustainable energy.

Peter Scott founded Burn Design Lab (BDL) as a 501c3 in 2010, with the vision to turn traditional cooking wisdom into safe, durable, efficient stoves that could reduce the fuel demands straining forest ecosystems while serving the needs of those living in extreme poverty. In 2012, a cookstove testing laboratory was built, and from 2013 to 2016 Burn Design Lab worked on the development of a natural draft wood stove - which would become the Kuniokoa, now manufactured and sold in Kenya. In early 2016, Peter Scott resigned from his role as president of BDL and left for Kenya to devote his attention to the for-profit venture called Burn Manufacturing. In the past 4 years, BDL has established itself as an independent non-profit organization, and expanded its work to include stove design and development partnerships in Kenya, The Philippines, Guatemala, Ghana and Uganda.

BDL engineers follow an integrated approach to stove research and design, including user and market research, modeling, designing, prototyping, testing, and user evaluation. BDL gives balanced consideration to reducing emissions, increasing efficiency, improving firepower, user safety, durability and cost. By designing clean burning cookstoves that produce fewer emissions and require less fuel, BDL aims to save lives, reduce deforestation, and promote the economic empowerment of women in the developing world.

CLEAN COOK STOVES 101

1. **3 BILLION PEOPLE** COOK WITH OPEN FIRES OR PRIMITIVE STOVES AROUND THE WORLD

2. ONLY **1/3 OF FAMILIES** RELYING ON SOLID FUELS HAVE ACCESS TO IMPROVED COOKING SOLUTIONS

3. **4 MILLION PREMATURE DEATHS** PER YEAR ARE CAUSED BY INDOOR AIR POLLUTION FROM OPEN FIRES AND RUDIMENTARY STOVES

4. ONLY **21.8% OF THE RURAL POPULATION** IN SUB-SAHARAN AFRICA HAS ACCESS TO ELECTRICITY

5. WOMEN AND CHILDREN SPEND ON AVERAGE **5 HOURS EACH DAY** COLLECTING FUEL

6. **2-5% OF GLOBAL GREENHOUSE GAS EMISSIONS** ARE FROM COOKING FIRES

7. **1.36 BILLION TONS OF FUELWOOD** ARE CONSUMED ACROSS THE DEVELOPING WORLD

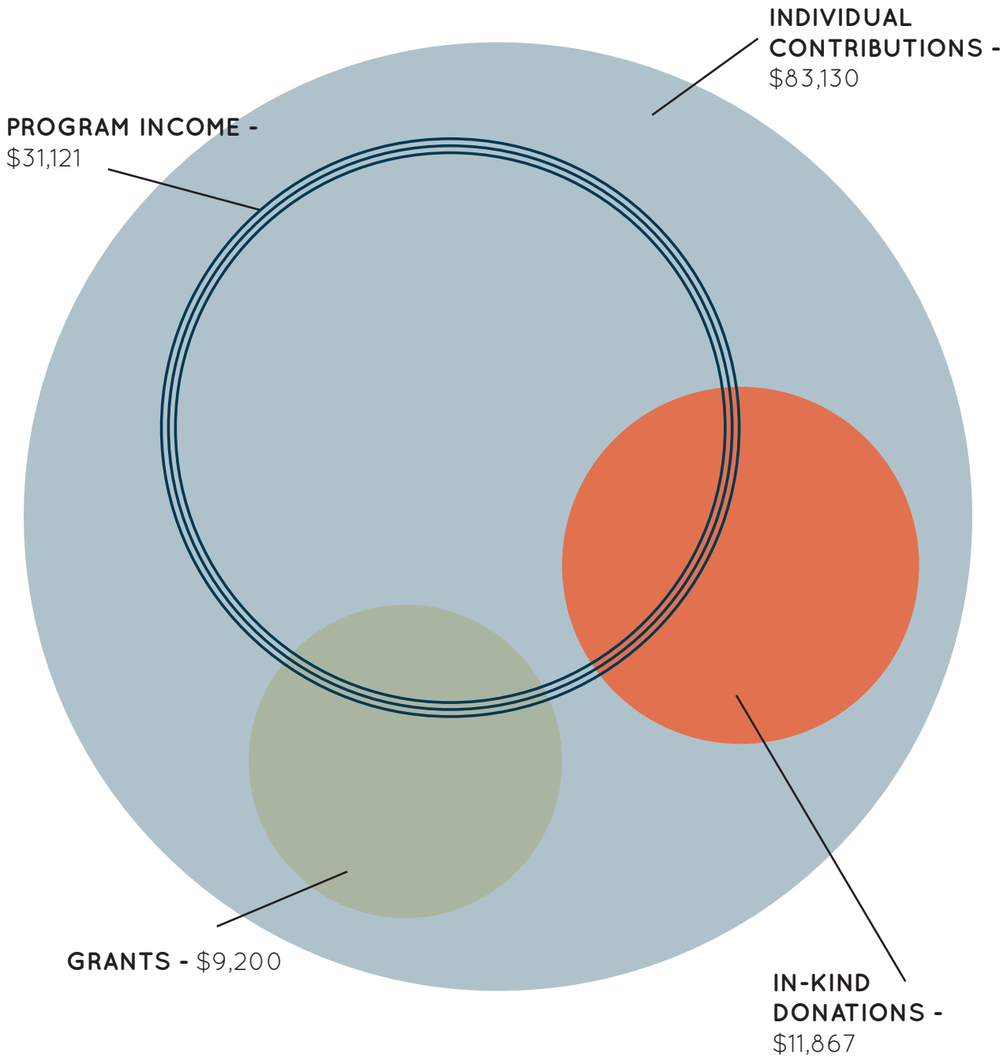
8. **52% OF DEFORESTATION** IN AFRICA IS CAUSED BY WOOD BURNING FIRES AND THEIR FUELS

9. **2030** IS THE GOAL FOR THE UN'S SUSTAINABLY DEVELOPMENT GOALS, INCLUDING SDG7: ACCESS TO AFFORDABLE AND CLEAN ENERGY

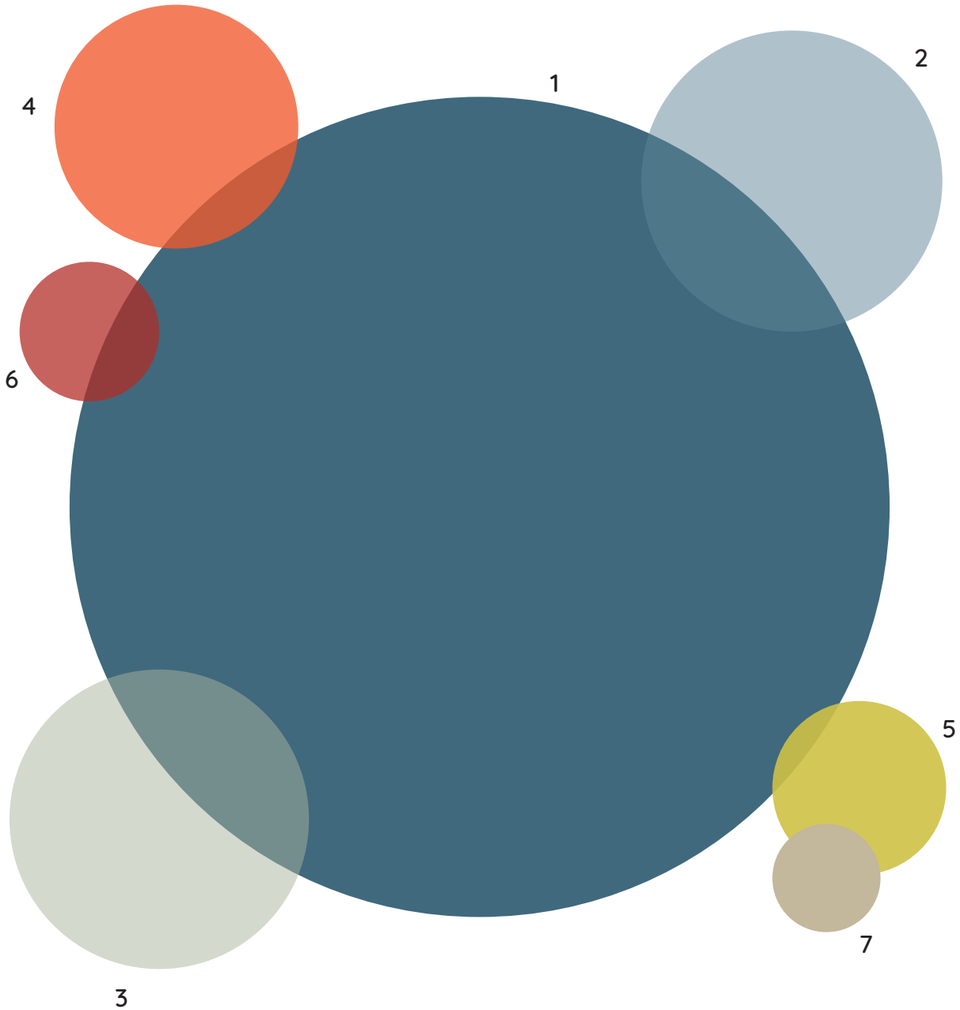
10. **$4 BILLION IN ANNUAL INVESTMENT** NEEDED FOR ADEQUATE, EQUITABLE ACCESS TO CLEAN COOKING TECHNOLOGY

