

William McDonough stands on the green roof of the Gap headquarters he created, in San Bruno, California. *Photograph by Todd Eberle.*
On February 7, 1993, the architect William McDonough, a prophet of the sustainability and clean-technology movements, which set in motion many of the green design practices that are commonplace today, delivered a centennial sermon from the high altar of the Cathedral of St. John the Divine, in New York City. The sermon, which laid the foundation for a lifelong crusade to do nothing less than right the wrongs of the Industrial Revolution, was titled "Design, Ecology, Ethics and the Making of Things."

"If we understand that design leads to the manifestation of human intention, and if what we make with our hands is to be sacred and honor the earth that gives us life," McDonough said that day, "then the things we make must not only rise from the ground but return to it, soil to soil, water to water, so everything that is received from the earth can be freely given back without causing harm to any living system. This is ecology. This is good design. It is of this we must now speak."

Over the past few decades, McDonough, who is 57 and who, with his uniformly black attire and rimless round glasses, has the look of a dapper monsignor, has done little but speak of this. The McDonough sermon nowadays, accompanied by slick PowerPoint slides, has become command-performance material

what are the major ideas? cradle to cradle

Are they legitimate?

→ Can they take hold + make a difference "circular" economy

for C.E.O.'s and world leaders. McDonough has given it twice at the White House as well as at such power confabs as the World Economic Forum, held annually in Davos, Switzerland, and the ted (Technology, Entertainment, Design) conference, held annually in Monterey, California. His evangelist's flock comprises politicians, high-techies, and fat cats who lap up the fine points of his remarkable theory of ecological design—what he calls "Cradle to Cradle," a repudiation of the Industrial Revolution's linear, cradle-to-grave system of manufacture, consumption, and junk-heaping. Cradle to Cradle, in McDonough's words, "does not just reduce waste, it eliminates the concept of waste," stipulating that products be manufactured in new ways that will allow them to be reduced to their essential technical or biological elements in order to be re-used. Nature's cycles provide the model. Organic substances go back to the soil, to feed the earth's "biological metabolism." Everything else is returned as "nutrients" for what is termed the "technical metabolism," to be infinitely, effectively re-used. As McDonough sums it up, sounding a bit like a tree-hugging Clint Eastwood, "I've got three words for you: Waste equals food."

In 2002, McDonough co-authored *Cradle to Cradle*, a book-length manifesto outlining the new paradigm for "remaking the way we make things." His collaborator was the German chemist Michael Braungart. In 1995, McDonough had branched out from his architecture firm, William McDonough + Partners, with studios in Charlottesville, Virginia, and San Francisco, and with

Cradle to Cradle - main ideas
1. Eliminate the concept of waste
2. Smart Design - so good that there is no need for regulation

Braungart founded McDonough Braungart Design Chemistry (M.B.D.C.), a consultancy based in Charlottesville, devoted to Cradle-to-Cradle-izing the planet, industry by industry, compound by compound, molecule by molecule. "Our goal is very simple," McDonough tells me from the shotgun seat of a Toyota Prius as we speed down Highway 101, south of San Francisco, headed for a speaking date he has at the NASA Ames Research Center, in Silicon Valley. "It is to help create a delightfully diverse, safe, healthy, and just world, with clean air, water, soil, and power—economically, equitably, ecologically, and elegantly enjoyed, period." He acknowledges, "Cradle to Cradle is daunting because this is an imperfect world, and we try to imagine the perfect to try to achieve the best possible." Yet he and Braungart are pulling it off in measurable ways.

Over the last three decades, McDonough has worked with an all-star list of companies, whose aggregate revenues exceed \$1 trillion. McDonough will not discuss details about his clients, but reportedly he has collaborated with, among others, Google, G.E., Wal-Mart, Ford, British Petroleum, Nike, the Gap, Whole Foods, Herman Miller, the city of San Francisco, the U.S. Postal Service, and a number of Chinese municipalities. Buildings—including a preliminary assignment from Google for its new corporate campus—are being designed; products are being made to Cradle to Cradle specifications; and conceptual master plans have been drawn up for cities, including six in China alone. "The whole nation of Holland is

3. Use renewables

4. Use renewable energy and production

- Waste = food.
6. Alternative Plan.
7. Abundance of clean air, water, food, toxin

going crazy for Cradle to Cradle right now," says McDonough. "They have huge conventions called 'Let's Cradle.' I guess when you become a verb you know you are getting somewhere."

