




PLASTIC DREAMS

NOT CONTENT TO REST ON ITS UNIQUE HDPE RECYCLING TECHNOLOGY, ENVISION PLASTICS HAS AMBITIOUS PLANS THAT COULD TAKE IT INTO OTHER PLASTIC NICHES AND EVEN PLASTIC MOLDING. **BY KENT KISER**



Tamsin Etefagh passes me a hair net. I have to put it on, she says, if I want to see the equipment that makes Envision Plastics (Reidsville, N.C.) a technological leader in the recycling of HDPE containers. I don the net, and Etefagh leads the way into a clean, quiet room with a vaulted ceiling to accommodate a tall, white machine that takes up a quarter of the space. From the outside, the funnel-shaped machine doesn't look overly impressive, but it's what happens inside that counts. According to Etefagh, the firm's vice president, the unit is the only one in the world that can purify postconsumer HDPE resin to a contamination level of less than 320 parts per billion.

That's clean enough for the resin—which the company has dubbed EcoPrime™—to be used in food-grade applications, including milk and juice containers, frozen food bags, and bottles for personal care products, vitamins, and pills. In 1998, the U.S. Food and Drug Administration (Washington, D.C.) issued a letter of non-objection affirming EcoPrime's food-grade quality, making Envision the only U.S. postconsumer HDPE recycler with that distinction, Etefagh says.

Envision is so focused on maintaining the high quality of its EcoPrime product that it built an adjoining room exclusively for loading the resin into Gaylord containers. The room is spotlessly clean and largely empty, except for tubes that snake down from the ceiling and feed the resin into waiting containers. The room even has a system that prevents outside air from entering when the loading door opens. That quality focus is one reason why Envision has succeeded so quickly, growing from recycling about 20 million pounds of HDPE a year at its founding in 2001 to about 109 million pounds now, with even bigger and broader plans in its future, Etefagh says.

GETTING STARTED

Envision Plastics traces its roots to 1997, when Parmass Holdings—a private equity group—acquired the plastic recycling assets and technology of Union Carbide Corp.'s facility in Piscataway, N.J. That patented technology removes contaminants, also called volatiles, from recycled HDPE resin to make it pure enough to use in food-grade applications. After receiving the FDA letter of non-objection for the technology, Parmass sought a plant where it could build a commercial-scale version of the equipment that was operating on a small scale in Union Carbide's lab. In other words, Etefagh explains, “we had the technology without the machinery for it.” In 2001, the group purchased the FCR Plastics HDPE recycling plant in Reidsville, N.C., from its previous owner, Casella Waste Systems, and launched Envision Plastics on June 1, 2001. FCR continues to serve as a major supplier of scrap plastic to the facility, Etefagh notes.

Envision Plastics makes its food-grade EcoPrime recycled resin only from natural-colored HDPE containers (right) that previously were used in food-related applications, such as milk and water bottles. “We are very quality-conscious and picky about the material we buy,” Tamsin Ettefagh says. Half of the Reidsville, N.C., plant’s scrap feedstock is natural HDPE containers; the other half is mixed-color HDPE bottles (far right), whereas the Chino, Calif., operation buys 70 percent natural and 30 percent mixed. The two operations can process 6 million pounds and 3 million pounds a month, respectively. When processing mixed bales, Envision pulls out any PET bottles and other undesired plastics to sell to other recycling companies.



With its East Coast presence established, Envision sought a West Coast footing, which it found in October 2001 in a facility formerly operated by U.S. Plastic Lumber in Chino, Calif. The company initially planned to use a \$3.6 million recycling grant from the state of California to install its food-grade HDPE technology in the California facility. When the grant funds were held up, however, Envision shifted those projects to its Reidsville plant and invested its own money to see the project to fruition. (Envision

has since been able to activate the California grant and is finalizing plans to install the necessary equipment to produce food-grade HDPE recycled resin at its California location.)

