"Defining the Value Proposition of Environmental Plastics, Plastic Lumber in the Marketplace and the Environment."

for presentation at the Society of Plastic Engineers, Global Plastics Environmental Conference, Detroit, Michigan , February 18 & 19, 2004,
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Whenever I enter into a speaking engagement on a topic selected by someone else I like to reference my friends at Webster Dictionary to get a clearer understanding of the words involved and the various meanings that can or could be applied to each word, their synonyms and the many meanings that can be weaved by their combinations. Review of the key words of this session adds some valuable insight to how we might approach this topic.

Define: ***v***: Explain, expound, interpret, circumscribe, limit, mark (off), designate, delineate, describe.

Value: ***n***. worth
r***el***: appraisal, assessment, charge, cost, expense, price
syn: quality
v. estimate
rel: compute, figurem, gauge
syn: appreciate, care (for), revere, reverence, venerate
idiom: set much by

Proposition: ***n***. Proposal; Something which is proposed to another for consideration
syn: invitation, proffer, proposition, suggestion
rel: motion, recommendation, idea, plan, project, outline, scheme
v. Propose; to set before the mind for consideration
syn: pose, prefer, propone, propound, put, suggest
rel: move, offer present, submit, tender, ask, request, solicit

Environmental: ***adj***. a surrounding or being surrounded; All the conditions, circumstances, etc. surrounding and affecting the development of an organism.
n. environ, to surround, encircle

The combination of the various words and their meanings adds an unusual complexity to defining the value proposition of plastic lumber. Uniquely, the value of the recycled plastic lumber can be embodied and attached to several of these definitions for which we can empirically assign a dollar value to better understand the economic and environmental good generated from this product. Through this paper we will look at the recycled raw materials, finished product markets, solid waste reduction, reduction of

harmful chemicals to the environment and the reduction of deforestation of global forests along with the additional economic benefits from the recycling of materials.

Recycled Plastic Raw Materials:

Typically, plastic lumber is primarily manufactured from recycled high density polyethylene from both rigid containers such as one gallon milk jugs and/or flexible packaging such as stretch wraps. This is an over generalization. Currently as there are now a number of resin combinations and alloy compounds entering the marketplace, allowing a premise for the economic and environmental good that plastic lumber offers.

Recycled plastic raw materials trade in price ranges that include these factors:

Resin Type: PE, PP, PVC, PS and others
Cost: In relationship to pricing of similar virgin materials
Physical Properties: Density, Melt Characteristics
Color: Natural (un-pigmented), Mix Color, Black, White, Specific Color
Form: Chunks, Purge, Regrind (particle size), reprocessed pellet
Volume packaging: Large to small; railcar, truckload(s), Gaylord, odd lots
Additives: Slip, fire retardants, mineral
Contaminates: Moisture, wood, paper, metals, oils, floor sweeps, pesticides, etc
Demand: Domestic and Global
Credit: Worthiness of buyer
Ethical: Worthiness of the seller/broker
Transportation costs: Landed costs at point of manufacturer

Normally the buy/sell trading conversations start with the resin type, color, physical properties, cost and then the conversation wags around to the other variables in the buyer/seller relationship, which aid in the fine-tuning of the final price. The highest raw material values are “natural color” unpigmented materials as they can be used in many color combinations for an end product. There is debate over the value of regrind versus reprocessed pellet, but in my own experience, our processes are designed to be most effective with a regrind. The primary basis of this decision is that our materials go through a wash and dry process, thereby eliminating the primary harmful contaminates and any metals or glass. This washing process could introduce a moisture problem if not processed correctly. For our manufacturing process, another heat history created in making a reprocessing pellet adds no additional manufacturing value. However, sometimes there is a need for the heavier bulk density of a pellet for material handling equipment to function properly or remove the uncertainties found in the contaminants within regrind material.

To establish economic value for recycled HDPE plastics at the writing of this paper being November 2003:

$.27 for natural milk jug regrind that has been granulated, washed and dried.

$.18 for mix color which has been granulated, washed and dried

Finished Products and End Markets:

The value proposition for finished products and end markets varies to the application. Let me give some examples. The Environmental Protection Agency (EPA) has initiated bans on the use of CCA (copper, chromium, arsenic) pressure treated lumber materials in playground and residential application effective December 31, 2003. The park and recreation market was among the very first large consumer market to embrace the attributes of plastic lumber and is motivated by the need to keep splinters and harmful chemicals away from children. The park and recreation market place has an established distribution system that embraces new and innovative products. Plastic lumber solves the safety needs of removing splinters and pressured treated chemicals from parks and playgrounds, but it also adds an attractive color and durability element that did not exist with wood products. Its market acceptance has been so total that it is very difficult to find any natural wood used in current construction projects in park and playground applications.

The largest single product market for plastic lumber within the domestic United States is the residential deck and railing industry. The consumer is searching for several market value propositions that will reduce maintenance, including no painting, no staining, no splinters and no rot. Adding to the market value consideration is the US EPA ban on CCA pressure treated materials resulting in an increase in market demand for alternative material systems. Recycled Plastic Lumber and other alternate materials have moved to fill this market need and are here to stay within the building product material system marketplace.

