

Special Report

DISRUPTING THE WORLD'S OLDEST INDUSTRY

<http://environment.wharton.upenn.edu> • <http://knowledge.wharton.upenn.edu>



SPONSORS

The Initiative for Global Environmental Leadership (IGEL), Rubicon Global and Knowledge@Wharton have partnered to create this special report on business and the environment.

IGEL
INITIATIVE *for* GLOBAL
ENVIRONMENTAL LEADERSHIP



www.RubiconGlobal.com

INTRODUCTION



Disrupting the World's Oldest Industry

Nature wastes nothing. Human beings are less frugal. We have been generating garbage for thousands of years, and are only now starting to confront the reality that our waste streams are poisoning the planet. Governments have begun to regulate how we dispose of what we no longer want; large corporations are working to find sustainable solutions that are also profitable; and smaller “green” companies and non-profits are aiming for zero-waste-to-landfill, which may be as close as we can come to the example set by nature. This special report, sponsored by the Initiative for Global Environmental Leadership (IGEL) and Rubicon Global, looks at where we have been, where we are going and how we are getting there.

The Commercialization of Garbage

1

For much of human history, people have found ways to profitably reuse their waste. But the rising tide of consumerism that followed World War II brought with it TV dinners, disposable razors and an ever-changing stream of new gadgets, clothes and automobiles. It also began to fill the world with trash. Encouraged by environmental legislation, and financed by Wall Street, large corporations were created to make the garbage disappear. Years later, and billions of dollars richer, these giants are looking for ways to join the “green revolution.”

The Elimination of Garbage

5

At the start of the 21st century, new companies began to tackle the environmental problem created by the country's fast-accumulating trash. Rather than generating revenue from the use of their own landfills and other assets, these pioneers began creating profits for themselves by sharing savings with their customers. Data is at the heart of these approaches, which range from local to international. All are working to dramatically reduce, and possibly eliminate, the need for landfills.

Zero Waste: 'Nil to Landfill' Is Now a Practical Goal

9

The push to divert virtually all material from landfills and incinerators is strongest in Europe, but it has also gained a foothold in the U.S. Zero waste goals are increasingly being embraced by progressive communities and companies that see value in turning waste streams into profit streams. And with more than 70 extended producer responsibility (EPR) laws enacted on the state and local level, some with industry support, corporate America is becoming a partner in waste reduction.

Poor noted, "Though the poor may fall in greater numbers because of their proximity to the causes of disease ... the rich, who inhabit the splendid squares and spacious streets ... often become the victims of the same disorders which afflict their poorer brethren."

Eventually, the reformers succeeded. In 1866, New York State passed the Metropolitan Health Bill, which regulated and professionalized sanitation. Similar laws were enacted in other states as well.

It is no accident that these new regulations emerged in the wake of the Civil War. According to Heather Rogers, author of *Gone Tomorrow: The Hidden Life of Garbage*, the war brought about "a new scale of battle-related industrialization," which led in turn to rising urbanization. As the fighting ended, factories began to churn out manufactured products for citizens on a massive scale, triggering mass consumption and drawing workers into rapidly growing urban centers. And with less time to repair what was broken, and less space to store what might later be re-used, these urban dwellers began generating huge amounts of trash.

A new profession, sanitation science, emerged to deal with this new and growing problem, and reform-minded "sanitarians" set about finding solutions. Foremost among them was Col. George E. Waring, Jr., who assumed command of New York City's Street Cleaning Department in 1895. During his brief tenure, Waring created an efficient system of sanitation that cleaned the streets and extracted whatever value could be found in the garbage that was collected.

New Yorkers of the time were required to separate their garbage and to put a "call card" in the window when it was ready for collection. A highly disciplined and well-paid army of licensed workers known as Waring's White Wings (for the starched white uniforms they wore) collected the trash and brought it by barge to a processing center on Barren Island in Jamaica Bay. Workers at the center picked out items of value as they whisked by on a 104-foot conveyer belt. Organic waste was cooked and compressed into fertilizer and grease, which was used to make soap and candles, among other products.