According to Phillip Bernstein, a lecturer at the Yale School of Architecture and a vice president at Autodesk, Inc., a leading design-software producer for the architectural, entertainment, and engineering professions, "When it comes to new ways of shifting our sustainability paradigms, Bill is the granddaddy of this way of thinking. He's the visionary inventor, there before anyone. And now he's actually building the factories that make clean water, working on the concept cars that make clean air, doing the big thinking that is moving things forward."

"I have been plowing this row for 30 years," says McDonough. "The work all of a sudden is coming to fruition, and it's a great moment in our culture, where these kinds of ideas are now being addressed by corporations, by agencies. I like to say there is a strong current interest in the leadership of our species in issues of sustainability, and I think we have about 20 years to fix this problem."

"What are the consequences if we don't make it?" I ask.

"We would be in deep trouble," he says. "So, as you might imagine, as our design philosophy becomes mainstream, our office is flooded with calls."

It was not always like this, not even as recently as the antediluvian 1990s. "I used to get called loopy," says McDonough, adding, "but I was used to it."

Cradle to Cradle - The ...

As a Yale architecture student in the mid-1970s, McDonough liked to fit solar panels into his projects. "One of my teachers [Pritzker Prize-winner Richard Meier] kept coming to my desk to give me criticism, and he would say, 'Bill, you've got to understand: solar energy has nothing to do with architecture,'" he recalls. Today, design-school professors no longer view solar-energy systems as part of the plumbing. In fairness to Meier, the modernist master had no way of knowing that the kid he was talking to would become the harbinger of a movement to redesign design itself. Many of the radical players in the ecology and sustainability movements who have made their voices heard have done so through protest. Think of the vigilante-style work of Greenpeace in the 1970s. For most environmental activists, communal sacrifice and curbs on industry in order to create greater eco-efficiency—that is, the reduction of environmental impact and resource consumption on a global scale—are the prescriptions of choice. McDonough sees the matter through a very different lens. To him it's a design problem. Shrill broadsides against industry are misdirected. Dire predictions of heatless winters and a car-less future are missing the point. Perhaps the most compelling part of McDonough's plan is its repudiation of the Judeo-Christian guilt that has long defined the green movement. He and Braungart reject what they call the "dour face of eco-efficiency." "How many environmentalists do you know who say growth is good?" McDonough asks. "We celebrate growth. Abundance is something we want. Our idea is

to make production so clean there's nothing left to regulate." This, he notes, is extremely appealing to people of all political persuasions, from those who love the environment to those who want commerce free of regulation.

The metaphor he employs to make his point is the cherry tree. "Think of the abundance of a cherry tree's blossoms in the spring," he says. "We celebrate its abundance of blossoms. You don't look at a cherry tree in the spring and go, 'Oh, my goodness. How many blossoms does it take?' It's not very efficient. You know, thousands of blossoms, just so that a couple of them can turn into cherry trees, is not very efficient. But it's highly effective. And effective, rather than efficient, is what we want. Think about efficiency versus effectiveness in another way. You don't listen to Mozart and think, How many notes does it take? He could have hit the piano with a two-by-four and got them all at once. Very efficient, but would we love it?

"One of the points we make in *Cradle to Cradle* is that being less bad is not being good—it's being bad, just less so. To be efficient is the same as being less bad. If I left here and went north to Canada and found myself going 120 miles an hour toward Mexico, it is not going to help me to slow down to 20. I'm going the wrong way. We need a change in direction.

