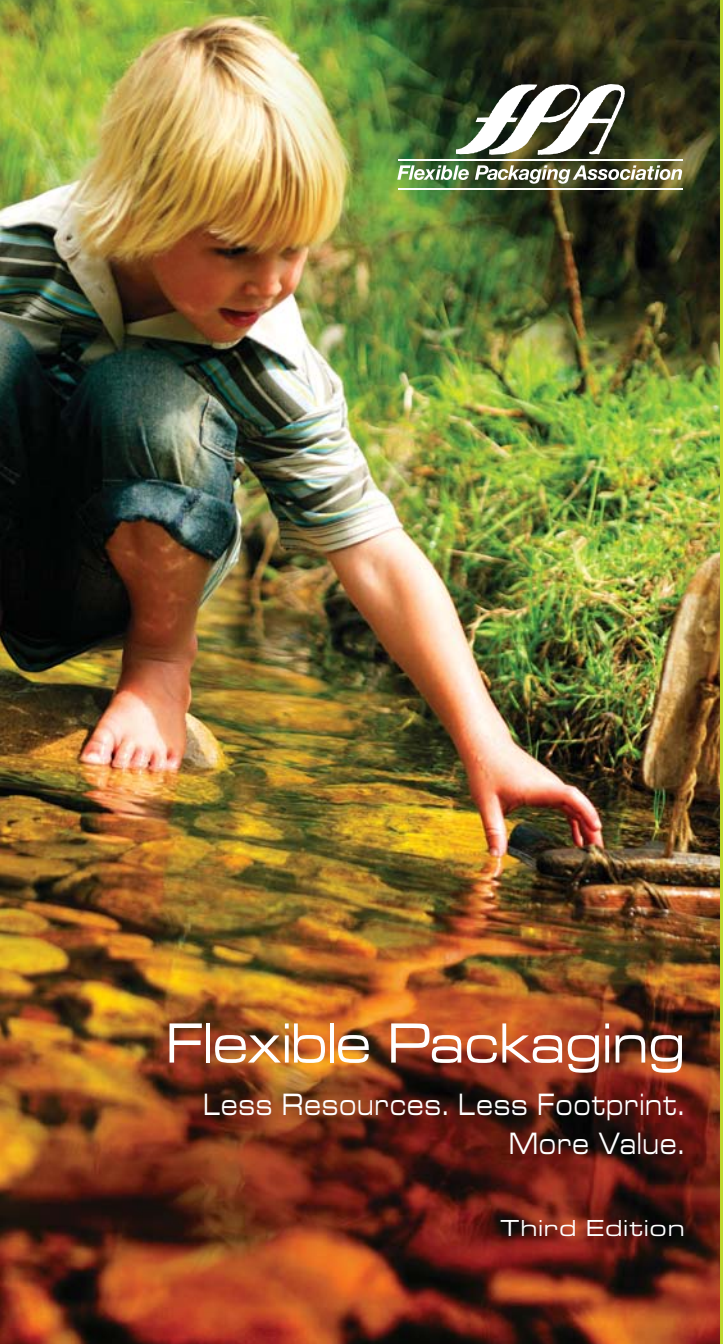

Flexible Packaging: Less Resources, Energy, Emissions, and Waste

FLEXIBLE PACKAGING OFFERS SIGNIFICANT VALUE AND SUSTAINABILITY BENEFITS TO PRODUCT MANUFACTURERS, RETAILERS, AND CONSUMERS. ALTHOUGH THERE ARE MANY PACKAGING OPTIONS AVAILABLE TO MEET VARIOUS PACKAGING DEMANDS, **FLEXIBLE PACKAGING OFFERS CONSIDERABLE ADVANTAGES, WITH FEWER TRADE-OFFS. FLEXIBLE PACKAGING REDUCES WASTE, ENERGY USE, AND GREENHOUSE GAS EMISSIONS.** ADDITIONALLY, FLEXIBLE PACKAGING PROVIDES MANY CONSUMER CONVENIENCES INCLUDING EXTENDED SHELF LIFE, EASY STORAGE, MICROWAVEABILITY, AND RESEALABILITY.

Flexible Packaging

Less Resources. Less Footprint. More Value.

This brochure describes several FPA case studies of flexible and alternative packaging systems. The studies identify trends in packaging weight, product-to-package ratio, landfill discards, energy consumption, and greenhouse gas emissions.

