Sustain the World: The Case for Flexible Packaging

FPA™ Flexible Packaging Association

Connecting. Advancing. Leading.

Less Resources. Less Footprint. More Value.℠ Flexible Packaging

In 2018, the FPA commissioned PTIS, LLC to provide a holistic view on the sustainability benefits that flexible packaging offers. The resulting report, *A Holistic View of the Role of Flexible Packaging in a Sustainable World*, achieved this goal while also providing foresight into future sustainability implications of these versatile materials. Included in the report were six Life Cycle Assessment (LCA) case studies comparing flexible packaging to other packaging formats across a range of products. An LCA is a method for characterizing impacts associated with the sourcing, manufacturing, distributing, using, and disposing of a product or product system.

This brochure presents all six LCA case studies in abbreviated form, each of which evaluates common packaging formats for their environmental impacts with a cradle-to-grave boundary. The products used in the case studies span multiple market segments, including **coffee**, **motor oil**, **baby food**, **laundry detergent**, **cat litter**, and **juice**.

To view the full report or individual case studies in their entirety, please visit **www.flexpack.org.**

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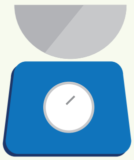
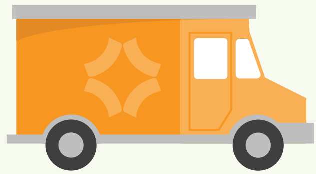
FLEXIBLE PACKAGING SUSTAINABILITY BENEFITS

Flexible packaging offers a number of sustainability benefits throughout the entire life cycle of the package when compared to other package formats including:

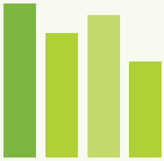


LIGHTWEIGHT/SOURCE
REDUCTION



TRANSPORTATION BENEFITS
DUE TO INBOUND FORMAT
AND LIGHTWEIGHT NATURE

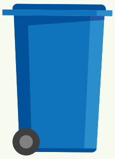
HIGH
PRODUCT-TO-PACKAGE RATIO



BENEFICIAL
LIFE CYCLE METRICS

MATERIAL/RESOURCE
EFFICIENCY

FOOD SHELF LIFE
EXTENSION



REDUCED MATERIALS
TO LANDFILL

COFFEE PACKAGING

WATER CONSUMPTION

A traditional steel can uses **16x** as much water as the stand-up flexible pouch, mostly because of the material development stage.

The HDPE plastic canister consumes **2x** as much water as the stand-up flexible pouch.

Stand-up flexible pouch	1,011 LITERS
HDPE plastic canister	3,164 LITERS
Steel can	17,238 LITERS

GREENHOUSE GAS EMISSIONS

The HDPE canister and steel can respectively emit **4x** and **7x** more GHG emissions than the flexible pouch.

Stand-up flexible pouch	13.7 GRAMS of material	353 KG-CO_2 EQUIV
HDPE plastic canister	63.7 GRAMS of material	1,678 KG-CO_2 EQUIV
Steel can	111 GRAMS of material	2,763 KG-CO_2 EQUIV

FOSSIL FUEL CONSUMPTION

A steel can and HDPE canister respectively use **453%** and **518%** more fossil fuel than a stand-up flexible pouch.

Stand-up flexible pouch	6,654 MJ-EQUIV
HDPE plastic canister	41,130 MJ-EQUIV
Steel can	36,809 MJ-EQUIV

END OF USE SUMMARY

SOURCE REDUCTION BENEFITS

According to the U.S. EPA Waste Hierarchy, the most preferred method for waste management is source reduction and reuse.

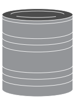
High product-to-package ratios associated with flexible packaging enable packaging efficiency.

High product-to-package ratio:

96% Product weight | **3.9%** Package weight

Low product-to-package ratio:

83% Product weight | **17%** Package weight



67% Product weight | **33%** Package weight

ALTERNATIVE MATERIAL RECOVERY DOWNFALLS

For the HDPE canister to have the same net discards as the flexible pouch package, the recycling rate for the HDPE canister would need to jump from **34%** to **84%** with a **70%** recovery rate for the lid.

The recycling rate for the steel can would need to increase from **71%** to **93%** and the LDPE lid would need to go from **21%** to **75%** for the steel can to have the same amount of landfilled material as the stand-up flexible pouch.