"What we really need is an eco-effective strategy, to go along with our eco-efficient one, where we look at the idea of actually inventing new things that will take us

all the way up to our desired goals.”
“The industrial revolution of 150 years ago was not designed,” McDonough tells me. It evolved over decades as captains of industry and their technologists learned how to overpower nature and forge great machines to make standardized items of consumption. “If you look at the first industrial revolution as a retroactive design assignment, it would be to design a system that puts billions of pounds of toxic waste into the air and the water, depletes our soils and washes toxins into the ocean or into the air, produces endocrine disrupters to affect our hormonal systems, creates and distributes carcinogens, causes climate change, and dumps plastics in the oceans. If this was the design assignment, we’re doing great. If it’s not the design assignment, then what is? And so instead of seeing what goes on today as inevitable, what we have to recognize is that it’s not possible any longer to say that it’s not part of our plan, because it’s part of our de facto plan. It’s the thing that’s happening because we have no other design. We need a new industrial revolution.”

The three principles of Cradle to Cradle, McDonough says, are really very simple, even if they do require a radical change in the way the world operates. “(1) Waste equals food. So we eliminate the concept of waste. (2) Use current solar income. So rely on natural energy flows—also geothermal and wind—instead of unnatural energy flows. (3) Celebrate diversity. We want to see as many manifestations within the

protocol as possible to celebrate human culture—natural culture. We want 400 kinds of French cheese, but we don't want 400 kinds of French plastic. So within technology, we want coherency; within biology, we want diversity."

One of the things that is holding back the environmental movement and its proponents, says McDonough, is the collective burden of guilt about the ills of our society. "They say they want durable products that last a long time. Like a 25-year car. I'll tell you why that's not good. That car will still be made with toxins in the adhesives, compound epoxies. O.K., it amortizes its damage over a longer period of time, but it's still a car that is damaging. You also lose jobs, because people don't buy enough cars. You are using outdated technology on the roads for a longer time." The solution that he and Braungart suggest is a five-year car that allows for industry to "transform the technology at high speed toward the Cradle to Cradle concept. The five-year car is a car whose materials are all coherent and tagged. In fact, all materials in the car have 'passports.' So we know where they come from, and we know where they're going"—back to the auto-makers—"after five years of utility, so the car could be recycled and updated with the latest in safety and efficiency. All done with the same materials that you—in effect—lease from the auto company. They keep making the cars out of the same stuff."

In order to pull this off, McDonough says, "we need a huge amount of R&D—fast," to produce gut remodeling of industry so that systems will become so

Cradle to Cradle

well designed there is no need to restrain industry. "Regulation is a sign of design failure," he insists. "A regulation is what we call a license to harm: a government-issued permit to industry so that it can dispense destruction, sickness, and death at an acceptable rate."

"I want things designed so well there is no need for regulations," he continues. "How about cars that spew out good emissions? Factories that make clean water. Then growth is good. Then the question becomes: What do you want to grow? Right now industry is set up to grow cancer and Alzheimer's. For every case of leukemia we create nine jobs. Are the government and industry willing to sign on to that as the right kind of job-creation program? If so, we clearly need an alternative plan."

The first sweeping change McDonough calls for is to have solar energy brought to scale—which is generally accepted as a viable plan. "I want to see solar power cheaper than coal. Then the forces of the market will deliver us a solar-powered world. We're not just talking about solar collectors on our roofs," he says. "Think of square miles of marginal land covered with them."

He admits, "The order of magnitude that we're going to have to scale up to is immense. Can we achieve it? Of course we can. We make over a trillion auto parts every year. We do very complicated things. When we think about how simple it could be to make solar collectors—flat sheets in the sunshine—this is not a complex thing, to capture solar energy."

navo
'You picked a good day to come along with me,' says McDonough as we cross the nasa Ames Research Center campus after a series of meetings. 'You can see the breadth of my work. We are really starting to get into some weird, unexpected areas.' One of today's discussions with high-ranking nasa scientists veered into speculative talk of McDonough's helping to design colonies on the moon and Mars.