The data sources for the FPA case studies include:

- The *FPA Sustainability Assessment of Flexible Packaging 2009* research report produced by Battelle Memorial Institute. Battelle used a streamlined life cycle assessment (LCA) to identify trends in energy consumption and greenhouse gas emissions.
- PE Americas analysis of readily available data. This PE Americas analysis was not critically reviewed per ISO 14040 standards and represents the magnitude of the comparative environmental profiles.
- Other data sources as footnoted.

The FPA case studies describe representative systems which include plausible assumptions for other packages and therefore may be generalized to discuss the advantages of flexible packaging over alternative packaging.

Beverage Packaging

Beverages have typically been packaged in aluminum cans, glass, or plastic bottles. Stand-up flexible pouches are making inroads in packaged juices and fruit drinks.

- **The flexible beverage pouch consumes 1/2 the amount of energy compared to the closest alternative.**
- **The flexible beverage pouch generates 75% less emissions than the closest alternative.**
- Stand-up flexible pouches significantly reduce greenhouse gases released and energy consumed during the transport of unfilled packaging from packaging converter to filling operation.

Beverage Packaging	Product Weight	Packaging Weight	Product-to-Packaging Ratio	Packaging Weight per 100 g Product	**MSW Landfill per 100 g Product***	**Energy Consumption MJ/8 oz**	**Emissions Kg CO_2 e /8 oz**
Glass Bottle & Metal Cap	8 ounces (236 g)	198.4 g	1:1	83.9 g	**54.5 g**	**3.36**	**0.29**
Plastic PET Bottle & Cap	8 ounces (236 g)	22.7 g	10:1	9.6 g	**6.0 g**	**3.00**	**0.18**
Aluminum Can	8 ounces (236 g)	11.3 g	21:1	4.7 g	**2.4 g**	**0.99**	**0.08**
Stand-up Flexible Pouch	6.75 ounces (199 g)	5.7 g	35:1	2.8 g	**2.8 g**	**0.45**	**0.02**

Cradle-to-grave life cycle energy consumption and CO_2 emissions data developed for the FPA by Battelle Memorial Institute.

Product assumed to be water.

*Recycling rates factored: U.S. EPA 2007 MSW Report.

Packaging weight, product weight, and product-to-packaging ratio calculated by Packaging & Technology Integrated Solutions, LLC (PTIS).

Raisin Packaging

- Stand-up flexible pouches are 37% less by weight compared to bag-in-a-box packaging.
- **Per 100 g of product, bag-in-a-box packaging produces approximately 3 times more MSW than stand-up pouches.**
- **A flexible pouch consumes about 54% less energy over its life cycle than the next most efficient package.**
- **Energy consumption during transportation is significantly less for flexible packaging than alternatives.**

Raisin Packaging	Product Weight	Packaging Weight	Product-to-Packaging Ratio	Packaging Weight per 100 g Product	**MSW Landfill per 100 g Product***	**Energy Consumption MJ/24 oz**	**Emissions Kg CO_2 e /24 oz**
Round Paperboard Canister with Plastic Lid	24 ounces (680 g)	39.69 g	17:1	5.83 g	**5.83 g**	**2.16**	**0.13**
Folding Carton with Inner Poly Bag	12 ounces (340 g)	22.68 g	15:1	6.67 g	**4.87 g**	**1.95**	**0.16**
Stand-up Flexible Pouch	24 ounces (680 g)	11.34 g	60:1	1.66 g	**1.66 g**	**1.06**	**0.05**

Cradle-to-grave life cycle energy consumption and CO_2 emissions data developed for the FPA by Battelle Memorial Institute.

*Recycling rates factored: U.S. EPA 2007 MSW Report.

Packaging weight, product weight, and product-to-packaging ratio calculated by Packaging & Technology Integrated Solutions, LLC (PTIS).

Parcel Mailer

There are two forms of mailers commonly used: recycled paperboard and HDPE flexible pouches.

- **The flexible pouch consumes approximately 1/3 the energy of the alternative to produce, ship, and use.**
- **The flexible pouch generates approximately 1/2 the CO_2 emissions of the alternative.**
- Recycled paperboard mailers produce 7 times more landfill waste by weight per 100 g of product than HDPE flexible pouch mailers (taking into consideration a 27.3% recovery rate of paperboard).
- The flexible pouch mailer uses 1/8 the amount of packaging per 100 g of product vs. the paperboard mailer.