HDPE CANISTER

2.5x net rate of landfilled material vs stand-up flexible pouch

STEEL CAN

3x net rate of landfilled material vs stand-up flexible pouch

FORMAT	PRODUCT-TO-PACKAGE RATIO (%)	PKG LANDFILLED ((G)/1000 KG COFFEE)
STAND-UP FLEXIBLE POUCH	96 : 4	40,294
PLASTIC (HDPE) CANISTER	83 : 17	142,063 (+252%)
STEEL CAN	67 : 33	163,122 (+304%)

MOTOR OIL PACKAGING

WATER CONSUMPTION

An HDPE bottle consumes **6x** more water than a stand-up pouch.

Stand-up pouch: **1.03** LITERS

HDPE bottle: **6.33** LITERS

GREENHOUSE GAS EMISSIONS

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.

Stand-up pouch: **19.20** GRAMS of material | **0.60** KG-CO_2 EQUIV

HDPE bottle: **56.40** GRAMS of material | **1.52** KG-CO_2 EQUIV

FOSSIL FUEL CONSUMPTION

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

Stand-up pouch: **14.12** MJ-EQUIV

HDPE bottle: **38.58** MJ-EQUIV

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.

High product-to-package ratio:

97.4% Product weight | **2.6%** Package weight

Low product-to-package ratio:

93.7% Product weight | **6.3%** Package weight

ALTERNATIVE MATERIAL RECOVERY DOWNFALLS

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.

RIGID HDPE BOTTLE

2x
amount of material ending up as municipal solid waste

FORMAT	PRODUCT-TO-PACKAGE RATIO (%)	PKG LANDFILLED ((G)/1000 KG MOTOR OIL)
FLEXIBLE STAND-UP POUCH W/ FITMENT	38.0 : 1 97.4% : 2.6%	26,301
RIGID HDPE BOTTLE	14.8 : 1 93.7% : 6.3%	45,501 (+73%)

BABY FOOD PACKAGING

WATER CONSUMPTION

The water consumption impact of a glass jar is **1,294%** more than that of a flexible stand-up pouch.

=	**0.08** LITERS
=	**0.05** LITERS
=	**1.05** LITERS

GREENHOUSE GAS EMISSIONS

The glass jar uses approximately **10x** more material than the other two packaging formats.

The glass jar has a carbon impact **3x** higher than the low carbon impact of the flexible stand-up pouch with fitment.

7.70 GRAMS of material	**0.03** KG-CO_2 EQUIV
10.10 GRAMS of material	**0.03** KG-CO_2 EQUIV
89.20 GRAMS of material	**0.12** KG-CO_2 EQUIV

FOSSIL FUEL CONSUMPTION

The thermoformed tub uses less overall fossil fuel/energy than the glass jar because it's much lighter, but neither format can match the reduction in fossil fuel seen with the flexible stand-up pouch.

The glass jar has a fossil fuel usage roughly **2x** that of both the flexible stand-up pouch with fitment and thermoformed tub.

0.73 MJ-EQUIV
0.78 MJ-EQUIV
1.46 MJ-EQUIV

END OF USE SUMMARY

SOURCE REDUCTION BENEFITS

When comparing product-to-package ratios, a high ratio like that of the flexible stand-up pouch with fitment is a good measure of source reduction and packaging efficiency.

High product-to-package ratio:

93.6% Product weight | **6.4%** Package weight

91.8% Product weight | **8.2%** Package weight

Low product-to-package ratio:

55.9% Product weight | **44.1%** Package weight

ALTERNATIVE MATERIAL RECOVERY DOWNFALLS

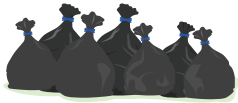
Thermoformed tubs contain a barrier layer that is difficult to process, which results in a **0%** recycling rate. Because of this, thermoformed tubs contribute to about **30%** more material in municipal solid waste than flexible stand-up pouches.

Even though glass containers are recycled at a rate of just over **30%**, **7x** more material ends up in municipal solid waste than the flexible stand-up pouch with fitment.

THERMOFORMED TUB

30%
More material in municipal solid waste

GLASS JAR



7x
More material in municipal solid waste

FORMAT	PRODUCT-TO-PACKAGE RATIO (%)	PKG LANDFILLED ((G)/1000 KG BABY FOOD)
FLEXIBLE STAND-UP POUCH W/ FITMENT	93.6 : 6.4	68,142
THERMO-FORMED TUB	91.8 : 8.2	89,381 (+31%)
GLASS JAR	55.9 : 44.1	513,699 (+654%)

LAUNDRY DETERGENT PODS PACKAGING

WATER CONSUMPTION

A rigid PET container's water footprint is **+660%** larger than a flexible stand-up pouch.

