TRIMTAB

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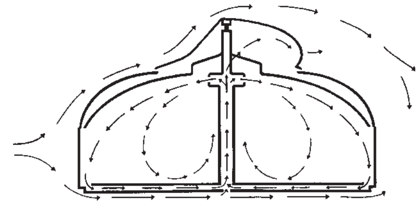

Keeping a Pulse on the Design Science Revolution

The Carbohydrate Economy: Return to BioBased Products

by Rona Fried

Plastic made from corn? How about carpet, clothes, dishes, and paint? It may sound funny now, but 100 years ago plant matter was the basis of almost all products. Petroleum increasingly replaced plants as society's fundamental medium and by the 1980s almost eliminated biological materials as a source of products and fuels. Now, due to a confluence of factors—high petroleum prices, low crop prices, increasing environmental costs associated with using petroleum, better technology for making plant-based products, and government support—the tide may be turning again.

This transition is not small potatoes. David Morris, vice president of the Institute for Local Self-Reliance (ILSR), coined the term "carbohydrate economy" 15 years ago. Shifting society's engine toward renewable, environmentally benign materials, where farmer-owned manufacturing enterprises process the crops they grow has enormously positive ramifications.

By substituting biochemicals—derived from vegetable oils, fiber and grain crops, citrus fruits, nuts and trees—to make industrial solvents, equipment lubricants, paints, and plastics, the environmental costs associated with the production, use and disposal of these products are greatly reduced. Pollution is no longer generated from extracting and processing crude oil into chemicals. End-of-life disposal is also not an issue—the products are completely biodegradable. Manufacturers are no longer saddled with high hazardous waste disposal costs, lengthy permit processes and compliance costs.

Since agricultural crops and residues are bulky, processing facilities are best located close to the source, making it a boon for rural economic development and the long-depressed farm economy. And taking

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Introduction to Permaculture: Ecological and Economical Design

by Larry Santoyo

Imagine living in a place that is blended into the natural environment. Your home is not only naturally heated and cooled, but is elegant and affordable. Integrated into the surrounding landscape are natural water systems where food is being grown safe from harmful chemicals, and waste is managed for productivity. A place where the neighbors, young and old, routinely help one another. There is less traffic, less pollution and more open spaces. Leisure time becomes abundant and recreational opportunities are close at hand. Also imagine that as a result of its design, this place saves you money, and most importantly, it saves the Earth its precious resources.

Through the simple and practical strategies offered by *Permaculture Design*, a village lifestyle like this is not a dream. Permaculture (a contraction of the words "permanent and culture"), is a highly developed Art, Science and Philosophy. Permaculture design sciences are used by homeowners, architects, land use planners, landscape designers, farmers and community service organizations.

Australian ecologist Bill Mollison formulated Permaculture in the mid-seventies. He researched around the world with various cultures and ecosystems until he developed what would become a globally recognized, environmentally benign system of land use—a permanence in culture modeled on *natural patterns*.

In Nature, total resource efficiency is accomplished by mananaging waste for productivity and balancing its consumption with contributions from each of the elements in the system. *Permaculture Sciences* design human eco-systems that model these patterns of multi-function and inter-connections. Regional groups and colleges teach Permaculture Design, and design firms throughout the country are now offering Perma-culture services. Permaculture brings to home owners and design professionals an innovative approach to planning, landscaping, building and retrofitting.

Permaculture groups train designers in simple techniques to "read the patterns of the landscape" and methods that "turn any problems into resources." Permaculture designers consider that every property has a unique pattern of natural characteristics. Proper alignment with these natural patterns is the basis of the permaculture process. Instead of the "one size fits all" approach,

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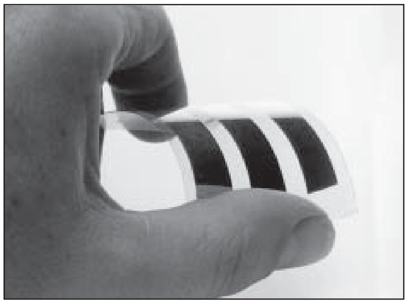
Straw bale house

Solar Cells From Buckyballs?

by David Faiman and Eugene A.Katz

One of the more remarkable discoveries of the late 20th century was that nature builds nanostructures in the form of geodesic domes. The prototype molecule of such materials, consisting of 60 carbon atoms arranged in a pattern resembling a soccer ball, was aptly named *buckminsterfullerene*. However, it soon became apparent that "buckyballs" were only the first of a huge family of so-called *fullerenes* having a rich variety of shapes and sizes.



