



RECYLCED PET: SUSTAINABLE OPTION IN THERMOFORMED PLASTIC PACKAGING

Recycled PET is offered as a sustainable solution to consumer demands in thermoformed packaging materials.

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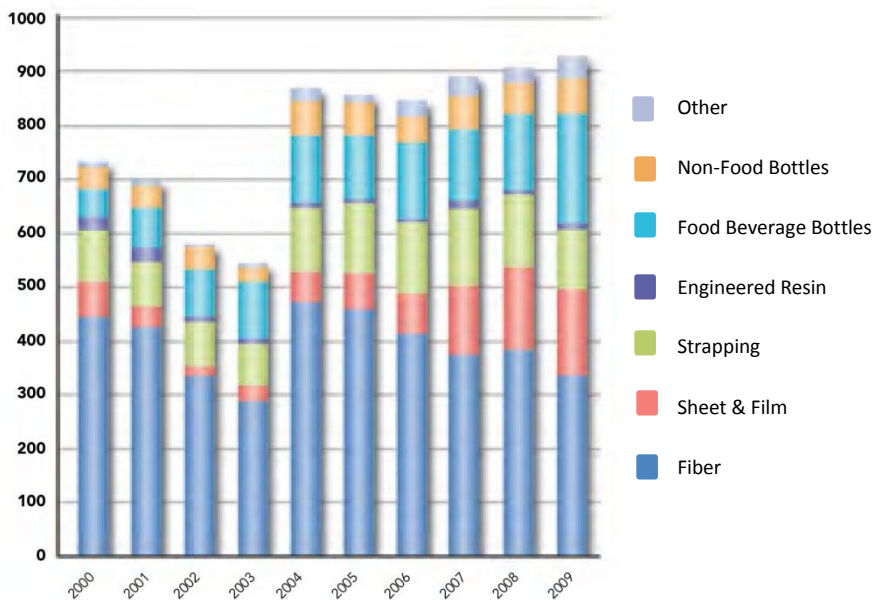
Polyethylene Terephthalate (PET) and Recycling

As consumer trends continue to increase demand in sustainable products, this creates an impact on the packaging industry. The negative press about plastic in consumer perspectives creates an obstacle in proposing plastics that can be used in a sustainable way for packaging. Education and widespread availability of sustainable plastic material options has allowed the packaging industry an advantage in combating that negative perception. After all, plastic packaging remains a preferred means for packaging products in retail markets as well as in wholesale and manufacturing markets. Polyethylene Terephthalate (PET) is a plastic material gaining widespread demand in that it is widely available in more sustainable formats, provides a great avenue for creating a sound recycling stream, and provides the features needed in durable, quality packaging for food and component packaging. Therefore, Plastic Package maintains the ability to offer innovative packaging solutions that meet the sustainable demands of consumers.

PET was introduced to the packaging manufacturing industry in 1950's (PET Resin Association, 2014). Since then, the material gained popularity with its diversified applicability as it boasts features such as durability, light weight, non-reactive and shatterproof abilities. In addition, PET is also applicable in food grade required packaging. Due to its versatile ability and utility in many different applications, it is very commonly used in packaging of food, beverage bottling, cosmetics, pharmaceuticals and electronics.

Beginning in the late 1970's, PET entered the recycling stream. While initial recycled PET content was used in non-packaging applications, the introduction of recycled PET pelletized form in 1977 presented an opportunity for packaging manufacturers to cater to the sustainable consumer demands (Hurd). The

Table 1 RPET Used (MMlbs) by Category (US & Canada); source: Napcor



growth of technology and capacity in the PET recycling industry now allows for food-contact PET packaging to be used in PET such as bakery clamshells, fruit and vegetable packaging in addition nonfood-contact packaging. Table 1 reflects the usage of recycled PET, or post consumer PET (PCPET), among different categories. Further enhancing PCPET's stance as a highly demanded

packaging material option is the fact that the

FDA has written over 20 letters of "non-objection" to the use of PCPET in packaging used for food

(Hurd). The widespread of established recycling infrastructure today, coupled with the increased demand in PCPET packaging, provides manufactures like Plastic Package the opportunity to offer PCPET packaging solutions to our clients with sustainable initiatives.

