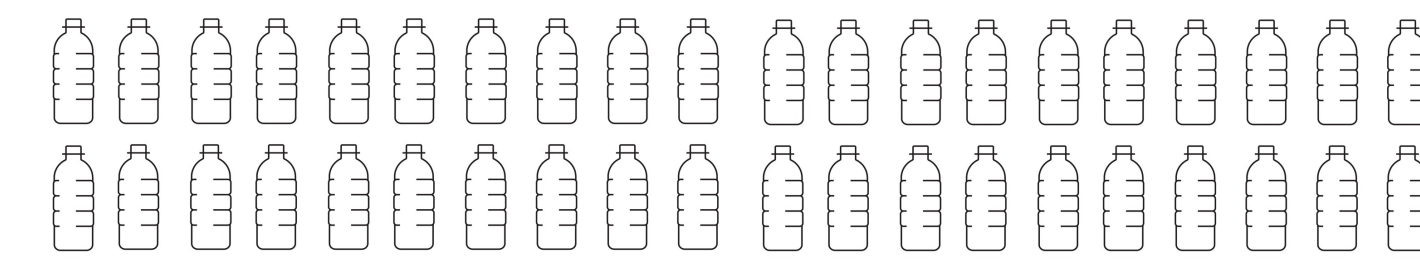


**Background**

The cost of plastic production, and its consequent pollution, are issues of global priority. The U.S. spends approximately \$3.7 trillion on the resource that makes up the majority of its litter; single-use soda and water bottles, made from Polyethylene terephthalate (PET). While this material is recyclable, its renewable vessels are wasted every time a bottle is thrown away



**Findings**

**Financial Perks**

Economic findings in the literature consistently prove that making recycled PET filament can be more cost-effective than buying virgin filament due to reduced raw material costs. Research indicates that rPET filament production lowers costs primarily because recycled feedstock eliminates the need for raw material extraction and processing.

**A Strong Alternative**

Multiple studies demonstrate that rPET filament can achieve properties comparable to commercial alternatives such as PETG. For example, one experimental study comparing rPET and PETG found tensile strength values of approximately 24 MPa for rPET and 30 MPa for PETG, with similar stiffness (Young's modulus of 1.43 GPa for rPET vs. 1.44 GPa for PETG). Additional literature reports rPET tensile strength values in the range of 35–40 MPa under optimized processing conditions, confirming its high quality for functional applications.

**A Well-Natured Machine**

From an environmental perspective, PET recycling remains underutilized. One study found that only 28.4% of PET waste is successfully recycled into usable products, with the remainder often entering the waste stream or environment. If the Recreator is optimized, it can redirect up to 80% of local bottle waste away from landfills.

**Introducing the Solution**

Today, small-scale recycling technology presents an opportunity to recycle PET “waste” into valuable material: 3D printer filament. This project describes the benefits of producing recycled PET (rPET) filament on a small-scale level using the inexpensive Recreator 3D MK5Kit. Compared to commercial 3D printer filament, rPET filament would reduce the need for plastic production, and simply reuse pre-existing materials.

**How the Machine Works:**

First, used PET bottles are collected, cleaned, and spiraled into a flat, uniform strip. This strip is fed into the MK5 Recreator Kit, where the machine will slowly pull the strip on its own to automate the process. As the strip is pulled into the machine, it will be warmed inside a heating chamber to become in shape. The machine's pultrusion nozzle will push out the flexible material in the shape of tubelike filament, and this process continues until the entire bottle has been converted

**Methods**

We conducted a review of literature that examined the sustainability, economic feasibility, and material performance of recycled polyethylene terephthalate (rPET) filament in comparison to commercial PETG filament. Sources were selected based on the following inclusion criteria: publications dated after 2006, peer-reviewed articles or credible technical reports, and studies that provided relevant data on energy consumption, cost analysis, and the mechanical or production feasibility of rPET. Using academic databases like Google Scholar and FSU Libraries, we identified sources that addressed small-scale plastic recycling systems and filament production processes.

**Our review focused on 3 primary areas:**

1. The process and associated costs of producing filament using machines like the MK5 Recreator Kit
2. The quality and durability of rPET filament in comparison to commercially available PETG
3. The potential amount of plastic waste that could be diverted from the environment through small-scale filament production

Data and key findings from each source were organized to allow for cross-source comparison. We tracked values such as cost per kilogram obtained, material performance, and weight of plastic in grams to identify the trends revealed in our findings.

After compiling and analyzing the data, results were translated into graphs and comparison charts to enhance clarity and support effective communication of findings.

**References**