Retired General S. Pete Worden, the director of the Center, announced to his colleagues, 'If the first thing we do is make a rubbish heap on the moon, that is not a good start.' The nasa scientists see strong parallels between their requirements for extraterrestrial colonies and McDonough's drive to eliminate terrestrial waste and exploit solar energy. 'Our buildings on the moon and Mars would need to be a waste-minimum if not waste-free environment, so why not make them Cradle to Cradle?' asked Olga M. Dominguez, nasa's assistant administrator for the Office of Infrastructure and Administration, who is McDonough's champion among the organization's officials in Washington. More immediately, McDonough has been exploring the idea of constructing a building at the Center that will function on Cradle to Cradle principles. Diana Hoyt, a nasa senior strategic analyst in the meeting, said that 'as a prototype for new design strategies and technology, this could be the first lunar building on earth.' McDonough was pleased to inform nasa that the prototype for such a building already exists. He completed it in 2001 in Oberlin, Ohio. The Adam

Joseph Lewis Center for Environmental Studies, at Oberlin College, is considered by McDonough to be the test case for his grandest schemes in sustainable design.

"It's a building like a tree," he says. "That was the design assignment, and when you think about a tree as a design assignment, it makes you think about design humility. Millions of years of R&D went into a tree. Unfortunately, in my world of architecture, the word 'humility' and the word 'architect' have not appeared together in the same paragraph since *The Fountainhead*. Just remember, it took 5,000 years to put wheels on our luggage."

With just a few years of R&D, McDonough tried to simulate arboreal perfection. "Think about what a tree can do," he says. "It can make oxygen, sequester carbon, fix nitrogen, distill water, provide a habitat for hundreds of species, accrue solar energy as fuel, make complex sugars into food, change colors with the seasons. We imagined ways we could do this in a 13,600-square-foot structure."

He succeeded to a large extent. The Lewis Center, made of glass, steel, and brick, with a soaring arched roof supporting solar panels, produces 13 percent more energy than it consumes, all through solar intake and eco-effective design features. The building is covered with trellises of vines, and a grove of trees on the north side helps to block wind and provides a habitat for birds. A "living machine" inside and next to the building has a marsh system full of organisms such as snails and plants that clean the wastewater.

Classrooms face west and south to absorb the sun. Special windowpanes control the intake of ultraviolet light. Careful landscaping eliminates the need for pesticides and irrigation. The interior is designed with raised floors and leased carpeting, which goes back to the manufacturer at the end of its useful life in order to be made into new carpet. The entire building can be disassembled, and its elements cycled back into the "technosphere" to be re-used. It is a waste-free unit that enhances its environment.

"We think of buildings like trees and cities like forests," McDonough says later in the day to hundreds of nasa personnel in a lecture hall. The slide projected on the screen behind him shows a rendering from the master plan his firm has done for the city of Liuzhou, in southern China. "Think about Paris with farms on the roofs," says McDonough, eliciting oohs from the audience as he reveals a bird's-eye view of a prospective, beautiful downtown Liuzhou. Scores of buildings are crowned with orchards, crop rows, and rice paddies, taking the place of hot, ugly roofs. It's an alluring vision: the city as a dense "forest," with each building supporting—literally—farmland made of native soil. McDonough has lifted up the earth and put it several stories above the streets. Green roofs help to prevent water-runoff and pollution problems—water feeds plants, instead of running into sewers—as well as heating and cooling problems, since the roofs absorb solar heat. Picture a habitat for hundreds of species of plants and animals,

instead of an overheated platform for an air-conditioning unit.

"China is going to house 400 million people in the next 12 years, so imagine that," McDonough says.

"You know, it's like rebuilding the entire United States in seven years—all the housing here. They've made brick illegal in 174 jurisdictions, because they're afraid of losing all their soil and burning all their coal making brick. So we have to look at new materials; we have to look at new strategies."

To facilitate his work in China, in 2000 McDonough accepted the co-chairmanship of the board of the China-U.S. Center for Sustainable Development, an agency that seeks to create positive solutions to the massive environmental and ecological issues the nations have in common. With Madame Deng Nan, daughter of the late premier Deng Xiaoping, who is the chief executive secretary of the China Association of Science and Technology, he is coming up with suggestions for a more sustainable future for the most populous country on earth.