A *plastic solar cell*

Because it turned out to be so simple to synthesize, the original C_{60} *fullerene* received much attention from scientists in many fields of expertise. Our interest, as solar cell specialists was sparked both by its optical properties and by the fact that the material can be synthesized from graphite and purified using nothing but heat—that is without chemicals. The optical properties of C_{60} have much in common with a theoretically ideal (albeit environmentally questionable) photovoltaic (PV) material, cadmium telluride. This fact, together with the exciting possibility that it may be possible to generate and purify C_{60} using merely an intense beam of sunlight, suggest that buckyballs might be the ideal material for solar cells.

There has been some controversy in the scientific literature regarding the optical properties of C_{60}. Could one actually make a solar cell from C_{60}, or only a detector of short-wave ultraviolet light?

We resolved that question by actually making a C_{60} solar cell. We grew a small crystal of C_{60}, coated one side of it with silver, and exposed it to light. It produced an electric current! We then studied its optical properties in a more thorough and scientific manner and were able to understand many of the reasons leading to the controversy in the first place.

But the path to carbon solar cells is still long because *buckminsterfullerene* is not a conventional semiconductor. Instead, it combines within a single material the properties of both semiconductors and molecular crystals, which necessitates careful studies of all of its physical and chemical properties. One of the problems that we have yet to solve is how to "dope" C_{60}. (Doping is the addition of trace amounts of foreign atoms to a pure semi-conductor to achieve the desired electrical properties.) This will be necessary if we are to produce a high-efficiency carbon cell that could compete in performance with silicon cells. While we have a number of ideas that are still being tested, we have still not produced a carbon solar cell with any significant degree of efficiency.

However, a group of European researchers centered in Austria has recently achieved an efficiency of 3% in a *fullerene* solar cell. Their approach is different from ours. Instead of trying to produce a so-called *pn junction* cell, as is done in the case of conventional silicon PV cells, the European group bonds buckyballs to a polymer chain, producing, in effect, a plastic solar cell.

Now 3% might not seem very impressive compared to more than 10% efficiency obtained from garden-variety crystalline silicon cells. However, this number must be seen in a correct context. First of all, the earliest silicon cells did not achieve 3% efficiency until long after the PV properties of silicon had been realized. Secondly, 3% already comes quite close to the efficiency of many low-cost *amorphous silicon* solar cells that are widely marketed today.

Perhaps most exciting is the prospect that plastic solar cells, whatever their ultimate efficiency may be, suggest totally new usage paradigms. The European group talks about "throw-away" solar cells that would be manufactured in huge rolls like today's polyethylene sheeting. Such material could be made into disposable clothing or other temporary covers, and used to generate power for all kinds of purposes that would not even be considered today because of the high cost of solar cells.

David Faiman is a professor of physics at Ben-Gurion University, and director of Israel's National Solar Energy Center at Sede Boqer in the Negev Desert. He can be contacted at faiman@bgumail.bgu.ac.il

Eugene Katz is a senior researcher at Ben-Gurion University's Jacob Blaustein Institute for Desert Research, Sede Boqer.

Resources

www.ipc.uni-linz.ac.at/publ/2001/2001-10.pdf

Image *Prof. Sariciftci, University of Linz, Austria.*

Who We Are

The Buckminster Fuller Institute (BFI), a 501(c)(3) nonprofit organization, is a diverse group of individuals committed to a successful and sustainable future for 100% of humanity. Founded in 1983 and inspired by the Design Science principles pioneered by the late R. Buckminster Fuller, BFI has served as an information resource to students, educators, authors, designers and concerned citizens working to advance humanity's 'option for success.'

Our Mission:

To catalyze awareness and action towards the realization of humanity's option for success.

Board and Staff

What's Design Science?

In the words of Buckminster Fuller, Design Science is "the effective application of the principles of science to the conscious design of our total environment in order to help make the Earth's finite resources meet the needs of all humanity without disrupting the ecological processes of the planet."

Trimtab

The *Trimtab* highlights projects, organizations and individuals who are applying Design Science principles towards humanity's option for success.