2019 FINANCIAL STATEMENTS

TOTAL INCOME - $135,319



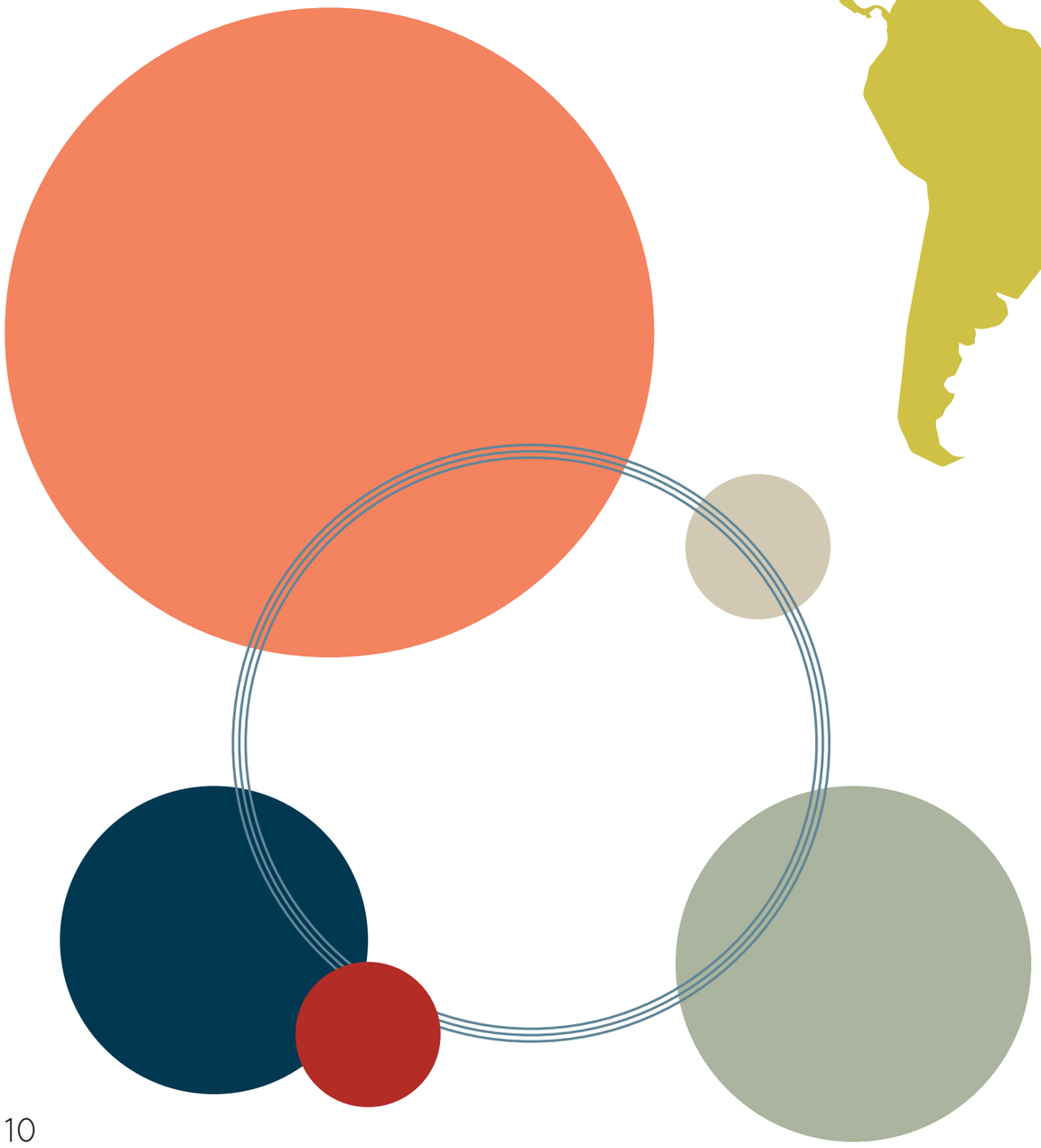
TOTAL EXPENSES - $256,025



1. Payroll: $176,520 (69%). 2. Facilities: $23,847 (9.3%). 3. Research and Development: $23,646 (9.2%). 4. Travel: $15,704 (6.1%). 5. Admin Operations: $8,137 (3.1%). 6. Legal and Professional Fees: $4,937 (2%). 7. Fundraising: $3,189 (1.2%).

2019 PROGRAM SERVICES

10 program services with impact in **4 countries**
Total 2019 Program Services Expenses: **$230,567**



- Improved Shea Roaster Project - **$91,822**
- Extended Life Stove Project - **$78,999**
- General Project Expenses - **$29,303**
- Burn Manufacturing Technical Support - **$20,779**
- Sustainable Biomass Fuels Project - **$4,843**
- Other - **$4,817**

PROGRAM HIGHLIGHTS

2019 Testing for Optimal Performance and Greater Impact

4 full-sized prototypes built and tested **124 times** in the lab

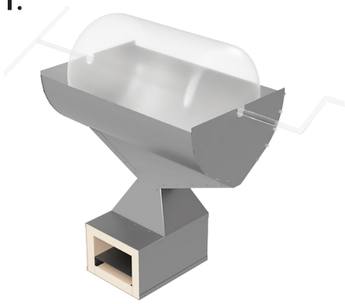
