Lost in El Sauce

Upcycled Plastic Bottle Chip Melter, Nicaragua

Project 19433

Phase 1- Problem Definition Design Review

Customers

- 4 Walls Rochester
    - Builds homes for El Sauce citizens
- Enlace Project
    - Community Development Organization

Objectives

- Reduce plastic waste in El Sauce
- Manufacture a functional device to melt plastic bottle chips
- Create a product that 4 Walls can use on the houses
- Create jobs/ a small business in El Sauce

Customer Requirements

- Melts primarily PET plastic chips to create 12"x12" sheet
- Reasonable cycle time
- Easy to operate, user friendly
- Uses human or grid power (110V or 220V AC)
- Device should not work when disconnect device is engaged
- Vacuum mold operation
- Interactive user interface
- Able to ship system to El Sauce, Nicaragua
- Scaled to operate in a home or small business
- Lightweight
- Easy to disassemble
- Minimal expected repairs
- Does not emit dangerous levels of toxic fumes
- Must not tip over when bumped by an average person
- Protect users from hot surfaces, sharp edges, and pinch points
- Low start up cost for local businesses
- Product price offsets labor, overhead, and marketing costs
- Low operation cost
- Equipment manufacturable in El Sauce

Engineering Requirements

- Melting temperature range, 240-260 oC
- Adjustable thermostat to hold temperatures between 100 and 260oC
- Max Temperature differential over the plate, tbd (15oC?)
- Products per hour >0.5

- Machine footprint < 1m2
- Sheet size approx. 12” x 12”
- Sheet thickness < ¼”
- Number of workers needed to operate
- Pressure to form plastic, tbd
- Temperature of contact surfaces <50oC
- Variable chip size acceptable
- Low subassembly weight
- Max voltage <250VAC
- Skilled operations, ideally 0
- Pinch points, ideally 0
- Sharps, ideally 0
- Electrocution hazards, ideally 0
- Components powered when disconnect engaged, 0
- Revenue – Costs >0
- Total Machine cost <$1250
- Machine can be broken down to transport
- Life cycle of machine parts
- Force to tip over > 500 N

Risks

- Product creates scrap waste when produced
- Melting plastic emits fumes
- Going over budget to purchase materials
- Unable to access facility with proper ventilation
- Unable to test sheet in vacuum former
- Unable to access 220V for testing
- Not enough time to fix issues if something goes wrong
- Risk of being burned by melted plastic
- Risk of body part being crushed by compression jack
- Risk of shock from high voltage
- Melter uses too much of El Sauce's energy/power
- Cost to implement and operate melter are too high
- Power supply needed will exceed what is available in El Sauce
- 12" x 12" sheet cannot be formed
- Melter is too large/heavy and cannot be transported easily
- Compression system does not operate properly
- Melter does not melt chips evenly

Next Steps in Process

- Continue Research
- Determine which type of molding to use
    - Injection vs compression molding
- Determine which type of heating/cooling systems to use

- Determine Preliminary Budget
- Begin working on 2D/3D Solidworks Designs
    - Mold
    - Heating/cooling
    - Electrical

Questions to consider

- What is the cost and accessibility of electricity in El Sauce?
- What kind of wall outlets do they have?