Parcel Mailer	Product Weight	Mailer Weight	Product-to-Mailer Ratio	Mailer Weight per 100 g Product	**Energy Consumption MJ/Mailer**	**Emissions Kg CO_2 e /Mailer**
Recycled Paperboard Mailer (100% recycled paperboard, 35% post consumer recycled material)	13.28 ounces (376 g)	96.38 g	4:1	25.63 g	**4.80**	**0.23**
HDPE Flexible Pouch Mailer	13.28 ounces (376 g)	11.33 g	33:1	3.01 g	**3.37**	**0.11**

Cradle-to-grave life cycle energy consumption and CO_2 emissions data developed for the FPA by Battelle Memorial Institute.

Product weight assumption: 100 sheets of 24 lb 8.5" x 11" copy paper.

U.S. EPA 2007 MSW Report.

Mailer weight, product weight, and product-to-mailer ratio calculated by Packaging & Technology Integrated Solutions, LLC (PTIS).

Multi-unit Packaging

Flexible collation shrink wrap packaging reduces product shift in transit, decreasing breakage and/or product waste.

- **The flexible shrink wrap consumes 35% less energy than the alternative.**
- Compared to paperboard folding containers (such as in this study), flexible shrink wrap provides an 81% reduction in packaging weight.
- Flexible shrink wrap packaging (in this comparison) offers 5 times more product-to-packaging ratio.

Multi-unit Packaging	Product Weight	Packaging Weight	Product-to-Packaging Ratio	Packaging Weight per 100 g Product	**Energy Consumption MJ/120 oz**	**Emissions Kg CO_2 e /120 oz**
Paperboard	120 ounces (3,402 g)	66.2 g	51:1	1.9 g	**2.13**	**0.05**
Flexible Collation Shrink Wrap	120 ounces (3,402 g)	12.6 g	270:1	0.4 g	**1.36**	**0.05**

Cradle-to-grave life cycle energy consumption and CO_2 emissions data developed for the FPA by PE Americas based on readily available data. The results are not critically reviewed per ISO 14040 standards and represent the magnitude of the comparative environmental profiles.

Source: The Dow Chemical Company, internal calculations based on data derived per Environmental Defense (www.papercalculator.org); Boustead Model V5; *The ULS Report*, February 2007; and a raw material cradle-to-gate, plus recycle system boundary.

Packaging weight, product weight, and product-to-packaging ratio calculated by Packaging & Technology Integrated Solutions, LLC (PTIS).

Coffee Packaging

Coffee packaging includes metal cans, rigid plastic containers, and the flexible "brick pack."

- **The flexible brick pack consumes 1/4 of the energy used by alternate packaging.**
- **The flexible brick pack generates 75% less emissions than the closest alternative.**
- The energy savings equivalent of changing all steel coffee cans to flexible brick packs is more than 17,200,000 gallons of gasoline per year.
- The flexible brick pack contains 88% less packaging by weight when compared to metal cans.[1]
- The flexible brick pack reduces the weight of waste to landfill by 72% vs. metal cans (taking recycling rates of cans into account).[2]
- **Flexible brick packs use 20% less space in shipping than cans,[2] reducing transportation emissions.**

Coffee Packaging	Product Weight	Packaging Weight	Product-to-Packaging Ratio	Packaging Weight per 100 g Product	**Energy Consumption MJ/11.5 oz**	**Emissions Kg CO_2 e /11.5 oz**
Metal Can with Plastic Lid	11.5 ounces (326 g)	96.38 g	3:1	29.56 g	**4.21**	**0.33**
Plastic Container & Lid	11.5 ounces (326 g)	59.53 g	5:1	18.26 g	**5.18**	**0.17**
Flexible Brick Pack	11.5 ounces (326 g)	11.33 g	29:1	3.47 g	**1.14**	**0.04**

Cradle-to-grave life cycle energy consumption and CO_2 emissions data developed for the FPA by PE Americas based on readily available data. The results are not critically reviewed per ISO 14040 standards and represent the magnitude of the comparative environmental profiles.

[1]Calculations compare 422.38 g total weight metal can with plastic lid (326 g of contents) versus 337.33 g total weight brick pack (326 g of contents).