In the subsequent months and years, the company assembled its leadership team, expanded its workforce, added technology, and increased capacity to

the point where it now has 99 employees (63 in Reidsville; 36 in Chino) and recycles 109 million pounds of postconsumer HDPE annually. Envision transforms that material into three categories of recycled HDPE resin, with its EcoPrime food-grade resin its premier product. The patented and patent-pending technology that produces EcoPrime not only reduces volatiles to almost undetectable levels, Ettefagh says, it also makes the resin odor-free, ideal for grocery bags and other uses in which any odor would be a prob-

lem. “It’s as pure as virgin resin but meets the growing need to create sustainable products,” she says.

Its next most valuable product is Prisma™ resin, recycled HDPE the company has sorted into custom colors based on specific customer needs. As Ettefagh walks through the Reidsville plant, she points out containers holding resin in colors she calls “Downy blue” and “Tide orange” used to manufacture bottles for those fabric care brands. With this precise color-sorting process, customers can buy a recycled resin that’s less expensive than natural-colored recycled HDPE—and they save even more money because they don’t have to color it, she notes. For one customer, the savings were 3 cents a pound from using Envision’s color-sorted resin instead of natural HDPE resin and an additional 6 cents a pound from lower colorant costs. “That’s really our big selling point,” she states.

Envision’s third recycled HDPE resin product is utility-grade material for economical reuse applications, such as blow-molded containers, extruded film and sheet, injection-molded municipal waste containers, flower pots, and drainage pipe.

A TRANSFORMATIONAL PROCESS

Envision’s headquarters plant in Reidsville, N.C., is nondescript from the outside, with only the company sign and the facility’s resin silos suggesting what it produces. You don’t catch a





glimpse of a single plastic bottle until you go around back, where incoming loads of baled natural and mixed HDPE bottles arrive for recycling. Some bales sit on the plant's loading dock, but most of the infeed is stored in trailers behind the operation. The bales are Envision's raw material, and some of them—primarily the mixed bales—are quite raw indeed, containing a host of non-HDPE items, everything from PET bottles to aluminum cans to clamshell food containers. There's no avoiding the raw smell emanating from the postconsumer containers as well as from the operation's on-site water treatment plant. At this stage, it's difficult to imagine this material becoming the clean, odor-free pellets that come out the other side of the plant.

With great patience, Etefagh talks and walks me through the process, which starts with workers breaking the bales and feeding them into the plant's two processing lines. The first step of each line is a trommel that loosens the flattened containers and knocks the caps off many of them. One line features a traditional industrial-grade trommel; the other line has a trommel designed for the mining industry, which has performed so well that Envision plans to replace its other trommel with this model, Etefagh says.

The materials move via conveyor up to a sorting station, where an employee picks out trash, miscellaneous plastics, and PET, leaving good HDPE on the belt. The company discards the trash, but it re-bales the other plastics and sells them to

other processors. The HDPE containers continue into the next room to the grinder, which reduces them to flake. The flake goes into a float/sink water separation tank, which culls out any remaining non-HDPE plastics, then into an intensive wash cycle with detergent to clean and deodorize it and remove labels, which are aspirated from the mixture. Envision's process removes 99.8 percent of labels from its feedstock, Etefagh says.

In the next room, which is noticeably cleaner and a bit quieter, a screening system divides the flake into a rough cut of smaller pieces and larger pieces in preparation for the color sorting stage. Envision's color sorters use optical technology to identify flakes of specific colors on the conveyor belt at a rate of 1 million flakes a minute, sorting them using air jets. The first sorting line simply separates light pieces from dark pieces. Material then goes through various additional sorters depending on the final desired product. The sorted flake then goes into one of four extruding machines, which melt the plastic and chop it into pieces the size and shape of lentils. The hot plastic cools and solidifies in a water bath.

In keeping with its focus on quality, Envision takes a sample from each extruder every hour to check the plastic for a few specific characteristics, such as color and melt flow, using its on-site lab and polymer scientists. The company conducts a more detailed array of tests every four hours, and it does a final check of the resin at the shipping stage.

All of the firm's resin goes through these stages, but only the best natural HDPE resin makes it to the final step—the devolatizer room. It's at this point that Ettefagh politely asks me to don a hair net to see the company's mechanical *pièce de résistance* and its adjoining packaging room. When the door closes behind us in the devolatizer room, I realize that everything is quiet. Everything is clean and dry. There's no more smell. The noisy, pungent loading dock and the sorting and granulating stages seem a long way away. This transformation of material is a testament to Envision's technological expertise at every step of the process, which helps explain how it has managed to carve a unique place in the recycled HDPE market in its nine-year history.