= 5.00 LITERS

= 37.98 LITERS

GREENHOUSE GAS EMISSIONS

The injection molding for the rigid PET container results in additional energy used in the process, leading to higher overall emissions **(+726%)**.

GRAMS per 1000 kg of product	$KG\text{-}CO_2$ EQUIV
21,209	3.10
118,175	25.60

FOSSIL FUEL CONSUMPTION

The rigid PET container has a fossil fuel usage nearly **504%** greater than that of the flexible stand-up pouch with zipper, and the package weight is **6x** heavier.

76.73 MJ-EQUIV

463.68 MJ-EQUIV

END OF USE SUMMARY

SOURCE REDUCTION BENEFITS

The flexible stand-up pouch with a zipper aligns with the Sustainable Materials Management framework that looks to maximize the use of resources in packaging as well as the U.S. EPA Waste Hierarchy that cites source reduction and reuse as preferred methods to reduce overall waste.

High product-to-package ratio:

97.9% Product weight | **2.1%** Package weight

Low product-to-package ratio:

89.4% Product weight | **10.6%** Package weight

ALTERNATIVE MATERIAL RECOVERY DOWNFALLS

When taking current recycling rates into consideration, the rigid PET container results in nearly **4x** more material ending up in municipal solid waste than the flexible stand-up pouch.

In order for the PET container to have the same level of municipal solid waste as the flexible stand-up pouch, the recycling rate of both the rigid PET container and cap would need to increase from the current rate of **30%** to more than **80%**.

RIGID PET CONTAINER

4x amount of material ending up as municipal solid waste

FORMAT	PRODUCT-TO-PACKAGE RATIO (%)	PKG LANDFILLED ((G)/1000 KG PODS)
STAND-UP FLEXIBLE POUCH	47.2 : 1 97.9 : 2.1	21,209
RIGID PET CONTAINER	8.5 : 1 89.4 : 10.6	82,604 **(+289%)**

CAT LITTER PACKAGING

WATER CONSUMPTION

The rigid pail has a water footprint **1,370%** higher than the flexible stand-up bag. A barrier carton has a water consumption impact **3,573%** more than that of a flexible stand-up bag.

Package	Water
Flexible stand-up bag	182 LITERS
Rigid pail	2,676 LITERS
Barrier carton	6,684 LITERS

GREENHOUSE GAS EMISSIONS

Compared to the flexible stand-up bag's greenhouse gas emissions, the rigid pail emits **996%** more while the barrier carton produces **331%** more emissions.

Package	GRAMS per 1000 kg of cat litter	$KG\text{-}CO_2$ EQUIV
Flexible stand-up bag	8,941	125.40
Rigid pail	125,404	1,373.85
Barrier carton	82,015	540.46

FOSSIL FUEL CONSUMPTION

The rigid pail requires **11x** as much material as the flexible stand-up bag and uses **1,429%** more fossil fuel in manufacturing than the flexible stand-up bag.

The weight of the barrier carton and energy needed in the paper making process leads to **69.6%** more fossil fuel in manufacturing than the flexible stand-up bag.

Package	Fossil fuel
Flexible stand-up bag	2,248 MJ-EQUIV
Rigid pail	34,371 MJ-EQUIV
Barrier carton	3,812 MJ-EQUIV

END OF USE SUMMARY

SOURCE REDUCTION BENEFITS

The stand-up bag offers a higher product-to-package ratio compared to the barrier carton and rigid pail formats.

High product-to-package ratio:

99.1% Product weight | **0.9%** Package weight

Low product-to-package ratio:

88.9% Product weight | **11.1%** Package weight

92.5% Product weight | **7.5%** Package weight

ALTERNATIVE MATERIAL RECOVERY DOWNFALLS

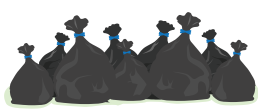
The rigid pail and lid recycling rate would need to increase from **11.1%** to **90%** to have the same weight of material ending up in municipal solid waste as the flexible stand-up bag.

The flexible stand-up bag results in about **9x** less material ending up in municipal solid waste than the barrier carton, and about **12x** less material by weight ending up in municipal solid waste than the rigid pail, even considering the recycling rate of the pail.