The Barren Island processing center remained in operation, profitably reducing New York's waste until 1936, when Robert Moses closed it down in favor of landfills that actually created land. Among his many accomplishments, Moses transformed the foul-smelling Corona Ash Dump, immortalized in *The Great Gatsby*, into the site of the 1939 World's Fair, attracting visitors from every part of the globe with its motto "The World of Tomorrow" and preserving for future archaeologists the detritus of 20th century America.

THE COMMERCIALIZATION OF GARBAGE

In the first years of the 20th century, the world of sanitation shifted. Instead of looking for ways to extract value from waste, those in charge of the nation's garbage focused instead on removing trash from sight as quickly and efficiently as possible. Intentionally or not, their success supported the growth of a new consumer culture. As waste disposal became more proficient, the value in waste grew more obscure and throwing things away became routine.

The Great Depression and World War II kept consumer culture in check for some time, but once victory was declared in 1945, years of pent-up demand and manufacturing capability brought consumerism roaring back. The baby boom meant a rapid rise in customers, and increasingly efficient manufacturing meant an equally rapid rise in things people could buy. Companies continually introduced new models of everything from cars to hats, while advertising stoked the public's desire for the latest fashion. According to historian Elaine Tyler May, consumer spending skyrocketed 60% between 1945 and 1950.

According to the EPA, the amount of waste going to landfills has declined from 89% of total municipal solid waste (MSW) in 1980 to 54% in 2011.

The result of all this consumption was an enormous increase in the volume of garbage that needed to be collected and disposed of. "Sanitary landfills" proliferated. Most were located away from population centers in rural and often impoverished areas. Within the city limits, garbage was used to fill in swampy areas and create new real estate.

Kitchen-sink garbage disposals, the modern compaction garbage truck, small-scale incinerators for individual buildings and numerous other innovations helped sustain and fuel the unfettered growth of consumerism for decades. But gradually America's growing waste stream began to raise concerns, even in Washington.

In 1976 Congress responded by enacting the Resource Conservation and Recovery Act (RCRA), which focused primarily on hazardous waste. A statement by the House Committee on Interstate and Foreign Commerce explains why: "Current estimates indicate that approximately 30 to 35 million tons of hazardous waste are literally dumped on the ground each year. Many of these substances can blind, cripple, or kill. They can defoliate the environment,

contaminate drinking water supplies and enter the food chain under present, largely unregulated disposal practices.”

Congress significantly expanded and strengthened RCRA, passing the Hazardous and Solid Waste Amendments (HSWA) in 1984. According to a history of RCRA published by the Environmental Protection Agency (EPA) in 2002, the amendments established more than 70 statutory provisions requiring EPA action, including an investigation of the “environmental soundness of municipal solid waste landfills (MSWLFs), and on amounts of waste being processed by them.” One of the more significant findings in the EPA’s final report was that thousands of municipal solid waste landfills “inconsistently used environmental controls, and that they posed significant threats to ground and surface water resources.”

In 2012, San Jose announced that it wanted to divert 75% of its municipal solid waste from landfills and increase that percentage over time.

The EPA quickly published new goals and recommendations for municipal solid waste management, but it was not until 1991 that new federal standards were established. Among other things, the regulations specified design and operating standards, restricted landfill locations, required liners and groundwater monitoring and required the closing of all landfills that did not meet these standards.

According to the EPA, there were 6,500 landfills operating in 1988. By 2002, that number had dropped to 2,500. This decline did not signal a diminution of waste or of landfill capacity. Quite the opposite: in 1985, the country produced 166.3 million tons of municipal solid waste (MSW); by 2005 the volume had grown more than 50%, to 253.7 million tons. The average size of America’s landfills skyrocketed as their numbers shrank.

GARBAGE GOES PUBLIC

The drop in the number of landfills was due primarily to the high cost of meeting the stringent new standards. Many small companies and public facilities simply could not afford to upgrade their landfills and ended up shutting them down. Two large publicly traded companies had the resources to buy up and consolidate many of these smaller operations, and to create mammoth new state-of-the-art landfills that dwarfed all previous facilities. Browning-

Ferris Industries (BFI) and Waste Management Inc., both launched in 1968, emerged as the dominant players in what had quickly become a new corporate era of garbage collection and disposal.