HONING THE COMPETITIVE EDGE

As Ettefagh leads me through Envision's plant, she can't hide her pride in the unique technology and how it sets the firm apart from other HDPE recyclers.

She hands me a clear plastic box that holds 24 small, round containers of recycled HDPE resin granules that look like candy in a rainbow of colors. "Unlike many of our competitors, we make more than just black and white HDPE grades," she points out. But that's not the only advantage the company offers. Envision's recycled HDPE resin is almost always less expensive than virgin HDPE resin, she says, and it allows users to improve the sustainability claims of their products because recycled resin generates significantly fewer greenhouse gas emissions than virgin resin when comparing their life-cycles.

Envision also offers customers a variety of resin blend-in additives, such as color correctors



Envision operates two processing lines at its Reidsville facility with the combined capacity of 10,000 pounds an hour. Below, Ervin McClelland feeds bales of mixed containers into one of the Reidsville processing lines. Each line has a sorting station (left) where an employee—here, Roberto Aguilar—pulls PET containers, miscellaneous plastics, and trash from the HDPE stream, tossing each material into a separate bin for re-baling or disposal.



to minimize the customer's colorant use, antioxidants to help recycled resin regain some properties lost in the recycling process, and lubricants to aid during processing (usually for injection-molding applications). In addition, the firm offers toll-processing services for companies that want to recycle their own plant scrap.

On the market side, Ettefagh notes, one strength of the company is that it's "always a buyer. Even if we don't need the material, we'll buy—at our price." That philosophy is a "huge" help to Envision suppliers who have realized the value of partnership with the company and don't have to spend the time shopping their material around, she says. The company even was a consistent buyer in 2008, when the market crashed. "Lots of people were calling us in a panic, and at least we would take their material so they could move out their inventory and replenish," she says. "That built us a lot of new relationships."

Envision also makes it a habit to help suppliers find markets for material it can't use. "When someone calls with PP, PET, or PS, we don't just turn them away," Ettefagh says. "We're a source of market information on where they can sell that material." In a related vein, if a supplier ships Envision a load of unacceptable material, the company doesn't simply reject the shipment. Instead, she says, "we'll work with the supplier to find another home for the load so they don't have to rework the material." That approach saves the supplier return-shipping costs and keeps material from potential disposal.

Internally, Envision takes a different tack than some of its competitors regarding its employees. Rather than giving incentives for meeting production goals, the company rewards its workers based on their quality performance. "If we have no quality complaints, everyone in the plant receives a bonus," Ettefagh says. This quality focus makes employees feel good, she explains, by affirming that "they're working for one of the highest-quality producers around." Envision also sets aside a percentage of its annual profits for staff bonuses, with the amount determined by each worker's seniority and contributions.

Operationally, Envision has implemented innovative practices to increase its efficiency and, in the process, save money. For instance, the company installed equipment that allows it to recover small particles of plastic from the fines removed by its water system. The equipment recovers 2,000 to 4,000 pounds of plastic par-



After the sorting stage, bottles are chopped into flake (top) and cleaned. A turbo-washer removes 99.8 percent of labels from the flake, generating 15,000 pounds of label waste a month (above). Currently, Envision landfills the material, though it continues to seek markets for it.

ticles a day—about three truckloads a month of material that previously went to the landfill. "That has a positive effect on our bottom line," Ettefagh says. To save in other areas, the company sharpens its own grinder blades and vacuums moisture off its flake rather than using drying towers, which consume more energy, she says. The firm also takes hot water from its extruders, increases its temperature in a heat exchanger, and gives it a second life as wash water.



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CHALLENGES APLENTY

Envision also faces its share of challenges in the competitive plastic recycling market.

In North America, Ettefagh estimates that the company has about 30 competitors in its niche—some many times its size—though only seven can make bottle-to-bottle-grade recycled HDPE resin. The biggest competitor for scrap plastic, however, is China. Depending on the market, Chinese buyers can offer higher prices and cash payment terms that many U.S. scrap plastic suppliers find hard to resist, she says. "We're all fighting over the same pounds."

