



## **I. Abstract**

According to the US EPA in 2003, 19% of PET containers were recycled. The vast majority of the PET packaging recycled was bottles and strapping. SmartCycle™ is PET derived from recycled bottles for use in thermoformed applications and specifically clamshells. Part of the SmartCycle™ marketing and branding strategy is to raise awareness of these low bottle recycling rates and the lack of collection and recovery of PET clamshells. SmartCycle™ has implemented an education program in its pilot market to help material recovery facility operators and recycled material users understand the value of PET packaging beyond bottles. Many of the concepts integrated into the SmartCycle™ product development were inspired by the Sustainable Packaging Coalition's definition of sustainable packaging from initial concept through to the products' end-of-life phase.

## **Keywords**

Material recovery facility, MRF, polyethylene terephthalate, PET, clamshells, branding, recycling, sustainable packaging

Source: Interview with Michael Brown of Packaging 2.0

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## **II. Introduction**

In 2003, of the total PET packaging in the waste stream only 19% was recycled. Of the PET packaging that was recycled, 66% of it was bottles and much of the remainder was PET strapping. An estimated 500 million pounds of polyethylene terephthalate clamshells were produced that year and a negligible amount of them were recycled. This occurs as a legacy of work practices at material recovery facilities (MRFs) where materials are hand-picked off of a conveyor. The practice of picking "bottles with necks" came about to insure a higher percentage of PET and HDPE recovery and less cross-contamination amongst plastics. This practice is still widely used both in the US and in Asia, however technologies for automatic sorting have been implemented in Europe with great success.

SmartCycle™ is a product of Packaging 2.0 LLC which designs and markets customized, thermoformed packaging. Driven by Michael Brown's entrepreneurial initiative, Packaging 2.0 provides a foundation for expanding product development designed for reducing environmental impact. SmartCycle™ is PET derived from recycled bottles for use in thermoformed applications and specifically clamshells. SmartCycle™ has implemented an education program in its pilot market to help MRF operators and recycled material users understand the value of PET packaging beyond bottles. The SmartCycle™ branding logo (a stylized bottle base) seeks to make consumers aware of this problem while building awareness of recycling and sustainability.

## **III. Keeping PET in the Recycling Loop**

After considering the chemical characteristics of PET, the breadth of applications for the packaging material and the existing infrastructure for recovery already in place, Michael Brown decided to focus on using recycled PET as a source material. According to a 2004 NAPCOR Report on Post Consumer PET Container Recycling, there are over roughly 4 billion pounds of



PET available in the US for recycling annually; with a current recycling rate of about 21% (2004 American Plastics Council).

The sustainability of a fossil fuel-based polymer, like PET, is contingent upon its ability to circulate in closed-loop cycles through reuse and recycling.

### **Breaking the PET Recycling Status Quo**

SmartCycle™ is an entrepreneurial venture operating in a market niche underserved by other packaging manufacturers. As a result, it bears the first-mover burden of educating the many players involved in these products' life cycle. In order to achieve its objective of remaining in the recycling stream, SmartCycle™ has implemented an education campaign directed at MRFs. The company has designed a logo and website ([www.smartcycle.com](http://www.smartcycle.com)) to highlight the products' advantages and to encourage consumers to recycle the containers along with bottles.

### **Education**

SmartCycle™ is developing training materials directed at MRFs likely to have contact with clamshell PET containers exhibiting the 'Made from Bottles' logo. This will ensure that MRF management and sorting staff are aware of the new product and how it can potentially be processed with necked bottles.

### **Branding**

As previously outlined, MRFs preferentially select necked bottles for recycling. SmartCycle™, being made from recycled bottles should be recycled with bottles, but as a clamshell its shape does not indicate its recyclability to MRF sorters (no neck). To address this critical detail, a clearly visible logo was developed to convey the value of the material.

Distinctive SmartCycle™ package mark:



The printed logo is primarily green making an environmental association, and the flower design which is engraved into the clamshell tooling imitates the Petaloid Base found on the bottom of most plastic bottles.

This logo achieves several goals. First of all it provides a clear marking for MRF sorters and clearly states that the base material is made from bottles. Secondly, its high profile position on packages inherently improves recycling and sustainability awareness amongst retail consumers and gets them to initiate the recycling phase after consumption.



### **Testing the Market**

Currently, SmartCycle™ licenses its design plan to produce a line of PET clamshells that are being tested against three primary criteria in a pilot market in a chain of New Hampshire Co-ops. This pilot program, started in February 2006, is seeking to determine:

- interest for producers to use this type of packaging,
- consumers' rate of putting SmartCycle™ into recycling stream, and
- MRF's acceptance of education programs and subsequent sorting of SmartCycle™.

Interest in the product is high, and recently SmartCycle™ has come to terms with Klöckner Pentaplast, a leading plastics manufacturer, to produce larger runs of thermo-formable film for broader distribution. In the test market, initial results indicate MRF's willingness to sort and include the products bearing the SmartCycle™ logo has been reasonable, but measuring consumers' recycling rate is so far difficult to quantify.

There is a slight cost disadvantage to this type of product compared to equivalent reprocessed thermoformed containers. Costs are somewhat higher due to the use of a limited number of FDA compliant processes and purely bottle feed stock. Although the cost of SmartCycle™ is slightly higher than cheaper petroleum-based plastics, it is currently cost competitive with biopolymers.