BFI was sold to Allied Waste Industries (AWI) and private investors in 1999. Nine years later, a smaller competitor, Republic Services, acquired AWI, growing into the second-largest public waste company virtually overnight. In 2012, Republic generated \$8.1 billion in revenue. Waste Management, the largest waste company in the U.S., had 2012 revenues of \$13.6 billion. Together these two companies represent nearly two-thirds of the publicly owned waste services sector and about 40% of the total United States non-hazardous solid waste services industry.

Both Waste Management and Republic have grown strongly over the years. Their business models look similar: Each company invests heavily in long-term fixed assets, such as trucks, landfills and recycling centers (also known as material recovery facilities). These investments generate revenue over long periods through customer fees. Once the capital investment is fully amortized, much of this revenue drops to the bottom line.

While landfills, some of which are observable from space, are among the more visible of Waste Management and Republic’s assets, they account for just 12% of Republic’s revenue and 20% of Waste Management’s. Both companies derive the bulk of their revenue (77% and 62% respectively) from collection, the use of trucks to collect and haul garbage to landfills, recycling centers or transfer stations, where material from several areas is consolidated before being transported to its final destination.

Traditional waste streams are changing, however. According to the EPA, the amount of waste going to landfills has declined from 89% of total municipal solid waste (MSW) in 1980 to 54% in 2011. During this same time period, the amount of material being recycled has grown from less than 10% of total MSW to more than 34%. With volumes of traditional waste declining, and many indicators suggesting that recycling, reuse and perhaps energy generation are the growth markets of the future, there could be changes in the structure of traditional waste handlers. (Waste Management’s total revenue from recycling in 2012, for example, was \$1.4 billion, about 1% of total revenue.)

Waste Management and Republic are now investing in material recovery facilities, which in addition to processing fees, generate revenue from fluctuating prices for commodities like plastics, cardboard, metal, aluminum, glass and the like.

Elsewhere, Waste Management is pursuing a number of other large-scale strategies aimed at reducing its carbon footprint. Its website, in one example, notes, "At about 130 disposal sites, we use naturally-occurring landfill gas to power homes and businesses. Just recently, we even developed the technology to convert landfill gas into a fuel our fleet vehicles can run on."

ADAPTATION

Republic Services is approaching the change in the marketplace differently. "We believe that our business is a local business," notes Peter Keller, vice president of recycling for Republic. "People in Portland, Ore., Seattle or San Francisco have a different outlook on life than people in Phoenix or Tuscaloosa, Ala. Different communities behave differently; not every market is the same."

Keller points to San Jose, Calif., which for years deposited most of its MSW in Republic's landfill. Then in 2012, the city announced that it wanted to divert 75% of its MSW from the landfill and increase that percentage over time.

"We said OK, we'll do that and we made a significant investment [in a recycling facility] and are now processing 100% of the commercial material that comes out of San Jose." The change has meant an 80% reduction in the volume San Jose sends to Republic's landfill but "we have the opportunity to make reasonable returns on the recycling facility, too," Keller notes.

Before building a recycling center in a specific location, Republic looks at a number of critical factors, including population density and growth, the density of its commercial routes in the area, the relative cost of disposal, and the local regulatory framework and culture. In San Jose, the decision was to make the investment in recycling. Every year, says Keller, Republic adds three to five new recycling plants to its current inventory of 74 plants.

"At the end of the day, we are service providers," Keller notes. "We want to provide services that our customers demand, and to the fullest extent possible create business models that are sustainable and work for both parties."





The Elimination of Garbage

AT THE START OF THE 21ST CENTURY, new companies began to tackle the environmental problem created by the United States' fast-accumulating trash. Rather than generating revenue from the use of their own landfills and other assets, these pioneers began creating profits for themselves by sharing savings with their customers. Data is at the heart of these approaches, which range from local to international. All are working to dramatically reduce, and possibly eliminate the need for landfills.

Today two companies, Waste Management Inc. and Republic Services, dominate the waste industry, but a large number of smaller players handle about the same amount of business as the two giants. As a result, even a modest-sized company, such as regional supermarket chain Wegmans Food Markets, says it can find itself dealing with an unwieldy number of suppliers.

“Our goal is moving all of our material into something more sustainable than a landfill by 2022.”

— Nate Morris

Not long ago, Wegmans had just one person overseeing all of its waste management, handling interactions and invoices from haulers, recyclers and other suppliers throughout the chain's six-state region. As the company grew, says Jason Wadsworth, Wegmans' sustainability coordinator, “There was really no way that one person could manage all of that.”