Trimtab Production

Editorial Team, Joshua Arnow, Lauren Darges, Deborah Grace, Jaime Snyder
Contributing Writers, David Faiman, Rona Fried, Gavio, Debra Gorman, Eugene Katz, Max Lindegger, Larry Santoyo, Blair Wolfram
Copy Editing, Katherine Chargin
Design and Layout, Joanne Klein
Printing, Accent Printing, Santa Rosa, CA

Contact Info

Buckminster Fuller Institute
111 N. Main Street, Sebastopol, CA 95472
(707) 824-2242 • (800) 967-6277 • FAX (707) 824-2243
info@bfi.org • www.bfi.org

Biodiesel—A Plant Based Fuel

by Debra Gorman and Gavio

In the late 1800s Ruldolf Diesel envisioned the diesel engine to run on vegetable oil. Considering the world energy situation, it is exciting that today's diesel engines—without any modifications—can still run biodiesel, a fuel derived from vegetable oil. In fact, with just a few minor modifications, diesel engines will run on straight vegetable oil, too.

Biodiesel is nontoxic, biodegradable and clean-burning, reducing overall emissions by as much as 80% compared to petroleum-based fuel. Biodiesel can be produced from any type of vegetable oil and can be blended in any proportion with regular diesel.

Several U.S. companies have turned the environmental problem of waste vegetable oil into an alternative fuel industry. Currently, about 3 billion gallons of waste vegetable oil are generated annually in the U.S. The usage of that alone could reduce our consumption of diesel fuel by 10%. Many of these companies are also using soybean oil due to cash incentives offered by the USDA's Commodity Credit Corporation. The soy industry has been a driving force in the commercial production of biodiesel as a result of product surpluses and falling prices. This has raised concerns among environmentalists that a dependence on soybean crops for fuel might lead to problems similar to our current dependence on petroleum.

To see biofuels as part of a sustainable future, we must look at a much larger picture.

In Southern California, for example, a factory will soon be producing biodiesel from algae. The algae will be grown in ponds, which will process the animal waste from local feedlots, a serious local toxic waste issue. Lipids are harvested from the algae in copious quantities to produce a renewable source of oil for biodiesel. In addition, the algae pond produces enough recoverable methane to generate power for the entire operation. In this way, one system's waste becomes another system's raw material.

Another low-cost, eco-friendly source for biodiesel being studied by the Department of Energy is mustard seed, which yields a high percentage of oil. The meal that remains after the oil is extracted makes a valuable organic pesticide.

A regenerative future for humanity requires that our sources of energy be renewable and clean. Many people are embracing the use of biodiesel as a transition step toward reducing our dependence on petroleum and cleaning our air.

Biodiesel is available right now and can be used in any diesel engine. It can even be made at home. Its increasing popularity is creating a viable market in which more sustainable alternatives will flourish.

Debra Gorman is a massage therapist and artist. Gavio is an artist who applies his talent to interior design painting. Both live in Sebastopol, California and are actively applying sustainable living practices in their lifestyle.

Resources

National Biodiesel Board: www.biodiesel.org

www.worldenergy.net

www.mauibiodiesel.org

www.veggievan.org

From the Fryer to the Fuel Tank: The Complete Guide to Using Vegetable Oil As an Alternative Fuel, by Joshua Tickell, Tickell Energy Consulting, 2000, $24.95

Debra Gorman and Gavio's '96 VW Passat TDI *has been running on biodiesel since September* 2001.

Biodiesel vs. Straight Vegetable Oil

What is the difference between running on biodiesel versus plain vegetable oil? Biodiesel is made from vegetable oil (see below) and can be used in any diesel engine. To run on plain vegetable oil your diesel car will need some modifications including a second fuel tank. One of the advantages of the conversion is that it eliminates problems when starting your car in cold weather which can occur with biodiesel.

For information on conversions:

www.greasecar.com

www.greasemonkeyconversions.com

How to Make Biodiesel

The process of converting vegetable oil into biodiesel fuel is called *transesterification*. Chemically, transesterification means taking a triglyceride molecule, or a complex fatty acid, neutralizing the free fatty acids, removing the glycerin, and creating an alcohol ester. This is accomplished by mixing methanol* (wood alcohol) with lye (sodium hydroxide) to make sodium methoxide. This dangerous liquid is then mixed into vegetable oil. The entire mixture then settles. Glycerin is left on the bottom and methyl esters, or biodiesel, is left on top. The glycerin can be used to make soap (or any one of 1,600 other products) and the methyl ester is washed and filtered.