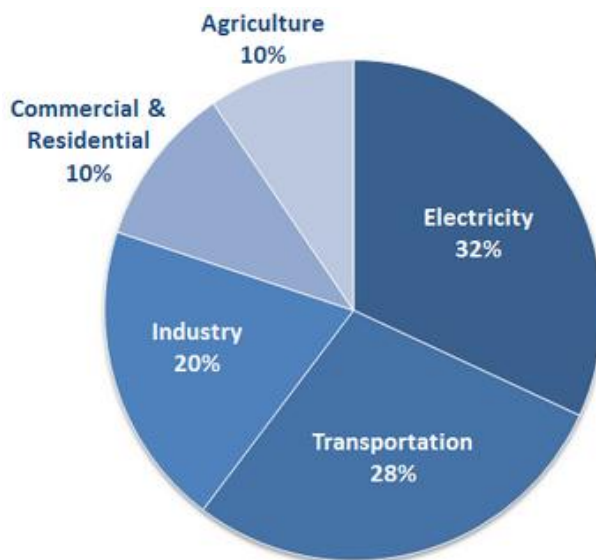
Environmental Benefits of Using Recycled PET

We now know that PCPET provides many sustainable benefits as a packaging material. Allow us to further develop an understanding behind the factors which substantiate PCPET as a more sustainable packaging material with demonstrated comparisons to virgin PET, or PET generated from virgin sources as opposed to recycled or post-consumer, and another common packaging material, Polystyrene (commonly known as OPS in the packaging industry). The following is an overview of the factors that are used to measure the benefits of using PCPET as a packaging material.

Greenhouse Gas Emissions

One of the methods that carbon footprints, or the amount of carbon dioxide that is emitted by and an entity via the consumption of fossil fuels, are measured is through measuring the emission of

Table 2: Allocation of Greenhouse Gas Contributors; source: EPA



greenhouse gases into the environment across the supply chain of given materials. Taking measures across the supply chain provides an overall big picture view of the impact made to the environment when sourcing materials. According to EPA.gov, the largest source of greenhouse gas emissions from human activities is a result of our use of electricity, heat and transportation as demonstrated in Table 2 (US EPA, 2014). Greenhouse gas emissions are measured in million British Thermal Units (MMBTU's or MBTU's). This unit is reflected throughout the following segment.

Landfill Impacts

Municipal Solid Waste (MSW) is the items thrown away by homes, schools Hospitals and businesses.

In 2012, Americans generated 251 million tons of MSW of which 87 million tons was recycled and composted (US EPA, 2014). Plastic containers and packaging composed 13.78 million tons of the total of MSW generated in the US PET bottles and jars were the most recycled plastic products within this category (US EPA, 2014).

Reduction in Production Energy Requirements

PCPET Comparison to Virgin PET and OPS

Processing PET for manufacturing purposes consist of the manufacturing process as well as the transportation process when accounting for greenhouse gas (GHG) emissions for the sake of this

comparison. Manufacturing virgin PET requires 30.3 MMBTU's per 1,000 lbs of material produced (Franklin Associates, 2011). Meanwhile, the processing of recycled PET only requires 7.43 MMBTU's per 1000 lbs of material produced (Franklin Associates, 2010; NAPCOR, 2014).

OPS is one of the common alternatives to using PET or Recycled PET in packaging components. In order to demonstrate the significance in carbon footprint reduction that occurs when utilizing recycled PET, we make the comparison of production energy requirements to one if it's most common alternative, OPS, in the table displayed as follows. Furthermore, the energy requirements are displayed for varying percentages of recycled content of the recycled PET material. Recycled PET is procured and utilized in the manufacture of thermoformed containers at varying percentages dependant on supply availability, customer provided specifications, and other factors.

