KENYA COOKER

SHELL OIL COMPANY

EDSGN 100 Section 017
Submitted to Andrew Lau
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TEAM TURBO

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PROBLEM STATEMENT

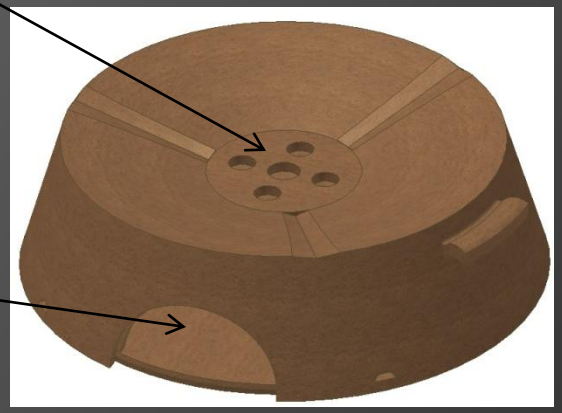
- Our goal was to create a biomass stove that is not only more efficient and more effective than the Envirofit, but also more affordable.
- This stove must also be able to use new fuels such as corn, Switchgrass, Miscanthus Gigantus, etc.

TURBO TOASTER

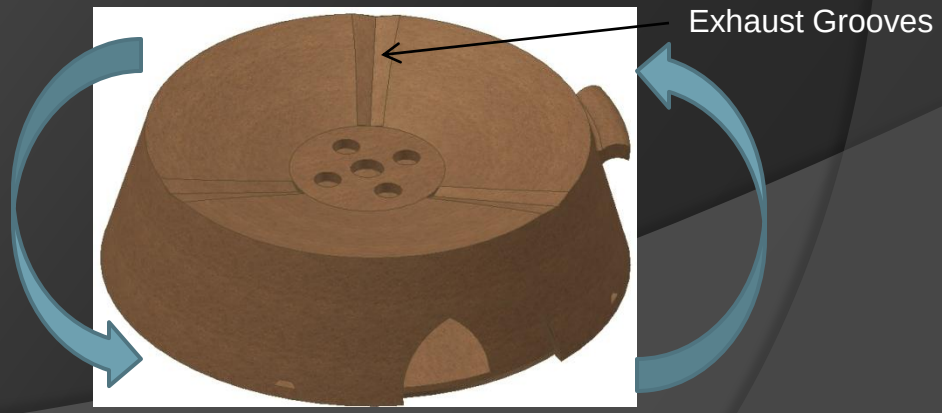
Bottom Piece

Top Piece

Assembly Open



Assembly Half Open



Link to Inventor and SolidWorks files Turbo Toaster

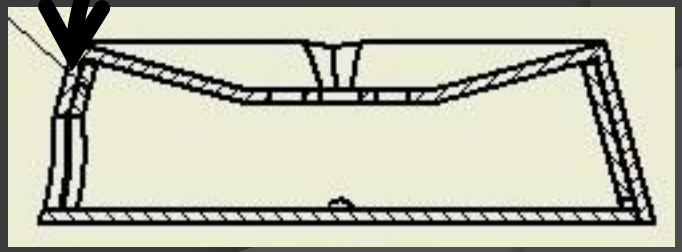
DETAILED DESCRIPTION

- Our design is a two piece rotating stove made solely from ceramic.
- This allows the stove to be very inexpensive.
- The stovetop has a concave design to maximize heat transfer.
- The concave top also allows for versatility by accepting any size pot.

DETAILED DESCRIPTION

- There is an access hole in the side through which fuel can be added while cooking.
- Once rotated, the hole is closed, but there are four intake holes in the bottom that line up, allowing for air flow to feed the fire.
- On top of the concave surface there are grooves to promote heat movement around the pot.
- Double walls help with insulation and encourage complete combustion of fuel.
- For more information on stove design : Stove Research

Double walls help insulate and encourage complete combustion



ALTERNATIVE FUELS

Miscanthus Giganteus

- A large perennial grass used for energy production (Originated in Asia and Africa)
- Cousin of Switchgrass
- Grows up to 13 feet
- Grown commercially in Europe and UK
- Has potential as an energy crop
- High product yield per acre
- Longer growing season than Switchgrass
- For more research regarding alternative fuels check out these links
  - BioChar
  - Corn
  - Switchgrass
  - Miscanthus Giganteus

ALT. FUELS CONTINUED

Advantages of Miscanthus Giganteus:

- Carbon sequestration (Carbon Offset)
- Environmentally friendly crop
- Low fertilizer requirements
- Does not need to be annually tilled or replanted
- Can be combusted raw or turned into biomass
- Not used for food
- Produces more than double the biomass of Switchgrass per acre

Energy Comparisons	
Appalachian Coal	12,500 Btu/Lb
Powder River Basin Coal (Montana)	8,500 Btu/Lb
Miscanthus Giganteus	7,500 Btu/Lb
Wood (Depending on type)	5,500-9,500 Btu/Lb

CERAMIC

- Cheap compared to other materials:
  - Constructed from clay
  - Clay ranges from $0.09 to $0.22 for a pound
  - Cheapest sheet metal is about $5 per sq/ft
- Clay is abundant:
  - It can be harvested from the Earth
  - It can be easily shaped
- New Business Opportunity:
  - Ceramics require firing clay to make
  - Creates business opportunities for people to construct stoves
  - Molds can be made which will increase manufacturability

