

ONSITE PLASTIC RECYCLING MQP

SARAH DUQUETTE
MECHANICAL ENGINEERING

ALEXANDRA MILLER
MECHANICAL ENGINEERING



ASHLEY KISHIBAY
CHEMICAL ENGINEERING

BENJAMIN SCHADE
MANAGEMENT ENGINEERING

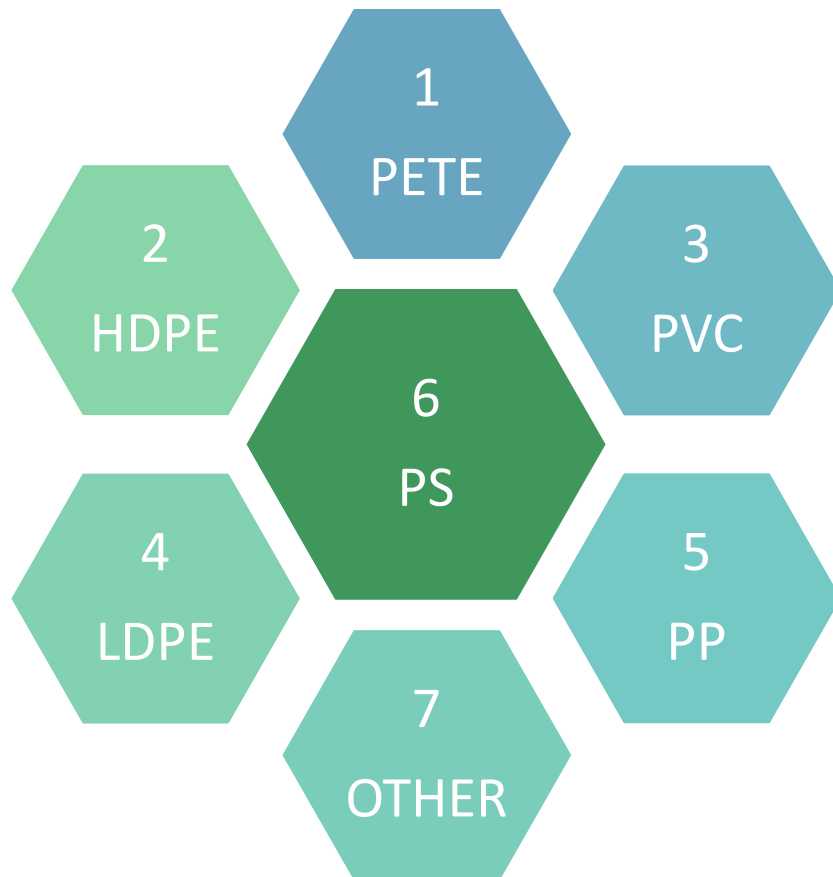
Advisors: John Sullivan, Stephen Kmiotek, Jerry Schaufeld

PROJECT OVERVIEW

- Less than 10% of plastic waste in the United States is recycled
- Expanded Polystyrene (EPS or Styrofoam) is one of the least-often recycled materials
- EPS takes up a large volume without much weight; shipping large quantities of plastic costs an exorbitant amount
- Small towns can affordably recycle EPS if preprocessing densification occurs onsite
- Our prototype allows EPS to be cut, cleaned, and densified to reduce shipping costs to recycling/repurposing facilities



BACKGROUND ON PLASTIC – EXPANDED POLYSTYRENE



- Annual Production: 15 million tons in the US
- Uses: Packaging, disposable food/drink containers
- Density: 19 kg/m³
- Melting point: ~300°C
- Degradation: > 430°C

MATERIAL RECOVERY FACILITIES

Towns send curbside collected material to local Material Recovery Facilities (MRFs) that sort and process recyclable materials. Plastics are recycled in three main steps.

Shred



Clean



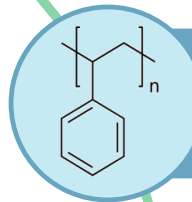
Densify



DECENTRALIZING RECYCLING

The goal of this project was to make a small scale MRF designed for EPS

Trucking costs are the largest barrier to recycling EPS, so a small scale MRF at a town transfer station will reduce shipping costs