Table 3 Energy Requirements for Raw Material Production; source: Franklin 2011, Franklin 2010, NAPCOR 2014

Energy Requirements to Produce 1,000 lbs of material (MMBTU)	
OPS	40.9
Virgin PET	30.3
100% Recycled PET (Pellet)	7.43
75% Recycled PET (Pellet)	13.55
50% Recycled PET (Pellet)	19.68
25% Recycled PET (Pellet)	25.80

Greenhouse Gas Emission Demonstration

The reduced energy requirements provided at the different levels of recycled PET content can be further demonstrated when applied to Plastic Package's manufacture of packaging containers produced in PET.

There must be a conversion factor in order to achieve a more accurate comparison when switching from OPS to PET. During the manufacturing of thermoformed containers, the yield per pound of material is less on PET than on OPS. Therefore, for every 1,000 lbs of OPS used to thermoform an OPS container, the equivalent in PET would be 23.8% more pounds of material, or 1,238 lbs., to produce that same container. The following table displays the energy requirements and CO2 Emission equivalents in two formats. The first format is comparing 1,000 lbs per each material. The second format is comparing the 1,000 lbs. of OPS to the 1,238 lbs. of PET in order to account for the additional 23.8% in material requirement.

Table 4 Emissions and Energy Data Comparison OPS VS. PET/RPET; Source: Franklin 2010, Franklin 2011

	Emission equivalents of CO2/1000 lbs of resin produced	Energy Requirements to produce 1,000 lbs of material (MMBTU)	Converted Energy Requirements to produce 1,238 lbs of PET	Converted equivalents of CO2/1238 lbs of PET Resin
OPS	2787	40.9		
PET	2391	30.3	2960	37.51
Recycled PET (100%)	1072	7.43	1327	9.20

Based on annual reporting data, Plastic Package estimates the utilization of 1.25 million pounds annually of OPS. If Plastic Package were to substitute all of the OPS usage to 100% PCPET, emitted greenhouse gases would be reduced in the material production levels as a result of displacement.

Table 5: Greenhouse Gas Emission Demonstration Source: Plastic Package Inc. 2014; EPA Greenhouse Gases Equivalents Calculator (conversions below are based on replacing 1238 lbs. of PET for every 1000 lbs. of OPS)

Lbs. of OPS	Lbs. of PET	Savings CO2 Equivalents/1000 lbs. of OPS Replaced	Equates to the same greenhouse gas reduction as:		
1.25 Million	1.55 Million	1460	174 Cars	93,148 Gallons of Gasoline	114 Homes worth of Electricity use

Landfill Reduction Impacts

In order to truly achieve a full view of the beneficial impacts of using recycled PET, it is essential to recognize the benefits with regards to landfills. By diverting PET into the recycling stream and further providing a sustainable supply for plastic sheet made from recycled content, there are considerable greenhouse gas emission savings to landfill space. The EPA estimates a savings of 32.6 MMBTU’s of greenhouse gas emissions per ton of material recycled versus landfill disposal (US EPA, 2013). Furthermore, for every ton of recycled PET material that displaces virgin PET, there is a net savings of 25.74 MMBTU’s of greenhouse gas emissions (US EPA, 2013). Realistically, however, the current sources for all PET is a mix between virgin PET and recycled PET. As we take that into account, a savings of 25.20 MMBTU’s of greenhouse gas emissions is realized (US EPA, 2013). To demonstrate that, the following chart displays these figures:

Table 6 Landfill Sources and Energy Savings; source: (CA Air Resources Board, CA EPA, 2011)

Method of Diversion	Savings in emitted MMBTU’s/Ton of Material Source Reduced
Recycling vs. Landfill Disposal of PET	32.6
Impacts for Source Reduction/1000 lbs Material Source Reduced: Virgin PET	25.74
Impacts for Source Reduction/1000 lbs Material Source Reduced: Virgin PET & Recycled PET Mix	25.20

Summary

As a result of consumer trends evolving to a more sustainable buying pattern, industries are adapting product offerings to meet that demand. As a packaging manufacturer, Plastic Package offers an innovative approach to the packaging solution for the clients we serve. By offering recycled PET as a sustainable material option for the packaging products we manufacture, greenhouse gas emissions and landfill waste disposal is reduced. Furthermore, Plastic Package manages a sound recycling program for the scrap materials generated in manufacturing. Doing so allows Plastic Package to enhance the future availability of recycled PET as a sustainable material option.

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