To compensate for the scrap it loses to China, Envision started buying material from other countries, including Canada, Mexico, Costa Rica, Poland, France, and Spain. Today, it imports scrap plastic primarily from Canada and the Tijuana area of Mexico, mainly because the European material contained too much PP.

Also, European HDPE milk bottles often include a barrier layer of ethylene vinyl alcohol plastic (EVOH) to protect ultra-high-temperature pasteurized milk from oxygen contamination. "EVOH is OK at a small percentage, but it's a nightmare at a large percentage" because it absorbs moisture and melts at a lower temperature than HDPE resin, Ettefagh explains.

EVOH isn't the only polymer challenge Envision encounters in its operations. "Our biggest issue is dealing with all of the new packaging innovations [that are] coming out without an understanding of how they affect recycling," Ettefagh asserts. Some plastic products—including certain water bottles and HDPE packaging—now incorporate an oxydegradable additive. This additive—which she calls a "huge threat"—contains an activator that makes the plastic biodegradable. If that additive persists in recycled HDPE resin, it could compromise the quality, safety, and/or longevity of the recycled product—such as plastic lumber or plastic strapping—with potentially disastrous consequences, Ettefagh says. Yet another concern is that many HDPE containers have shrink-sleeve labels that aren't



Envision uses optical sorting technology (above) at its two plants to sort plastic flake into different color streams, with the ability to distinguish up to 40 million shades of color. The sorters can cull plastic flakes of different colors (right) that will combine to make a color for a specific customer or product.



Tamsin Ettefagh has worked for Envision Plastics since its founding in 2001 and has spearheaded the firm's commercial success, with more growth to come. "We have a laundry list of things we'll continue to improve in our company," she says, "and we'll share those savings with our customers in the future."



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After the sorting stage, the plastic flake enters one of four extruders, which melt the plastic, press it through a die with small openings, and chop it off in lentil-sized pellets. The hot pellets cool in a water bath (above), go through a spinning dryer, then get loaded into Gaylord containers. Customers can buy recycled resins that match their brand colors, saving money on both resin and colorants and improving the sustainability of their packaging.

the same polymer as the bottle. That creates additional quality-control work for Envision to make sure the label material is purged from its system.

Envision faces more headaches as many curbside collection programs expand the types of plastics they accept to increase recycling rates and trim their disposal volume, “even though there are not solid markets for all those materials,” Ettefagh says. This exacerbates the longstanding misperception among the public that all plastics are the same and that the chasing arrow symbol guarantees that a material is recyclable, she says. To illustrate how this trend affects Envision and similar recyclers, Ettefagh offers statistics on yield loss—the amount of contaminants in loads of scrap plastic. Comparing the 1990s to the first decade of the new millennium, the yield loss in bales of natural HDPE containers has grown 60 percent, she reports, while the yield loss in bales of mixed HDPE containers has increased about 47 percent. That

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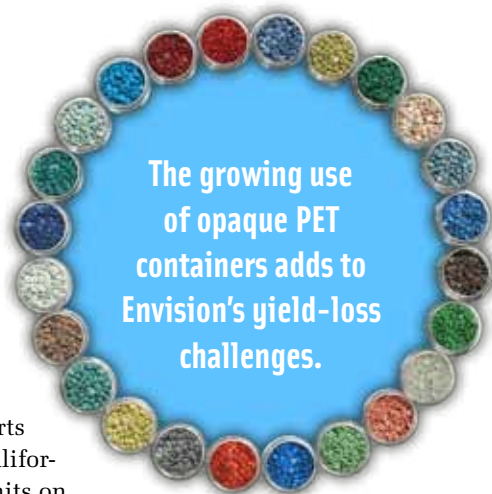
undesired material represents both a financial loss for Envision and a processing challenge, requiring extra vigilance to keep such contaminants out of its HDPE stream.