Such problems led to the development of waste brokers who could help ease the burden of companies by providing

a few key services: managing day-to-day interactions with suppliers, consolidating invoices and leveraging the combined purchasing power of the broker's multiple customers to obtain better pricing for each.

THE BEGINNING OF A NEW APPROACH TO WASTE

In 1995, Oakleaf Global Holdings took the broker concept in a new direction. Key to Oakleaf's approach was a concept inherent, but largely unappreciated, in the broker model: Oakleaf owned no waste facilities of any kind — no landfills, garbage trucks, dumpsters or recycling plants. It was, in the language of Wall Street, asset-light. This asset-light approach did offer two advantages. The company could take on huge national customers without investing in major assets. And without trucks and landfills of its own, Oakleaf could choose solutions for its clients from among all the available suppliers in each market.

Using this asset-light approach and fueled by Wall Street, Oakleaf grew rapidly, attracting major clients. By 2007, Oakleaf was working with 2,500 haulers, employing 650 people and generating \$580 million in revenue. New Mountain Capital acquired the company that year for \$655 million. Later, Waste Management acquired the company for \$425 million in 2011.

Launched in 2000 to provide comprehensive waste disposal, Heritage Interactive is not strictly an asset-light company. Its parent, Heritage Environmental Services (HES), owns a nationwide network of Treatment, Storage and Disposal Facilities (TSDFs) as well as in-house transportation services. But Kurt Wirgau, director of international business development for Heritage Interactive, stresses that location is the determining factor in whether or not his company makes use of HES assets. “Using HES assets gives us a distinct advantage in the

marketplace, but whenever necessary we use a network of independent audited and approved service providers,” he says. Heritage Interactive itself owns a single recycling plant in Iowa City, Iowa constructed for the benefit of a client in the area.

Cost reduction drives Heritage Interactive’s business model. Because the company shares whatever savings it can find with its customers, the more it reduces costs, the more money it makes. “When we find more sustainable solutions for our customers, that in turn pays our bills because that’s how we are incentivized through all of our contracts,” says Wirgau.

“Our sell is: we will take over all of your waste services as they stand today with no up-charge, and as we find ways to reduce your waste, we share those savings with you,” Wirgau notes, “whether it’s just a financial gain that both parties can split by reducing waste, or the financial gain we can uncover by pulling materials from the waste stream and turning them into valuable commodities on the back end.”

To do this, Heritage Interactive relies on an extensive network of service providers. “Just the number we need for our current customers,” says Wirgau. New suppliers are added only as needed and are monitored for compliance, since risk reduction is one of the key benefits the company’s customers seek.

Since these suppliers are crucial to its business, Wirgau adds, “We look at them more as partners rather than just suppliers we can beat up on pricing.” Instead of simply negotiating price with a supplier, “We take a closer look at the details of the service to target inefficiencies.” If the customer’s dumpsters are being picked up when only half full, for instance, (dumpsters sensors can gauge this), Heritage will refine the pick-up schedule to cut customers’ costs.

With costs critical for all stakeholders, sustainability has become the decisive factor in the company’s success. When the company started in 2000, Wirgau believed that cost savings would drive the business. But now he says, “All of our contracts have sustainability goals. That’s our bread and butter. If a customer is not interested in diversion, we would probably not be as effective as a big asset-owning company.”

The company currently services thousands of sites in a range of sectors. One customer is the Subaru plant in Lafayette, Ind., which joined Heritage Interactive in 2002 and three years later achieved its goal of being landfill free, well ahead of schedule.

CROSSING THE RUBICON

Rubicon Global is an asset-light waste and recycling company focused on sustainability. Its customers are

primarily in the retail, food service and hospitality industries, as opposed to the heavy industrial sector that Heritage Interactive primarily serves. But the two firms have similar business models: Rubicon Global aims to cut costs for environmentally concerned customers by working with suppliers to reduce inefficiencies and divert material from landfills.

“Our goal,” says CEO Nate Morris, “is moving all of our material into something more sustainable than a landfill by 2022.”