From: www.veggievan.org/biodiesel/transest.html

*Ethanol, which is not toxic, can replace methanol in the process.

...from the Archive

The Design Scientist must be a responsible participant in nature's own evolution, self-disciplining to deal comprehensively and capably with the maximum and minimum of the combined and complementary physical and metaphysical subdivisions of universe.

- R. Buckminster Fuller

Introduction to Permaculture (continued)

Nature is allowed to direct the land use plan. By skillfully using permaculture methods of site analysis and evaluation, elements, such as buildings and roads and practices, such as farming and forestry are established only in areas with optimum conditions—working with nature in an efficient and economical way.

Other basic principles are taught to permaculture designers. One of the most important is *relative location* or the careful placement of elements within a system. Elements are placed not in isolation, but in relation to the dynamics of the total site. Proper placement is achieved when an element or a practice is designed to interact efficiently with all of the influencing elements. To do this, permaculture designers use simple physics and biology, as well as specific observation skills.

The permaculture designer treats the built environment and the natural environment as a whole. Houses are designed not only for optimum solar advantage but are carefully sited away from sensitive areas. Prime agricultural land and wildlands are protected. Precautions are taken for the predictable threats of fire, flood, wind, and cold air drainage. One of the primary objectives in permaculture is for designers to develop simple biological alternatives to reduce the need for the expensive and resource consuming demands of high technology. Proper shading alone has reduced cooling costs in desert areas by up to 20%.

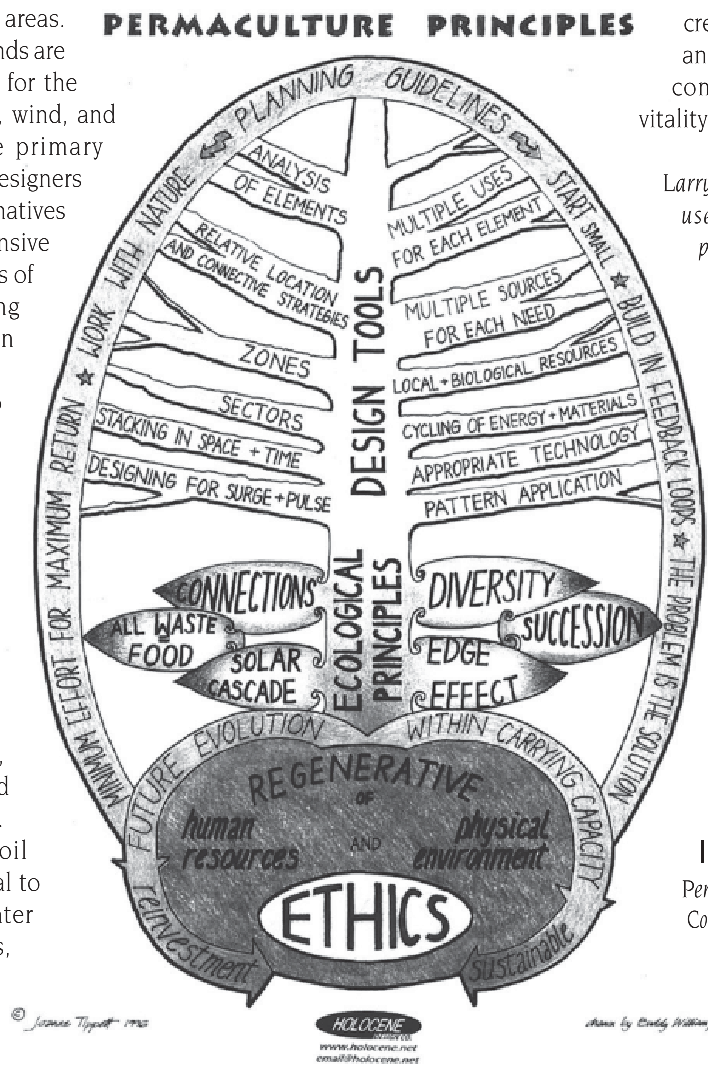
Permaculture designers also learn to observe and research naturally occurring plant and animal assemblies (called guilds). This information is translated for use in sustainable farming. Perennial fruit trees, shrubs, and vines, together with livestock and animal commercial crops are selected to mimic natural assemblies—each plant and animal benefits the other, providing a permanent and maintenance free resource system.

