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Special Report: Business of Green

A Refuge Made From Refuse

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A blog about energy, the environment and the bottom line.

In the 1990s, Elsa Zaldívar, director of Base- ECTA, a rural development organization, was working with women in Caaguazú, in central Paraguay, growing and harvesting loofah for export to make mats, slippers and sponges. Ms. Zaldívar noticed that nearly a third of the harvested crop was below export quality, and more was ending up as waste trimmings in the manufacturing process.

Teaming up with an industrial engineer, Pedro Padrós, Ms. Zaldívar devised a way to blend loofah waste and other agricultural fibers with recycled plastic to form lightweight, flexible panels for walls, roofing and even basic furniture.

The panels have been used in three prototype homes, and production costs have been halved to $3 a square meter, or 28 cents a square foot, a figure competitive with the price of timber — which in any case is in short supply because of deforestation.

The United Nations Human Settlements Program, U.N.-Habitat, says that 600 million urban and a billion rural residents of developing countries live in overcrowded housing and dire sanitary conditions. In Latin America and the Caribbean alone, more than 110 million people live in city slums.

That adds up to a sizable market for socially conscious entrepreneurs promoting low-cost sustainable housing technologies for the poor.

“Sustainable development, and especially waste management, is gaining speed here as a social housing solution,” said Alberto Paranhos, senior advisor on Latin America and the Caribbean for U.N.-Habitat. “In many cases in Latin America, waste is not considered a problem anymore, but a resource for development.”

Alejandro Salazar, a Colombian chemical engineer, has pioneered cost-effective construction technologies using industrial and demolition refuse as raw materials.

Through his engineering consulting firm, Ecoingenieria, and a growing clutch of processing and construction subsidiaries, Mr. Salazar has developed a business recycling potentially hazardous debris into inexpensive, prefabricated housing parts that serve to replace concrete.

Industrial companies pay him to cart away their scrap — for instance, the several tons of porcelain insulators disposed of every month by electrical companies when they replace utility poles and power transmission lines. “We can salvage and reuse any type of waste, toxic or not,” he said.

Since 2002, Mr. Salazar has built or repaired nearly 1,400 houses, and he is preparing to construct an additional 1,200 over the next three years. An average Salazar home, fully finished and measuring 36 square meters, or 388 square feet, costs about $11,000, or about $4,000 less than a comparable house built from conventional materials.

Mr. Salazar's customers, often poor urban families displaced by the country's civil war, typically have to put down about 10 percent of the price — if necessary with the help of long-term, low-interest loans — while the remainder is covered by government credits. Company engineers and instructors train families to build their own homes with the prefabricated parts and supervise the four-week construction process.

Industrialists like Mr. Salazar have a model to draw on in the work of the Center for Research and Development of Structures and Materials, or Cidem, a Cuban research institute that has been developing environmentally friendly, low-cost housing technologies since the early 1980s. Housing construction in Cuba was hit hard by the economic crisis that followed the collapse of the Soviet Union, the country's main trading partner. To combat the crisis, CIDEM — working with Grupo Sofonias, a nonprofit development organization based in Switzerland, and various academic institutions — formed EcoSouth, an international network that disseminates technical information about the manufacture and use of "eco-materials" to local entrepreneurs in the Caribbean and Latin America.

"Our aim is to reduce the amount of embodied energy as much as possible during the manufacturing of building materials and also during transportation by producing locally," said Fernando Martirena, director of Cidem.

Materials developed by EcoSouth members include an alternative cement that incorporates a binder made from the ashes of sugar cane straw, roughly halving the carbon dioxide emitted in production compared with conventional cement; clay bricks fired in low-energy kilns using bio-waste fuels; and an improved, low-cost method for making a roofing material known as micro-concrete roofing tiles.

To date, EcoSouth has helped to set up more than 500 small-scale workshops producing those and similar materials. "We have developed simple technologies, labor-intensive technologies, so that these materials can be produced at the municipal level by small, efficient businesses," Mr. Martirena said. "Eco-materials are not only practical when it comes to solving our current housing shortage; when there's no longer oil available, perhaps in 50 years, I'm sure that we'll be using them as alternatives."

In North America, too, the need for safe, low-cost construction materials has provided fertile ground for companies developing innovative materials and production technologies. One such company is Vidabode, founded in 2005 by its chief executive, Wanda Arnold, a representative of Canada's First Nations, or Native American, communities.

After several years of research into the construction needs of impoverished areas, the company opened a manufacturing and research facility in Amherst, Nova Scotia, in October to produce lightweight precast panels in a material it calls Vidacrete, which it says is resistant to wind, fire, mold and insects. Formed of concrete and a patented fiber reinforcing material, the panels are sold with a 25-year warranty, and at the end of their life, they can be ground down and recycled.

The Amherst plant has a rapid production system that can turn out 400 panels, each measuring eight square feet, or 0.7 square meter, every 12 hours. Vidabode, while initially focused on meeting local demand, is already working to develop a global market through exports and licensing.

"Our aim is to show foreign governments how much easier and more sustainable Vidacrete is to construct with, and then demonstrate that it would be much more economical for them to consider a licensing agreement to build a plant in their own countries," said Stephen Clinton, the company's licensee relations agent.

The company is negotiating to build plants in 50 countries. It has developed training programs in 33 languages and already has contracts to open two licensed plants in Angola next year.

The average cost of a panel produced at the Amherst plant is $9 a square foot, a figure that would be substantially lower for plants in developing countries with low manufacturing costs.

"Vidacrete can be used in localized areas that deal with everything from seismic zones to snow loads," Ms. Arnold said. "Local engineers and architects applying for a licensed plant are asked to provide their own building plans — that way they're able to design with their country's culture in mind."

Mr. Clinton said: "There's a staggering need for sustainable housing that's longstanding and multigenerational. There are many companies taking the same approach as we are. But the need is so high that there's room for everybody.

"These countries have to build as many houses as they can as fast as they can, and no one technology or company could ever fulfill that demand," he said.