RIGID PAIL

12x
amount of material ending up as municipal solid waste

BARRIER CARTON



9x
amount of material ending up as municipal solid waste

FORMAT	PRODUCT-TO-PACKAGE RATIO (%)	PKG LANDFILLED ((G)/1000 KG CAT LITTER)
FLEXIBLE STAND-UP BAG	99.1 : 0.9	8,941
RIGID PAIL	88.9 : 11.1	111,610 **(+1,148%)**
BARRIER CARTON	92.5 : 7.5	82,015 **(+817%)**

SINGLE SERVE JUICE FLAVORED BEVERAGES

WATER CONSUMPTION

The flexible drink pouch, by far, has lower water consumption than the glass bottle because of the small amount of water required for the laminating process.

12,108
LITERS

209,809
LITERS

GREENHOUSE GAS EMISSIONS

The flexible drink pouch has lower overall greenhouse gas emissions because of its light weight and overall efficient material and manufacturing process.

27,734
PKG WT.(G)/1,000 KG DRINK

4,652
KG-CO_2 EQUIV

531,362
PKG WT.(G)/1,000 KG DRINK

25,612
KG-CO_2 EQUIV

FOSSIL FUEL CONSUMPTION

The flexible drink pouch comes out with more favorable results in fossil fuel consumption.

88,736
MJ-EQUIV

326,690
MJ-EQUIV

END OF USE SUMMARY

SOURCE REDUCTION BENEFITS

The flexible drink pouch is far more efficient with a product-to-package ratio of **97.3% : 2.7%**.

High product-to-package ratio:

97.3% Product weight | **2.7%** Package weight

Low product-to-package ratio:

65.3% Product weight | **34.7%** Package weight

ALTERNATIVE MATERIAL RECOVERY DOWNFALLS

When considering the amount of packaging that ends up as municipal solid waste based on current recycling rates, the glass bottle results in more material ending up in municipal solid waste than the flexible drink pouch (**1,213%**).

GLASS BOTTLE

13x amount of material ending up as municipal solid waste

FORMAT	PRODUCT-TO-PACKAGE RATIO (%)	PKG LANDFILLED ((G)/1000 KG JUICE)
FLEXIBLE DRINK POUCH	97.3 : 2.7	27,734
GLASS BOTTLE	65.3 : 34.7	364,169 **(+1,213%)**

KEY DRIVERS SHAPING THE FUTURE OF PACKAGING PROGRAMS

EMERGING MARKETS: Development of mobile and global middle class in fast-growth economies

RETAIL IMPACTS: Increased connections facilitate dialogue and interactions among retailers and consumers

HOLISTIC DESIGN THINKING: Design for functional and emotional needs to differentiate among competitors

SUSTAINABILITY: Complex technologies to address sustainability beyond recycling and material reduction

CONSUMER/SOCIAL MEDIA/PERSONAL TECHNOLOGY: Instant feedback from consumers through social media and online shopping

SCIENCE AND TECHNOLOGY: Smart packaging innovations enable personalization and address issues like food waste

LAWS AND REGULATIONS: Legislation influences the design of packaging

ANTICIPATORY ISSUES AND DISRUPTORS: Collection of data and research to anticipate issues or changes in the industry

HOW THE INDUSTRY IS EVOLVING TO ADDRESS FLEXIBLE PACKAGING CHALLENGES

INDUSTRY CHALLENGES

Consumer participation in material collection and recycling

Lack of end-of-life alternatives and recycling options for multi-material laminated packaging

Social concerns provoking legislation for marine debris and single-use packaging

INDUSTRY SOLUTION

Educate consumers on which materials can be recycled and drive collection and recycling of flexible materials through collaborations (Wrap Recycling Action Program & How2Recycle labels)

Enhance processing technologies and auto-sortation of multi-material flexibles (waste to energy, Materials Recovery For the Future)

Promote development of waste management infrastructure to address marine debris and litter issues. Additionally, investigate new materials including compostable or bio-based structures.

Flexible packaging offers exceptional environmental benefits to converters, manufacturers, retailers, and consumers alike. As shown in the case studies in this brochure, flexible packaging generally uses less energy and fewer resources over its life cycle.

It produces less CO_2 emissions, improves product-to-package ratio, requires fewer trucks on the road for transport, and provides numerous safety and consumer convenience features. Flexible packaging is an excellent, sustainable choice, creating more value and a smaller footprint.

The path forward for flexible packaging will require industry collaboration, which will help develop next-generation technologies that can bolster sustainability. From bio-based materials and consumer education, to mono-material recyclable structures and recycling infrastructure, we look forward to the fruits of these collaborations and the wider adoption of flexible packaging across the globe.

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SOURCE

A Holistic View of the Role of Flexible Packaging in a Sustainable World, PTIS, 2018

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