Comprehensive water and soil conservation planning are integral to any sustainable design. For water conservation and flood controls, permaculture designers use roofs, parking lots, roadways and landscapes for harvesting run-off water. Basin and berm structures (called swales) and cisterns are constructed to collect this run-off and convert flooding problems into helpful resources of drinking water and low cost irrigation.

For economic development, Nature's model of resource efficiency is used again. In this process an inventory is meticulously prepared, examining a community's basic needs and cross referenced with its renewable resources. Needs that are not met by local resources are considered job opportunities for the community. Resources surplus to local needs are available as sustainable commodities for trade—thus creating a stable economy based on real need and renewable resources.

Mixed use zoning is recommended for community land use plans. Designing residential and commercial zones into clusters allows large areas of open and wild space to remain intact. This creates an access by proximity design allowing people to live, shop, work and recreate in the same proximity. Transportation and traffic problems are greatly reduced. Home based businesses can then be linked with other businesses for efficiency. Suburban and urban consumers can also be linked directly with nearby farms and other rural enterprise. Good planning saves money for an entire community. When our basic needs are provided for where we live, we create jobs, conserve natural resources, and enhance our sense of security. When community spirit is raised, economic vitality can be restored.

> *"Permaculture is the study of the design of those sustainable or enduring systems that support human society, both agricultural and intellectual, traditional and scientific, architectural, financial and legal. It is the study of integrated systems, for the purpose of better design and application of such systems."*
>
> Bill Mollison



Larry Santoyo is an environmental designer, land use planner, business consultant, and permaculture designer and teacher. He is now forming a land partnership group to create a Permaculture MicroVillage on California's Central Coast. He is available for consultation and design services at (800) 469-5857 or at santoyo@earthflow.com. You can visit his web site at www.earthflow.com.

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Resources

Introduction to Permaculture by Bill Mollison and Reny Mia Slay, Tagari Publications, 1998, 216 pages.

Further reading and links: www.permaearth.org/links.html

Images

Permaculture Principles poster ©Holocene Design Co. available at www.Holocene.net/permaculture.htm. Reprinted with permission.

Straw bale house image courtesy of Larry Santoyo.

Crystal Waters Permaculture Village

Established in 1989, the world-renowned ecovillage of Crystal Waters is located in the subtropics of S.E. Queensland, Australia. It is home to around 200 permanent residents and an abundance of wildlife.

In 1995 a United Nations World Habitat Award commended the village on its "pioneering ways in demonstrating new low impact and sustainable ways of living." Crystal Waters is listed in the Top 40 of the UN's Best Practices database. Residents and developers have devised creative solutions to typical development problems, and the village is a Mecca for town planners, developers and individuals interested in sustainability.

Max Lindegger, one of the four designers of Crystal Waters (with Robert Tap, Barry Goodman and Geoff Young) provides this reflection:

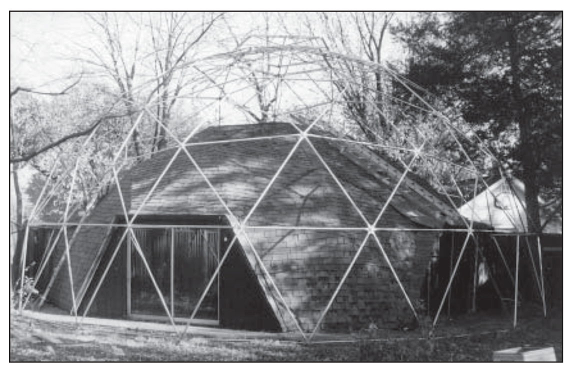
> When we started the design process for Crystal Waters, we aimed to design a village which provided as many of the basic human needs (identified as clean air, water and food; freedom of spiritual expression; opportunity for social interaction; meaningful activity/work; safe play/recreation and adequate shelter) as possible. We also wanted to restore some of the agricultural and environmental potential of the land.
>
> Starting in March 1985, we spent, over the next 9 months, many hours observing the 640-acre property. We walked the land in sun and rain, day and night. We measured temperatures and collected weather data, tested the soil and talked to neighbors.
>
> We used the process of overlay mapping, so well explained by Ian McHarg in *Design with Nature*. Using this process allowed us to 'exclude' land which under our criteria was considered unsuitable for human settlement. Criteria considered important were soil, slope, aspect, vegetation and hydrology.
>
> We carefully identified the important characteristics which would make a house lot 'special'—things like size and shape, the relationship to other homes.
>
> Most of our design work happened in the field where we could get 'the feel of the land', and minimize mistakes.
>
> Today Crystal Waters is a village with well over 200 human residents and an ever increasing wildlife population, showing that wildlife and humans can coexist, and that developments need not destroy the agricultural potential of land.