The Environment:

There are four basic areas for which there are enormous environmental benefits when manufacturing plastic lumber from recycled plastics: 1) Reduction in solid waste materials destined to the landfill, 2) Reduction in the use of harmful chemicals that might leach out the pressured treated lumber product and contaminate the water or soil, 3) Reduction of the deforestation of trees, 4) The value added to the economy by recycling plastic material. We will look individually at each of the areas and review the macro economic effects that 1,000,000 board feet would have on the environment and economy.

1) Reduction in solid waste:

An all plastic 2 x 6 is equivalent to one board foot and weighs approximately 2.6 pounds. There are approximately 6.4 milk jugs in one pound. Therefore 16.64 (2.6 x 6.4) milk jugs per one board foot are diverted from the landfill and placed into service as a long term durable product. There are approximately 6 fully inflated or 36 compacted one gallon milk jugs per cubic foot recycled plastic lumber.

1,000,000 board feet of plastic lumber would consume 16,640,000 one gallon milk jugs or 2,600,000 pounds (1300 Tons) of recycled HDPE, reducing landfill usage by 2,773,333 cubic feet for fully inflated or 462,222 cubic feet for crushed one gallon milk containers.

2) Reduction in Harmful Chemicals:

The chemical components of CCA pressure treated lumber are Chromium, Copper and Arsenic (a known carcinogen) and are described by a loading factor which represents the amount of CCA impregnation into a cubic foot of material. Example: (0.4) CCA refers to 0.4 pounds of CCA impregnated into a cubic foot of material. There are other higher loadings utilized in the CCA industry (especially for marine utilization), but 0.4 is a commonly used value for residential applications and is selected for this comparison. There are 12 board feet in a cubic foot. Therefore 83,333 (1,000,000 ÷ 12) cubic feet in 1 million board feet of wood. A 0.4 CCA content would mean 33,333 (83,333 x 0.4) pounds of CCA chemical used to process 1 million board feet of natural wood lumber.

47.5% Cr03 (Chromium Oxide)	= 15,833 lbs
18.5% CuO (Copper Oxide)	= 6,167 lbs
34.0% As2O5 (Arsenic Pentoxide)	= 11,333 lbs
Total	**= 33,333 lbs**

The estimated for the current market size of plastic lumber and alternate plastic/wood composite building materials is $500 million. A market value per board foot is $2.60 per board foot is used as a bench mark price. This market data would result in the following reduction of CCA used in the pressure treating process and reducing the possibility of harmful chemicals leaching into the soil or water tables:

192.3 Million Board Feet (500,000,000 ÷ 2.6 ÷ 1,000,000)
6,410,256 pounds of CCA Used (33,333 x 192.3)

3) Reduction in Deforestation of Trees:

While there is an obvious need to switch to an alternate building material from a CCA pressure treated wood product, there has also been a change in utilizing building products manufactured from rainforest hardwoods. This long term effect is outside the scope of this paper. However the utilization of 1 million board feet of plastic lumber can only benefit the global environment by reducing the need to deforest any type of land and the upsetting of the environmental ecosystem of the specific region that has been deforested.

4) The Economy

The dollar values that can be added to the economy are significant through the collection and processing of recycled plastic materials. One can also view the economic dollar

values lost by not having an optimized recycled container. Earlier in this paper I gave indications of current market pricing for recycled raw materials in the United States as of November 2003. $.27 for natural and $.20 for mix color HDPE, granulated, washed, dried and packaged in gaylords. A break out of the intrinsic specific costs may be compared in the following context for a natural color recycled milk jug material and a mix color container:

Natural	**Mix Color**	
$.15	$.08	Collection of materials in the communities
$.07	$.07	Intermediate processing (sort, grind, wash, dry)
$.01	$.01	Transportation cost
$.04	$.04	Profit
$.27	$.20	Total Costs

● Let's review economic benefits that one million board feet of plastic lumber would have both to the recycling infrastructure and economy.

16,640,000 one gallon milk jugs removed from the waste stream.
2,600,000 pounds of recycled HDPE direct to durable products.

● At current market pricing: $.27 for natural unpigmented milk jug regrind that has been ground washed and dried and $.20 for mix color you have this economic benefit.

$702,000 (2,600,000 x .27) if this were a natural unpigmented material
$520,000 (2,600,000 x .20) if this were a mix colored material
$182,000 lost to color value differences

● Let's review the total economic benefits to the current marketplace size described as totaling $500,000,000 (192.3 million board feet).

$134,994,600 (2,600,000 x 192.3 x .27) equivalents natural recycled materials
$ 99,996,000 (2,600,000 x 192.3 x .20)equivalents in mix color recycled materials

Plastic lumber products are relatively new to the economy with most products under 10 years in production manufacturing and there have already been enormous benefits to the US and global economies and environments. While we have been concentrating on the current activities, the future for products under development looks very bright. Currently there are several structural grade plastic lumber products in development that would meet the civil engineering design requirements to carry the loads necessary to build structures such as pedestrian and heavy load bridges; joists, beams and girders for marine waterfront applications and break walls; pier pilings, railroad ties and many other applications where traditional materials are not holding up in outdoor weathering applications or where harmful chemicals are being removed from the environment.

Truly the "Value Proposition" of recycled plastic has many aspects that lie within the raw material and finished products: reduction in solid wastes, reduction in the use of harmful

chemicals, reduction in deforestation of trees and additional revenues added to the economy through the processing of recycled plastic materials.

Thank you for the opportunity to present this paper.

Respectfully Submitted,

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