The growing use of opaque PET containers adds to Envision's yield-loss challenges. Though most PET containers—such as water bottles—are clear and easily detectable, opaque PET containers closely resemble HDPE containers, thus they are harder to sort out. Fortunately, Envision's float-sink process removes the material, so it doesn't present a quality problem as much as another yield-loss issue. "We're paying a higher HDPE price for lower-priced PET, plus we're losing pounds from our process," Ettefagh explains.

Though unwanted polymers and yield loss are problems throughout the plastics recycling industry, Envision faces some unique additional challenges, Ettefagh says. For instance, North Carolina and California—the locations of its two plants—are two of the most stringent states regarding water discharges from industrial

operations, she asserts. While most states have water discharge rules with limits on mercury in the parts per million, North Carolina's rules are in the parts per *billion*, and California has stricter limits on total dissolved solids, she says.

To comply, Envision had to make various operational adjustments, such as using a "purely mercury-free cleaner"—rather than a normal caustic cleaner—to wash labels off its HDPE flake. Envision also operates water treatment equipment inside its two facilities to clean its wash water prior to discharge. In fact, Ettefagh says, the company sometimes must purify the incoming "clean" water from its local utility because it exceeds the mercury discharge allowance. "We're



The growing use of opaque PET containers adds to Envision's yield-loss challenges.

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Gaylord containers full of recycled HDPE resin await shipping. Each container holds an average of 1,625 pounds.

probably paying a penny-plus more per pound than our competition just to deal with the water issues," she says.

That said, Envision has found ways to turn its water treatment requirements to its advantage. Specifically, "we've realized our ability to recycle our water, with the potential to recirculate it in a completely closed loop," Ettefagh says. "This technology will bode well for the overall reduction of our energy and resource usage and is very desirable to our customers."

The company also has significant safety challenges. "The plastics industry is one of the worst for safety, so there are high insurance costs to be in this niche," Ettefagh says. Daily hazards include working with granulator blades, forklifts, hot extrusion equipment, noise, and potential slips due to working with water. Despite these hazards, Envision boasts a good safety records, she says, thanks in part to monthly staff meetings with a third-party safety engineer and internal safety procedures.

NOT SITTING STILL

Even with those challenges, Envision has managed to not only survive but thrive. The most tangible proof of the firm's success is its plan to expand its California operations into an additional 125,000-square-foot space.



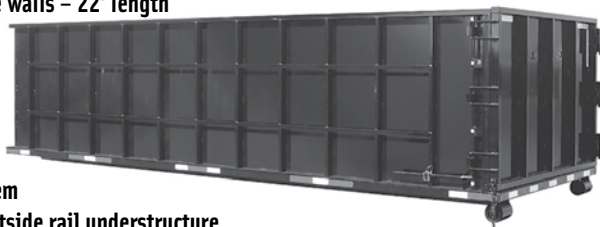
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(The Reidsville plant currently has about 80,000 square feet of office and operating space, while the Chino facility occupies 36,000 square feet.) The company will wash, sort, and extrude resin in its Chino plant and use the additional space to upgrade the resin to food-grade quality. Ecoplast Corp., Envision's sister company, will share the new California space, moving its activities from nearby Pomona.

Beyond its physical expansion plans, Envision seeks to expand its product scope into recycling PP containers. The firm has several reasons for this move, Ettefagh says: PP is the most-used resin in the world; there's global demand for recycled PP; more containers are converting to PP; and PP is rarely recycled in the United States, offering huge market potential. Pill bottles represent one particularly promising area in this niche. "There's a lot of low-hanging fruit in pharmaceutical containers," Ettefagh says. "They're all being thrown away now, in part due to privacy concerns." In addition to the privacy and infrastructure challenges of this new market, PP resin isn't as technically consistent as HDPE resin, with melt flows and densities "all over the map," she says. "We need a technology to custom-compound the PPs together and make a product that's reusable."

Envision also aspires to become more vertically integrated—namely, "manufacturing some end products," Ettefagh says. To avoid competing with its current customers, Envision will steer away from producing bottles, so it's "trying to come up with an innovative new thing," she says. "We're putting feelers out for an end product that makes sense." It's all part of the "laundry list" of improvements the company plans for its future, Ettefagh says. "Envision doesn't sit still. We always have a new project going on." ■

Kent Kiser is publisher and editor-in-chief of Scrap.



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