Standard shipping densities are higher than EPS material densities



Town truck capacities reach volume limit before weight for EPS

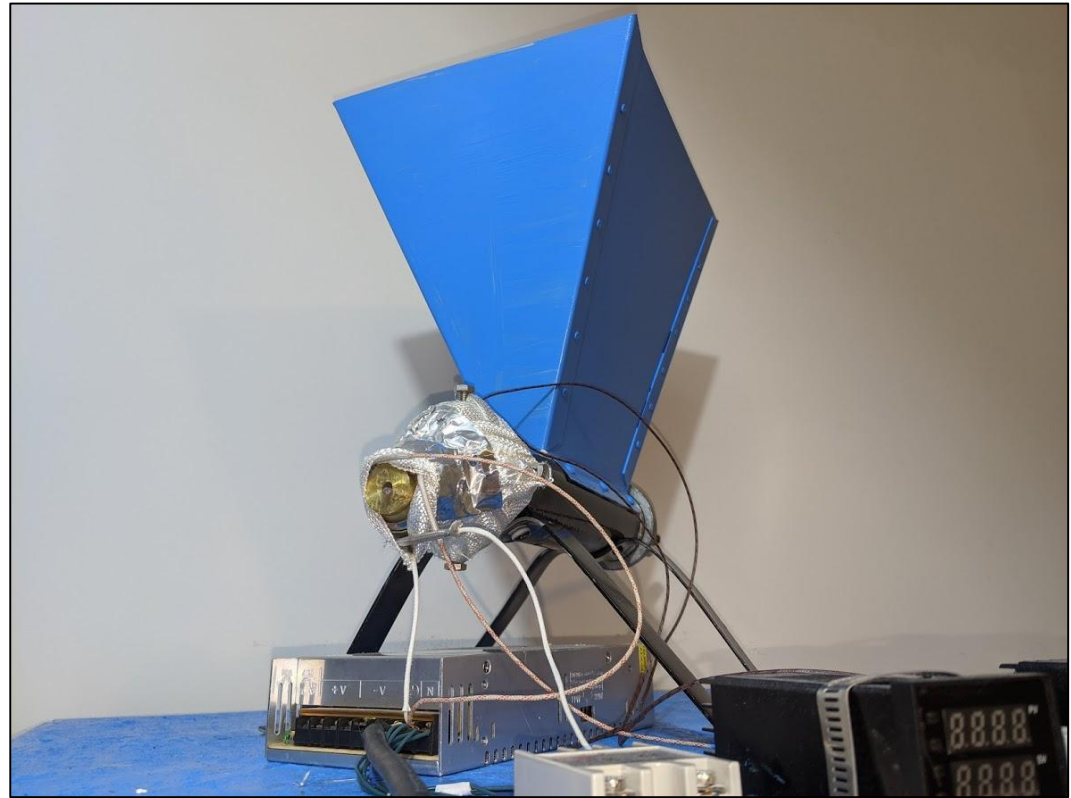


Average distance to MRF is 53 miles in the United States

OUR PROTOTYPE



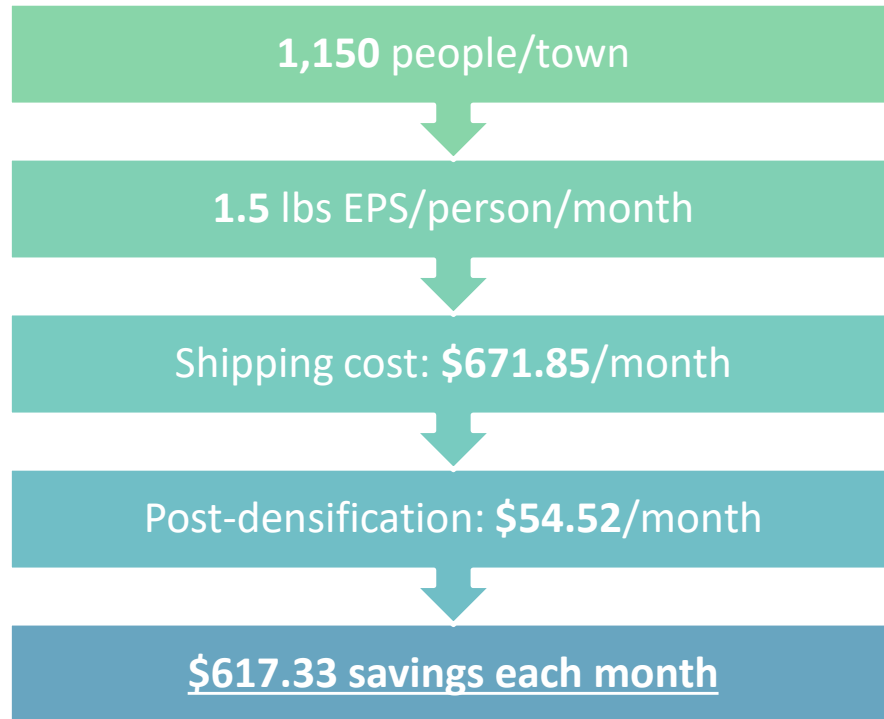
Hot wire shredder & cleaning bucket



Hopper & densifying auger screw

TOTAL BENEFIT

Potential Cost Benefit



*Estimated savings based on average values and US median town size

Social Benefit

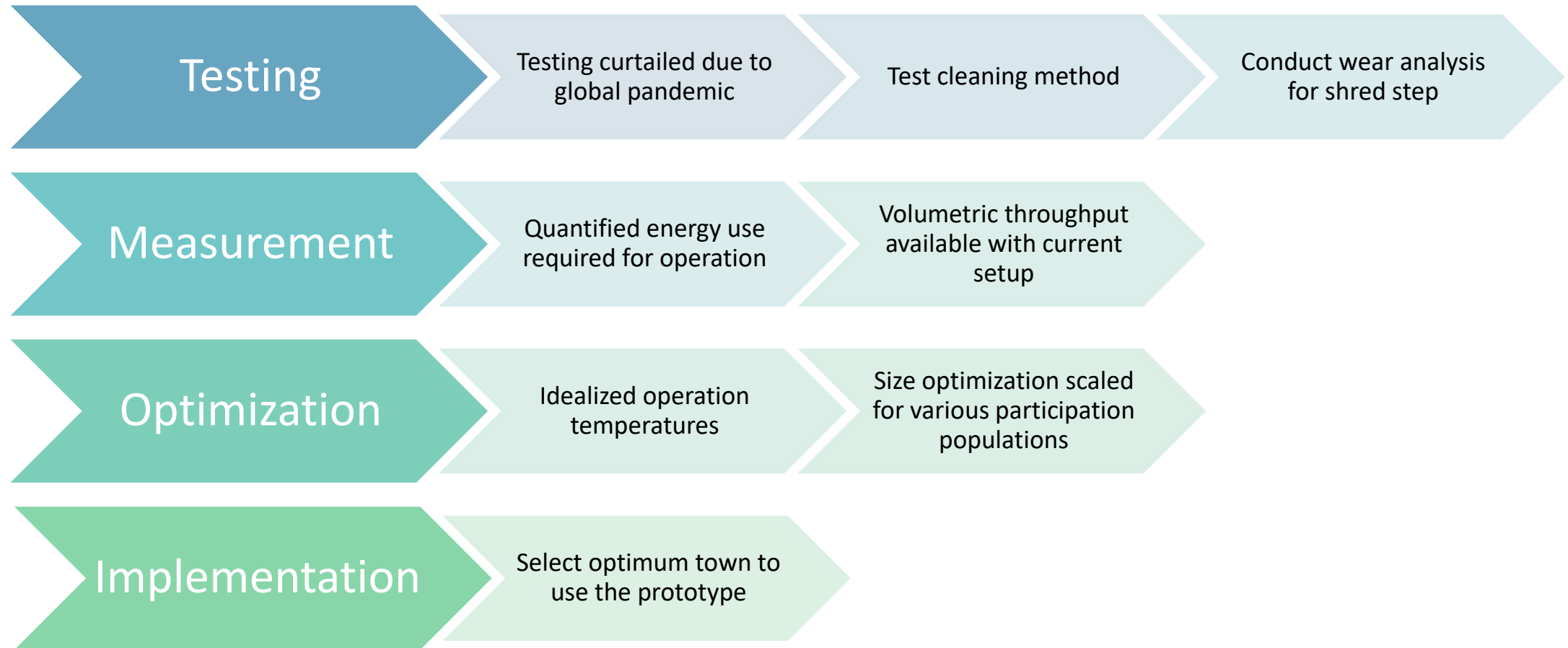
- Creates inexpensive method of recycling
- Lowers amount of polystyrene in landfill
- Reduces polystyrene in the environment
- Opens opportunity for grants for participating towns

LIMITATIONS

- Small-scale prototype has limited EPS volume intake
- Certain elements required for use
 - Trained operator
 - Not overly-soiled/contaminated EPS input
 - Energy supply, soap and water replenishment
- Towns must buy-in to the system
 - Advertisements to citizens
 - Method for sorting out EPS from other waste
 - Budgeted costs to run/obtain system and ship end products



FUTURE DIRECTIONS



CONCLUSION

Team developed a complex, cross-discipline prototype to recycle expanded polystyrene

Prototype allows towns to preprocess EPS

Densified polystyrene costs less to ship than expanded polystyrene

Easy-to-use method that saves money and reduces EPS waste in landfill



Extruding densified polystyrene