

# LIFE CYCLE ASSESSMENT MOTOR OIL PACKAGING CASE STUDY

## MOTOR OIL PACKAGE COMPARISON

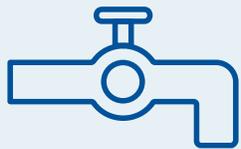
Motor oil has traditionally been packaged in rigid HDPE bottles, but recently, there have been examples of motor oil being packaged in flexible stand-up pouches with fitments. For this Life Cycle Assessment study, flexible stand-up pouches with fitments and rigid HDPE bottle formats were evaluated for their environmental impacts with a cradle-to-grave boundary.



FLEXIBLE STAND-UP  
POUCH WITH FITMENT



RIGID HDPE  
BOTTLE



### WATER CONSUMPTION

Manufacturing rigid HDPE bottles involves an injection molding process, which requires excess water to cool down the molds. Flexible stand-up pouches are formed by laminating multiple thin layers of film together, which requires much less water by contrast.

In fact, the HDPE bottle consumes **6X** more water than the stand-up pouch.

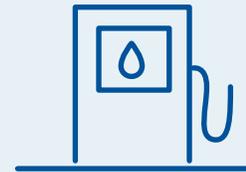


### GREENHOUSE GAS EMISSIONS

Both package formats contain plastic, but the flexible stand-up pouch has a reduced carbon impact because it uses much less material than the rigid HDPE bottle.

The rigid HDPE bottle has a greenhouse gas emission about **1.5X** that of the flexible stand-up pouch with fitment.

Even though rigid HDPE bottles are recycled at a rate of **34.4%**, **2X** as much material still ends up as municipal solid waste in landfills compared to the stand-up pouch, leading to a larger end-of-life impact.



### FOSSIL FUEL CONSUMPTION

A lighter package with a manufacturing process that is less energy intensive will almost always result in lower fossil fuel consumption, as is the case with the flexible stand-up pouch with fitment. Rigid HDPE bottles are heavier and require more energy/fuel during the injection molding process, which results in higher fossil fuel consumption.

The rigid HDPE bottle weighs about **3X** more than the flexible stand-up pouch and uses **173%** more fossil fuel resources.



# END OF USE SUMMARY

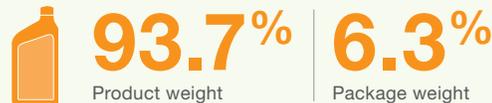
## SOURCE REDUCTION BENEFITS

While both the rigid HDPE bottle and flexible stand-up pouch enable packaging efficiency through high product-to-package ratios, the flexible stand-up pouch comes out ahead.

Flexible stand-up pouch:



Rigid HDPE bottle:



## RECOVERY BENEFITS

STAND-UP FLEXIBLE POUCH



1x

amount of material ending up as municipal solid waste

RIGID HDPE BOTTLE:



2x

amount of material ending up as municipal solid waste

Assuming the flexible stand-up pouch is not recycled, it still results in a **substantially lower** amount of material ending up as municipal solid waste versus a rigid HDPE bottle.

Compared to the flexible stand-up pouch:

- The rigid HDPE bottle results in almost **2X** the amount of material ending up as municipal solid waste.
- The rigid HDPE bottle's recycling rate would need to increase from **34.4% to 64%** to equal the amount of discarded material associated with a flexible stand-up pouch.

## IMPLICATIONS

When the rigid HDPE bottle and flexible stand-up pouch with fitment are used for motor oil packaging, the flexible structure has an overall favorable outcome in terms of fossil fuel usage, greenhouse gas emissions, water consumption and materials landfilled. This is largely driven by the flexible stand-up pouch using about **1/3** of the material used in the rigid HDPE bottle, which results in less energy used in manufacturing and transporting of the package materials, and a reduction in associated environmental impacts.

FORMAT	FOSSIL FUEL CONSUMPTION (MJ-EQUIV)	GHG EMISSIONS (KG-CO <sup>2</sup> EQUIV)	WATER CONSUMPTION (L)	PRODUCT-TO-PACKAGE RATIO (%)	PKG LANDFILLED (G)/1000 KG MOTOR OIL
FLEXIBLE STAND-UP POUCH W/ FITMENT 	14.12	.5998	1.03	38.0 : 1 97.4% : 2.6%	26,301
RIGID HDPE BOTTLE 	38.58 <b>(+173%)</b>	1.52 <b>(+153%)</b>	6.33 <b>(+513%)</b>	14.8 : 1 93.7% : 6.3%	45,501 <b>(+73%)</b>