Prototypes tested at **5 shea butter cooperatives** outside of Tamale, Ghana

24 tests conducted onsite in Ghana

The Roaster Design: a Journey in Iterations

BDL engineers have successfully developed 3 iterations of our roaster protype through a process of modeling, designing, prototyping, and testing at our lab in Vashon, WA. User feedback has been acquired through field performance testing trips to partner cooperatives outside of Tamale, Ghana.

1.



In hopes of creating a prototype to test in the field, BDL engineers designed a full scale prototype, FP-0, to fit the drum sizes used in Ghana.

2.

In May 2019, the FP-1 protype was designed and used to conduct field testing in Ghana in June of 2019

3.

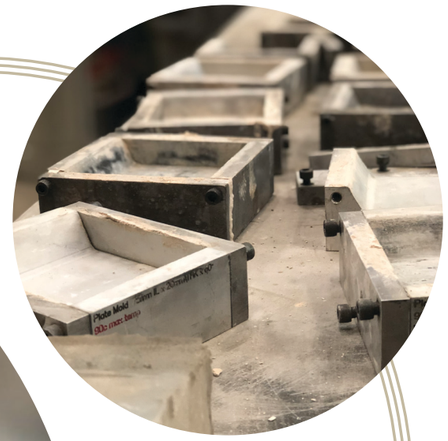
Next, BDL reevaluated past designs and issues that occured in the field to develop a list of design and testing goals for the new FP2 Rev E prototype, produced for testing in 2020.