### **IV. Product Design Based on Sustainable Packaging Definition**

Michael Brown realized a problem of this magnitude presented a clear case for a new product, and he set about solving this problem by applying guidance set forth in the SPC's "Definition of Sustainable Packaging." Michael indicated "My hope is that this effort makes the industry and the public more aware of the concept of sustainable packaging where packaging is seen not as waste...but as a valuable resource". The definition provided a framework within which to consider the different faces of this new package & system design. The eight criteria of the definition are listed below including brief discussions on how the SmartCycle™ design measures up.

#### **A. Is beneficial, safe & healthy for individuals and communities throughout its life cycle;**

Similar to most products, SmartCycle™ provides a service of product preservation, provides jobs in material manufacturing and in addition stimulates jobs in material recovery. The most unique social benefit that SmartCycle™ provides is found in its education of the public. SmartCycle™'s branding informs the consumer of the issues around recovery and educates them about the idea of a closed-loop system. Helping consumers realize their place in the supply chain in order to facilitate a higher material recovery rate is essential to the system.

#### **B. Meets market criteria for performance and cost;**

SmartCycle™ is in its early stages of development and is therefore somewhat more costly than comparable products. In its pilot stage, the target market consists primarily of



environmentally conscious consumers who value sustainable initiatives and are willing to pay a premium for such products.

The clamshells are of comparable quality compared to virgin packaging. SmartCycle™ contains no less than 50% post-consumer recycled content. Test bed manufacturers have found that SmartCycle™ meets stringent standards on degradation, clarity, brittleness, and ease of processing.

SmartCycle™ products can be used for food contact applications. For containers in contact with food, the post consumer content must be processed by recyclers that have a FDA non-objection status.

**C. Is sourced, manufactured, transported, and recycled using renewable energy;**

Michael Brown described using renewable energy as a “phase two” endeavor for the SmartCycle™ brand. From a resource efficiency perspective, the product design focuses on using recycled materials which require less energy to produce than virgin materials. Once the basic SmartCycle™ products are established in the marketplace, the company plans to require manufacturers to use an equivalent amount of renewable/green energy in the production process by converting to green energy sources or by purchasing certified renewable energy credits.

**D. Maximizes the use of renewable or recycled source materials;**

SmartCycle™ exists to divert plastics headed for landfills back into the recycling stream. The current SmartCycle™ specification requires no less than 50% of the package be made from post consumer recycled content. Michael Brown indicates that he would like to see this standard increase over time and higher levels of recycled content incorporated in the design concurrent with recycled PET feed stocks being available.

**E. Is manufactured using clean production technologies and best practices;**

Clean production includes the conservation of raw materials, water and energy, the elimination of toxic and dangerous raw materials, and the reduction of the quantity and toxicity of all emissions and waste generated during the production processes. SmartCycle™ is in its testing phase and will directly address these standards as part of its high volume manufacturing plan and future product roll-outs.

**F. Is made from materials healthy in all probable end-of-life scenarios;**

Residual antimony, used as a catalyst in the polymerization process, is present in PET at approximately 200 ppm (NAPCOR, 2006). The mobility of antimony during the use phase of PET packaging is the subject of some current investigations. However, it is the improper handling of PET at the end-of-life that is of major concern. PET will not leach noxious chemicals if kept in a landfill, but in inadequately controlled incinerators or in open burning, PET combusted with inadequate air or with coal may result in CO and benzene emissions.

SmartCycle™ addresses these end-of-life health issues by encouraging proper collection, recovery and recycling through specifying for recycled feedstocks to make the material.

**G. Is physically designed to optimize materials and energy;**



SmartCycle™ is designed to use as little material as possible. Firstly, the packaging itself is designed to be functional yet light. Secondly, the empty packages can be nested reducing the burdens of transportation such as shipment packaging and overall space requirements. Thirdly, as previously mentioned, specifying for post-consumer recycled content reduces energy inputs for feedstock materials.

#### **H. Is effectively recovered and utilized in biological and/or industrial cradle to cradle cycles.**

The greatest challenge that SmartCycle™ containers face is the one challenge it is designed to overcome: Recycling non-bottle PET containers. SmartCycle™ products have the benefit of overlapping with the American Plastics Council's "Collecting All Plastic Bottles" community based-initiative. In late 2003, over 1800 communities in the USA had implemented this initiative asking that residents recycle all plastic bottles<sup>1</sup>. Hopefully, when residents participating in this program see the 'Made with Bottles' logo they will know to include the non-bottle shaped container with the bottles.

#### **V. Conclusion**

SmartCycle™ seeks to improve upon deficiencies in the PET recycling method by addressing the problem in a systematic and innovative manner. The benefits of bringing such products to market are wide-ranging with the savings to the environment being the clear winner. The SmartCycle™ project represents a strong example of applying the sustainable packaging definition at the initial stages of product design and the reaping the resulting positive effects. Despite the current cost disadvantage, SmartCycle™ is poised to scale up its production runs and compete on an even level with less environmentally thoughtful containers. As thermoformed PET clamshell packaging usage rises, SmartCycle™ is making inroads to improving the recycling system and reducing the demand for virgin PET.

#### **Glossary of Terms**

Material Recovery Facility (MRF) – A specialized plant that receives, separates, and prepares recyclable materials for marketing to end-user manufacturers.

Polyethylene terephthalate (PET) – A thermoplastic resin of the polyester family

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<sup>1</sup> Dunbar, Judith. "Collecting All Plastic Bottles - Targeting Communities for Increased Plastic Bottle Recovery." American Plastics Council. 26 July 2006  
< [http://www.plasticsresource.com/s\\_plasticsresource/view.asp?DID=1754&CID=533](http://www.plasticsresource.com/s_plasticsresource/view.asp?DID=1754&CID=533) >