Max Lindegger teaches permaculture and ecovillage design courses at Crystal Waters. He has consulted in sustainable development in over 35 countries around the world. He is the Regional Co-ordinator of the Global Eco-village network (Oceania/Asia) Inc. He can be contacted at: lindegger@crystalwaterscollege.org.au. You can visit the Crystal Waters web site at: www.ecovillages.org/australia/crystalwaters.

A Dome over Bucky's Dome

from a Dome, Inc. press release

The legend of architect, author, visionary and internationally renown futurist thinker R. Buckminster Fuller lives on, with impressive examples of his work including the dome sphere at Epcot Center; the U.S. Exhibition at the Montreal World's Fair, and the largest free-span building in the world, the geodesic dome covering the Spruce Goose in Long Beach, California. After inventing and getting the first patent on a geodesic dome in 1954, Fuller build and lived in the very first dome ever in Carbondale, Illinois, while professor at Southern Illinois University (SIU). After Fuller moved out in 1971, maintenance has lacked and the house suffers from leaks and dimpling.



Now there is a dome over the dome! Workers led by professional dome builder Blair Wolfram from Dome, Inc. in St. Paul, Minnesota built a protective geodesic dome framework out of steel to enclose and weatherproof the house. Wolfram, known as the dome guy, has been building domes for almost 20 years and will be involved with the restoration.

Roof and structural repairs to Fuller's former residence are scheduled to begin May 1, 2002. Funding is the next challenge to the project. The current owner of Bucky and Anne's former home is Bill Perk, professor emeritus of SIU and advisory board member of the Buckminster Fuller Institute.

"The dome over the dome is the first phase of a long project," Perk said. He has initiated a not for profit organization called Friends of Fuller's Dome Home to accept donations to fund the renovation. Perk is interested in donating the house to the university after restoration. The dome is listed on the National Historic Register.

To donate or get involved, contact Bill Perk at billperk@midwest.net or (618) 549 3602. Blair Wolfram and Dome, Inc can be reached at (888) 366 3462 or www.domeincorporated.com.

The Carbohydrate Economy (continued)

petroleum out of the equation as a key ingredient in countless products reduces dependence on foreign oil supplies.

For all these reasons, the biobased industry is receiving increasing levels of government support. This includes two executive orders signed in by President Clinton plus the Ag Vision 2020 which helps the agriculture, forestry and chemical industries use crops instead of petroleum as feedstock to make products including plastics, paint and adhesives.

The major resin suppliers in the U.S. are Cargill Dow Polymers, Eastman Chemical and DuPont. A Cargill Dow plant came online at the end of 2001 to produce the resin, NatureWorks™ PLA. The resin will have numerous applications including, clothing and textiles, carpet tiles, diapers, feminine hygiene products, paints, coatings and pigments, cellophane, bags, wraps, films and other types of packaging. Sony, for example, plans to wrap its mini-discs in "plastic" made from this resin.

Cups, Plates, Spoons, Forks

Take disposable plastic dishware. About 60 billion cups, 20 billion eating utensils and 15 billion plates are used each year in the U.S., all destined for landfills or incinerators. Food scraps that could otherwise be composted must also be thrown away; it is not economical to separate it.

The use of disposable cutlery, plates and cups is bound to continue in such venues as sporting arenas, where it constitutes 50 percent of the waste stream. What if the dishware is made of biobased plastic and is completely biodegradable? Then it would be an advantage to combine it with the food waste, put it in a bioplastic bag and send it to a composting facility (which has lower fees than landfills too).

EarthShell, a nine-year old company based in Santa Barbara, California makes bioplastic dishware from a mix of potato starch, limestone, post-consumer recycled fiber, air, water and protective coatings. The potato starch comes from French fry and potato chip waste. Limestone is abundantly available and is a low cost feedstock. The result is dishware that completely biodegrades in compost and marine environments.

This logo indicates the product meets the "Standard Specifications for Compostable Plastics".