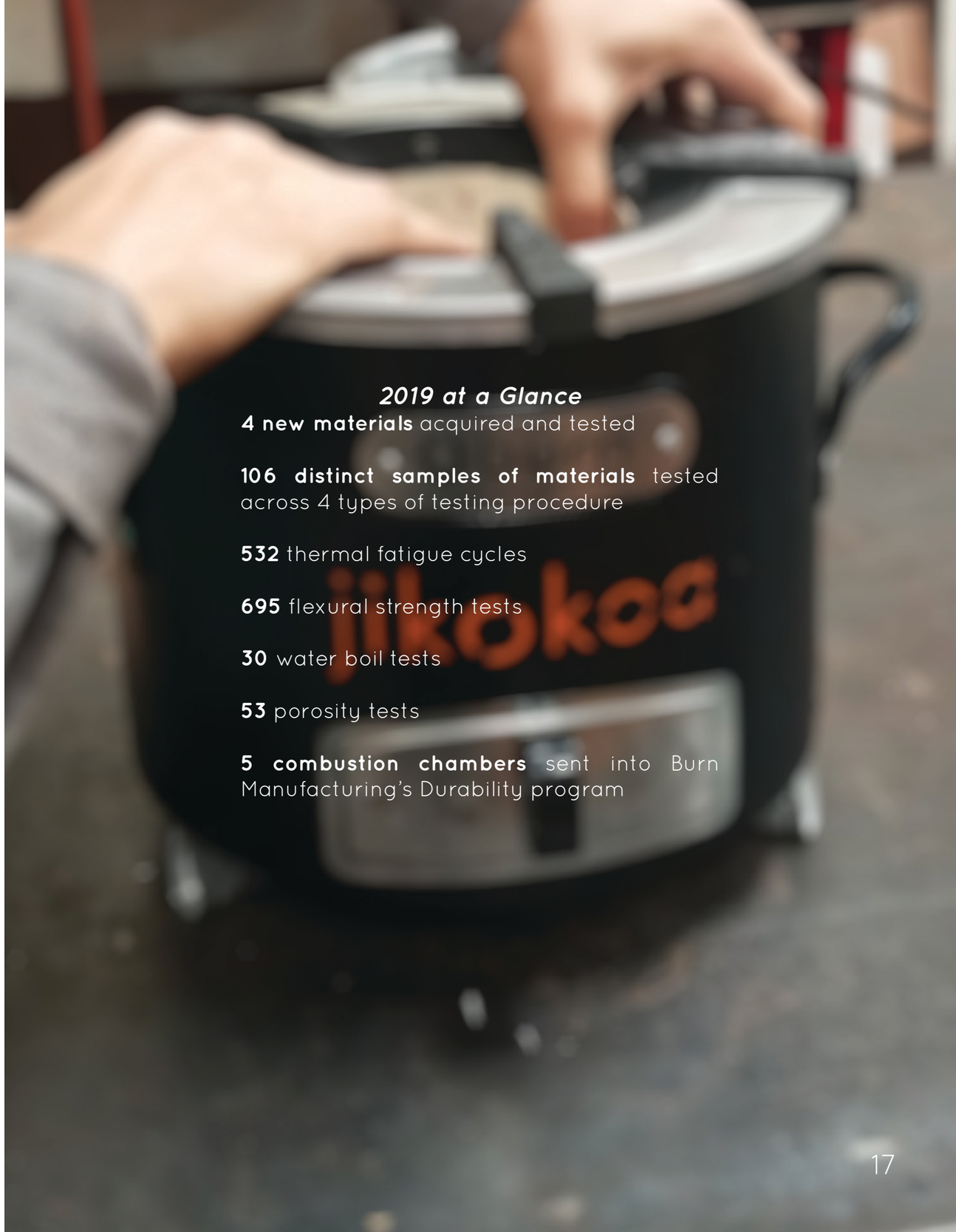
IMPROVED SHEA NUT ROASTER PROJECT

Every day in households across West Africa, women spend their time and energy engaged in some aspect of the shea butter industry, from gathering the shea nuts in the field to processing them into shea butter. The shea butter processing industry provides critically important cash income for many of the most vulnerable populations of women in West Africa. In northern Ghana alone, shea trees cover nearly 78,000 square kilometers of land and more than 600,000 women generate income from harvesting and processing the nuts. However, the vast majority of women in Ghana process shea using traditional indigenous methods. For this method women must use their hands, simple tools, and open wood fires for the entire arduous process of processing and refining the shea butter. The result is hazardous exposure to smoke and emissions, and the overconsumption of precious fuelwood. In 2018, Burn Design Lab began working to develop an efficient and clean burning Shea Nut Roaster in order to provide women in Ghana with an alternative method of roasting shea nuts, one where women don't risk life or tree limb for their livelihood.

EXTENDED LIFE STOVE PROJECT

The Jikokoa stove is well known for its environmental and social impacts. Over 100,000 stoves are sold each year in East Africa, collectively saving 3 million tons of CO2 and 1.8 million tons of wood since 2013. Now, Burn Design Lab is working to improve the Jikokoa by increasing its usable lifetime by at least 50%. Charcoal stoves are subject to severe swings in temperature, from cool resting temperatures to high temperatures of up to 1000 degrees C. Stove temperatures swing from cold to hot to cold three or more times per day, which wreaks havoc on the metal making up the stoves. The Extended Life Stove project focuses on extending the life of the Jikokoa charcoal stove with materials that can withstand frequent temperature changes and last longer while also being inexpensive enough to make the stove accessible to the hundreds of thousands of people buying the stove every year. The ELS project was made possible by a generous grant from the Grantham Foundation for the Protection of the Environment.





2019 at a Glance

4 new materials acquired and tested