ANALYSIS

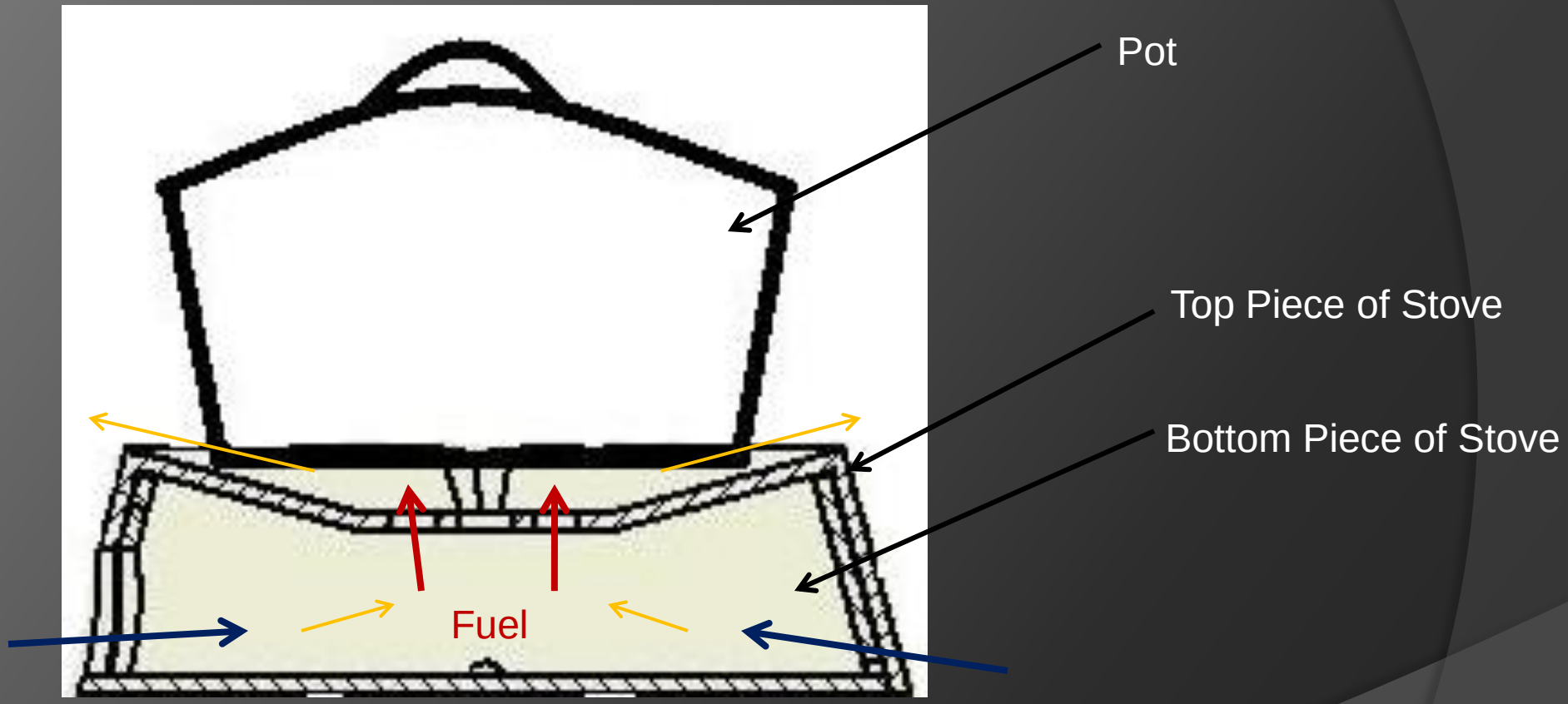
- We started with four main concepts, one from each person, and graded them based on four criteria, price, efficiency, ease of construction, and ease of use.
- We agreed that the best design would be one that incorporated all four concept designs.
- The final design features a two piece design that maximizes heat transfer and minimizes cost.

Objective	Price	Efficiency	Construction	Ease of Use	TOTAL	Weight Factor
Price		0.425	0.6	0.425	1.45	0.24
Efficiency	0.575		0.7	0.55	1.825	0.30
Construction	0.4	0.3		0.625	1.325	0.22
Ease of Use	0.575	0.55	0.375		1.5	0.25

ANALYSIS CONTINUED

- We tried to focus on decreasing cost, so our stove is made of all ceramic.
- We also tried to include easy fuel accessibility by making the holes in the sides that close on each other when rotated.
- Heat transfer was also a concern, so the top of the stove was designed to try to maximize the area of the pot that is exposed to heat.
- An air pocket underneath the pot helps to contain heat while avoiding pressure build up.
- The grooves direct exhaust flow in a safe manner.

AIR FLOW



Cold Air

Warm Air

Hot Air

WHY THE TURBO TOASTER?

- Affordable and practical cooking device
- Innovative design minimizes heat loss and maximizes efficiency.
- Concave top accepts any size pot without compromising effectiveness.
- Ceramic structure is cheap and readily available in Africa.
- Accepts all fuel types
  - Miscanthus Gigantis is recommended because it is clean burning and easily grown.