The company's clamshell, now in almost 500 U.S. McDonald's outlets, requires significantly less energy throughout its lifecycle than the two main alternatives, polystyrene and paper. The clamshell is the only rigid food service packaging to receive Green Seal certification. Its cost is competitive with standard products and meets industry requirements for rigidity, insulation, stacking, consumer usage properties and graphics capabilities. Millions of clamshells have been put to the test during McDonald's pilot period in 128 stores. EarthShell products are now available in northwestern U.S WalMart stores.

In Austria, Germany, and Sweden, McDonald's uses utensils made from maize by an Italian company, Novamont. The company, which employs about 100 people, makes bio-plastic used in a variety of applications from compostable bags to crockery, from loose fill for packaging to diapers. Goodyear uses another form of the plastic in its Biotred GT3 tires as one way to reduce CO2 emissions. Novamont is working on its version of the clamshell from "plastic" foam.

Biocorp, an American company, uses Novamont's resin to manufacture bioplastic food service products. It also makes bags for the collection of food scraps and yard trimmings and uses Cargill Dow's resin to produce "plastic" cold-drink cups.

Biocorp supplied all the compostable cutlery (45 million spoons, forks, knives, coated cups, cup lids, straws, and plates) and the starch-based bags for the food scraps used at the Sydney Olympics, enabling 75 percent—over 5.7 million pounds—of waste generated at the Games to be recycled and composted. Although the products cost more than conventional plastic, the overall price is competitive when disposal costs are factored in. Biocorp estimates that large food service operations such as schools, hospitals, and fast food restaurants can save up to 35 percent by composting food scraps instead of landfilling them.

Setting Standards

To verify the products are completely compostable, the U.S. Composting Council (USCC) and the International Biodegradable Products Institute have instituted the Compostable Logo Program. The symbol can appear on products and packages that conform to the American Society for Testing and Materials (ASTM) Standard D6400-99, "Standard Specifications for Compostable Plastics."

A similar standard is used successfully in Germany, Belgium and Japan. The ultimate goal is to harmonize the various standards in favor of globally accepted criteria.

People around the world are very concerned about genetically modified agricultural crops and question whether bioplastic feedstocks such as corn contain GMOs. Novamont uses only GMO-free corn; Cargill Dow claims there is no GMO present in the final process.

Rona Fried, Ph.D., is CEO of Sustainable Business.com, the center for business and environment on the Internet. Please visit www.sustainablebusiness.com or contact her at rona@sustainablebusiness.com.

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Resources

www.earthshell.com
www.biocorpusa.com
International Biodegradable Products Institute: www.bpiworld.org
The Carbohydrate Economy Clearinghouse: www.carbohydrateeconomy.org
USDA Biobased Industrial Products: www.usda-biobasedproducts.net/public

Images

Biocorp cup courtesy of Biocorp USA.
Earthshell image courtesy of Earthshell.
Compostable logo courtesy of the U.S. Composting Council.

BFI Welcomes 3 New Board Members

Each January the BFI board members gather from around the country for our annual in-person, two-day board meeting. At this year's meeting in San Francisco, we were delighted to welcome three new members to our board: Constance Beutel, Carl Frankel, and Greg Watson. Each is a dynamic addition to our team of Directors which now totals ten. In our next issue of *Trimtab* we will introduce you to all the BFI board members as well as staff in greater detail!

Fly's Eye Dome Raised

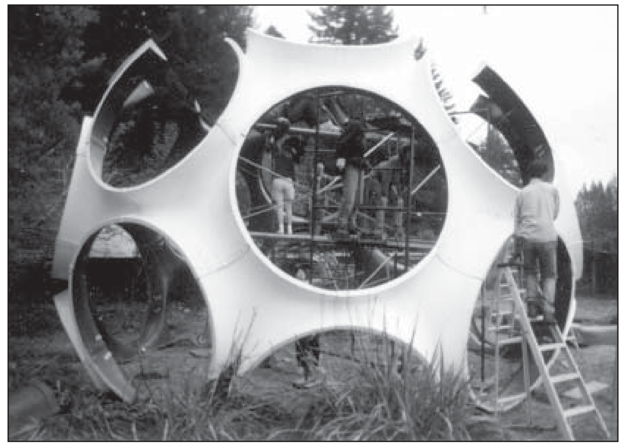
Last November, with the help of over 25 volunteers, we raised Buckminster Fuller's original prototype 26-foot Fly's Eye dome on the local property of BFI's Treasurer, Neal Katz.