[2]The *ULS Report*, February 2007, "Coffee Conundrum" Case Study.

Packaging weight, product weight, and product-to-packaging ratio calculated by Packaging & Technology Integrated Solutions, LLC (PTIS).

Foodservice #10 Packaging

Flexible pouch packaging is an alternative to metal cans for a wide range of foodservice applications. The flexible foodservice pouch eliminates sharp edges and offers dispensing fitments and product visibility.

- **The flexible foodservice pouch consumes 75% less energy than the metal can.**
- **The flexible foodservice pouch generates 1/10 the CO_2 emissions of the metal can.**
- The flexible pouch is less than 1/10 the packaging weight of the metal can.
- Each case of #10 flexible pouches with finished product utilizes 30% less volume than a case of #10 cans.

Foodservice Packaging	Product Weight	Packaging Weight	Product-to-Packaging Ratio	Packaging Weight per 100 g Product	**Energy Consumption MJ/108 oz**	**Emissions Kg CO_2 e /108 oz**
#10 Metal Can	108 ounces (3,064 g)	312.4 g	10:1	10.2 g	**12.59**	**1.07**
#10 Flexible Pouch	108 ounces (3,064 g)	28.4 g	108:1	0.9 g	**2.87**	**0.11**

Cradle-to-grave life cycle energy consumption and CO_2 emissions data developed for the FPA by PE Americas based on readily available data. The results are not critically reviewed per ISO 14040 standards and represent the magnitude of the comparative environmental profiles.

Source: Sealed Air Corporation, www.sealedair.com

Rotisserie Chicken Packaging

Ready-to-eat rotisserie chickens have traditionally been packaged in rigid dome containers. Innovative technology now allows a flexible package to perform in a deli hot case for freshly prepared foods while reducing environmental impacts.

- Eighty-eight percent less fossil fuel is used, and 85% fewer CO_2 emissions are generated during the manufacturing of flexible pouches.[1]
- The fossil fuel equivalent of changing a year's worth of rigid dome rotisserie chicken packaging to flexible pouches would save enough gas to drive around the world 1,475 times.[2]
- The flexible pouch uses 91% less space by case in shipping. More than 12 truckloads of rigid containers are needed to ship the same amount of Hot N Handy® pouches contained in one 53'-long truckload.[3]
- The flexible pouch offers a 2/3 reduction of solid waste by weight introduced in landfills versus rigid dome packaging.[1]
- The flexible pouch offers value-added features such as a built-in handle, a resealable zipper, and being microwaveable and hot case ready.

Rotisserie Chicken Packaging	Product Weight	Packaging Weight	Product-to-Packaging Ratio	Packaging Weight per 100 g Product	**Energy Consumption MJ/40 oz**	**Emissions Kg CO_2 e /40 oz**
Rigid Dome Container (Tray + Lid)	40 ounces (1,134 g)	64 g	18:1	5.6 g	**5.49**	**0.20**
Hot N Handy® Flexible Pouch	40 ounces (1,134 g)	15 g	76:1	1.3 g	**1.35**	**0.03**

Source: Robbie Manufacturing, Inc. Cradle-to-gate energy consumption data based on European eco-profiles (www.PlasticsEurope.org).

Product weight assumption: Average weight of cooked whole rotisserie chicken.

[1]Data based on 2007 Life Cycle Analysis testing by Robbie Manufacturing, Inc., conducted using SimaPro 7.1 LCA Software

[2]Compared to rigid packaging based on annual rotisserie sales of 550 M units. Fuel estimate: 1,809,623 gallons; total miles: 36,729,786.25 @ 20.3 MPG. Calculations generated using U.S. Energy Information Administration and U.S. EPA's Greenhouse Gas Equivalencies Calculator.

[3]Based on industry average packaging/shipping dimensions of rigid packaged rotisserie chicken.

Less Environmental Footprint.

FLEXIBLE PACKAGING OFFERS EXCEPTIONAL ENVIRONMENTAL BENEFITS TO CONVERTERS, MANUFACTURERS, RETAILERS, AND CONSUMERS. OVER ITS LIFE CYCLE, FLEXIBLE PACKAGING GENERALLY USES LESS ENERGY AND FEWER RESOURCES, PRODUCES LESS CO_2 EMISSIONS, SIGNIFICANTLY 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 LESS FOOTPRINT.

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