"We were talking today about lunar architecture, and wouldn't lunar architecture have to be sustainable," McDonough says from the podium at nasa. "As our species begins to explore the potential of our design, and we start to imagine what it would be like to have a goal like this, I'm going to give you a bit of my background, to sort of set the stage for future work."

"I was born in Tokyo in 1951, after the Second World War [where his father served as a foreign-language officer]," he says. "And when I was a little kid lying on

a futon, I remember listening to the oxcarts arriving from the farmlands, coming to collect our sewage—which my mother happily called the ‘honey wagons coming to collect our night soil.’ And being little children, you can imagine how excited we were about these stories about poop. We thought this was just the greatest thing, this idea that our waste could go out into the farmlands, become composted, become food, and come back on the carts in the morning—in the form of tofu and vegetables and things like that. “Most of my childhood,” McDonough continues, “was in Hong Kong, where we had six million people, who were mostly refugees from Communist China, sharing the same small island and territory nearby. During the dry season we had water every fourth day. And the relationship of the Chinese to the land is fundamentally different than our own. This land has been continuously farmed for 5,000 years. And how do you farm the same piece of dirt for 5,000 years if you don’t understand nutrient flow? In ancient China, it was impolite to leave someone’s house after a meal without leaving a deposit, because you were taking their nutrients. It’s a very tight equation: waste equals food.”

A few weeks later in his office in Charlottesville, McDonough tells me in an interview about moving, as a teenager, with his family to Westport, Connecticut. His father had become president of Seagram’s overseas division. McDonough experienced profound culture shock. “All of a sudden I saw American kids leaving the water running in the showers after gym.

And I remember being aghast. That was for me my late introduction to this world that we've come to have in the United States now—where it's estimated that if everybody used as many resources as the average American we would require six planets."

After graduating from Dartmouth, McDonough helped put himself through architecture school at Yale by working weekends and summers as chauffeur to the bandleader Benny Goodman. Before entering graduate school, he went to Jordan to work on King Hussein's Jordan River valley redevelopment project. "That changed me for life," he recalls, "because I had the chance to live in a Bedouin tent. When I first got there, I looked at this tent made of goat hair and said, 'They're going to make me live in a black tent in this 120-degree heat with no shade, no air movement?' But once I was in the tent, I discovered I was in deep shade, protected from ultraviolet light. The surface of the tent would heat up, and you'd get convective currents, so all of a sudden there was a breeze. The coarse weave was so open that the light came streaming in, so it was full of beautiful light to read by inside. When it rains, the hairs swell up, and it gets tight as a drum. And you make it from [a goat] that follows you around and eats everything you can't." McDonough says he remembers thinking, How exquisite are these tents? "At the same time, we were helping the local tribes make adobe houses, which work under entirely different principles of thermal mass and diurnal cycles. The heavy brick moderates the temperature in ways that are totally effective for

this place as well. So, I learned about mass and membrane and transparency from the tent and the adobe, and I saw that when you finish with them they return to the earth. The mud adobe hut is the earth; the tent will become compostable material."

"Then, when I got back to Yale to start graduate school," McDonough continues, "there was the first oil shock, in 1973. And I don't know if you remember Sheikh [Ahmed Zaki] Yamani [the former Saudi minister of oil]. He made two remarks in forming Opec. When asked, 'Do you think we'll see the end of the age of oil?', he said, essentially, 'I don't know that we'll ever see the end of the age of oil, but I can tell you this: the Stone Age didn't end because we ran out of stones. The oil age won't end because we run out of oil.' This had a huge effect on me. I started working on a solar house as a project at Yale."

Dreams, Nightmares, Selections.

Industrial Revolution, Take Two

Why can't a building be as eco-friendly as a tree? What if the concept of waste didn't exist? Having collaborated with such giants as Google, nasa, Ford, and Wal-Mart with his "Cradle to Cradle" philosophy, architect William McDonough wants to usher in a new Industrial Revolution. No sacrifices necessary, just smart design.

• BY MATT TYRNAUER