This dome and its sister 50-foot dome, along with all of the molds, were donated to BFI by Fuller's family in 1995. This past November we tackled the project of moving them north and out of storage in Santa Barbara.

Our gratitude goes out to the awesome volunteers who made this entire move and dome raising such a success. We especially thank Brad Twoomey, who devoted many days of enthusiastic hard work and perseverance to haul multiple loads of parts in moving trucks up from Santa Barbara. In addition, the expertise he provided in guiding us through the dome assembly was essential.

We'd also like to thank Mareva Russo, Brad Bishop and Christopher Peck for their giant contribution of time and energy to the project. Thank you to Neal Katz and his family for providing the land to raise the dome, the space to store the remaining parts, and for their hospitality and patience with the many curious visitors who wander onto their property.

The plans for the erected dome are simple for now. We'll put the skylights (the "fly's eyes") on this Spring and make sure there are no leaks. The Katz family will use the dome as a music room and BFI will use it as a meeting space. Already it has been featured in a photo shoot by *Inc. Magazine* and plans are in process for a film shoot by a local cable TV show.



See more photos of the dome raising at www.bfi.org/domes/flys_eye.

About the Fly's Eye

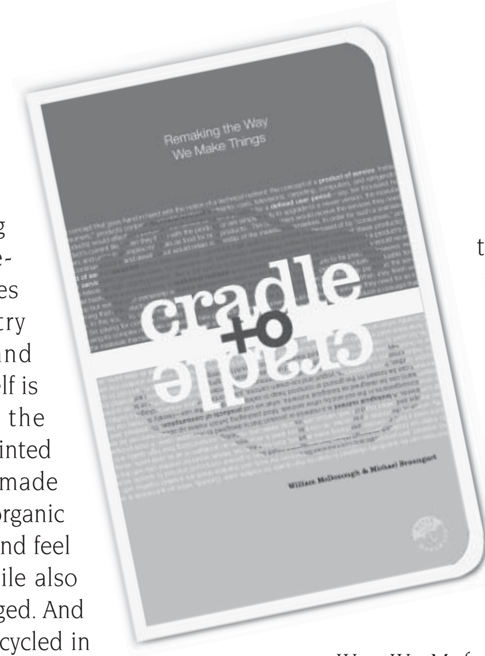
Buckminster Fuller discovered how Nature's "construction projects" are based on simple polyhedra, subdividing to produce more complex forms, including spherical structures. During Fuller lifetime he modeled hundreds of full-size and model-size shelter concepts, always looking for new technical advantages to improve his housing designs.

In 1961 Fuller applied for U.S. Patent #3197927, to introduce his Monohex structures which he called "Fly's Eye" domes. In 1975 Bucky commissioned John Warren to investigate the design and to prototype the Fly's Eye domes in fiberglass. This commission resulted in the tooling and the actual prototypes for the 12-foot, 26-foot, and-50 foot diameter Fly's Eye domes. The Fly's Eye dome was never mass produced. BFI now owns the original prototypes and manufacturing molds.

Cradle to Cradle : Remaking the Way We Make Things

A new book by William McDonough and Michael Braungart

William McDonough's new book, written with his colleague, the German chemist Michael Braungart, is a manifesto calling for the transformation of human industry through ecologically intelligent design. Through historical sketches on the roots of the industrial revolution; commentary on science, nature and society; descriptions of key design principles; and compelling examples of innovative products and business strategies already reshaping the marketplace, McDonough and Braungart make the case that an industrial system that currently "takes, makes and wastes" can become a creator of goods and services that generate ecological, social and economic value.



In addition to describing the hopeful, nature-inspired design principles that are making industry both prosperous and sustainable, the book itself is a physical symbol of the changes to come. It is printed on a synthetic 'paper,' made from plastic resins and inorganic fillers, designed to look and feel like top quality paper while also being waterproof and rugged. And the book can be easily recycled in localities with systems to collect polypropylene, like that in yogurt containers. This 'treeless' book points the way toward the day when synthetic books, like many other products, can be used, recycled, and used again without losing any material quality—in cradle-to-cradle cycles.

Cradle to Cradle : Remaking the Way We Make Things by William McDonough, Michael Braungart, North Point Press (March 2002), 208 pages, $25.00.

TRIMTAB

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111 N. Main Street
Sebastopol, CA 95472

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