106 distinct samples of materials tested across 4 types of testing procedure

532 thermal fatigue cycles

695 flexural strength tests

30 water boil tests

53 porosity tests

5 combustion chambers sent into Burn Manufacturing's Durability program

COOKSTOVE TESTING PROGRAM

The potential environmental, health, social, and economic impacts of a new cookstove design are difficult to quantify without first measuring the performance of it. At Burn Design Lab, we pride ourselves in our ability to provide our testing services and cutting-edge facilities to underserved cookstove manufacturers and entrepreneurs alike. In our laboratory we collect detailed measurements on emissions and fuel efficiency.

These measurements provide areas of improvement for engineers to modify their cookstoves to best serve the needs of the community that they distribute in. While a test is running, the emissions hood collects CO, CO 2, and PM 2.5 (particulate matter measuring at 2.5 microns or less) emitted from the cookstove. The emissions are collected and measured by the Laboratory Emissions Monitoring System (LEMS) developed by the Aprovecho Research Center. All results are reported using the ISO international Workshop Agreement (IWA) Tier system. A cookstove's rating is based on its performance in the areas of efficiency, indoor and total emissions, and safety.

INTERNSHIP AND FELLOWSHIP PROGRAM

Burn Design Lab supports engineers and scientists with a passion for improving the world. BDL provides young STEM professionals with design, prototyping, metal working, testing, product development, project management, and international experience. Interns and recent graduates are able to apply what they have learned or are learning in school, to one of the largest, most challenging problems on the planet.

ACKNOWLEDGEMENTS

Supporters
Henry E. Niles Foundation
Tides Foundation
Leiter Family Foundation
Grantham Foundation
Winrock International

Partners
University of Washington
Burn Manufacturing
International Lifeline Fund
Hands For Peacemaking Foundation

Board of Directors
Arie Verloop
Mikaela Alger
Meher Antia
Bob Powell
Jonathan Posner
Keith Putnam
Seth Zuckerman

Volunteers
Lou Fezio
Brad Johnson
Bryan Willman
Jack Kirkman
Peter Ariessohn
Charlie Sellers
Tom Lentzner
Margaret Morency
Anthony Ruh
Richard Ruh

burn

DESIGN LAB