Still, the conversation with customers often starts out focusing on cost savings, rather than sustainability. The company’s first point of contact in most corporations is a procurement officer preoccupied with reducing costs, according to Lane Moore, executive chairman of Rubicon Global and managing partner of QuarterMoore Capital, an Atlanta-based private investment firm. “So it’s important that Rubicon Global starts out focusing on cost reduction – renegotiating contracts and adjusting the frequency of pickups.... But then we start asking what materials are in the waste stream and what can be done with them.”

The non-profit Appalachia Ohio Zero Waste Initiative (AOZWI) is developing a model zero-waste plan for two local counties.

Although new technologies are being developed, there is currently no way other than physical inspection to determine the full contents of a waste-stream. And the piles of waste can be very large, indeed. One Rubicon customer, Martin Brower, a division of Reyes Holdings and McDonald’s largest distributor, looks to recycle about 950,000 pounds of cardboard, stretch-wrap, organics and other materials every month, according to Steve Kinney, Martin Brower’s vice president of supply chain solutions.

Once the materials are identified, however, technology takes over. Rubicon Global’s national database catalogues customers’ waste streams and the suppliers that recycle the materials. That enables even small, local suppliers to bid on the individual outlets of large companies.

Since 2012, for instance, Rubicon has been employing numerous small suppliers to service 3,000 7-Eleven stores. “We’ve been able to reduce our waste management spending from stores in the Rubicon Global recycling program by over 25%,” says Tom Brennan, vice president of infrastructure services for 7-Eleven.

Examples like that lead Peter Kellner, founder of Richmond Global and senior advisor to Rubicon Global, to view the waste industry as ripe for disruption.

NON-PROFIT COLLABORATIONS

At first glance, the group Rural Action bears little resemblance to Rubicon Global. It is a relatively small non-profit seeking to foster social and economic justice and fight the impact of waste in rural Ohio. The area has the lowest recycling rates in the state, and landfills that receive millions of tons of waste every year from New York City and New Jersey.

“I believe this form of [sustainability] network, allowing companies to collaborate and differentiate, will play an absolutely critical role in everything having to do with waste management or recycling in the future.”

— Thomas Odenwald

But four years ago, with sustaining support from a local foundation and in partnership with Ohio University’s Voinovich School for Leadership and Public Affairs, Rural Action launched Appalachia Ohio Zero Waste Initiative (AOZWI), a program that offers on a small scale many of the same benefits Rubicon Global does nationally. Michelle Decker, CEO of Rural Action, compares the two organizations. “Rubicon Global is working in a for-profit context for companies that want to bring down the cost of waste and improve their environmental impact; communities want the same thing, with the added element of wanting to grow jobs.”

AOZWI helps connect entrepreneurial suppliers with companies looking to reduce waste. “We are having entrepreneurs come to us with ideas about how to help other companies reduce waste, or how to use a material as a feedstock or if they are already doing that, how they can grow,” says Kyle O’Keefe, the coordinator of AOZWI. “What’s really unique about our project is that we are very much an intermediary type of organization. We know where people are collecting certain materials, where various feed stocks are and which companies need those materials, so we help them connect with each other.”

Rural Action also has connections with economic development agencies that can assist with planning and

even potentially with start-up capital, “And as a well-established member organization in the area,” O’Keefe says, “we can also help market these fledgling businesses by giving them lots of visibility.”

The Rural Action initiative does not have a sophisticated technology platform, but O’Keefe says that the group is essentially “an information broker.” In this capacity, AOZWI is also working with a national consulting company called Resource Recycling Systems to prepare an in-depth database of all the businesses in the region that are using materials from waste streams, whether they are buying cardboard and turning it into new fiberboard or pelletizing plastics. The database will document these businesses and “help build out a network that can feed them more materials and gain them visibility around their products,” according to O’Keefe. “This is something that’s never been done before, not in the state of Ohio at least, and probably not to the depth we’re going. We’ll even be working with cottage industries.”

For customers looking to find more productive approaches, AOZWI is developing a model zero-waste plan for two local counties. The plan is helping more than 60 different organizations including surrounding cities, solid waste districts and nearby Ohio University agree on common goals around recycling, education and outreach, illegal dumping and economic development. Once the plan is complete, says O’Keefe, “We are going to use the action plan as a guide to influence future solid waste district plans and new programs that get developed.”

This level of zero-waste activity is rare among non-profits, possibly unique, but it is, says Decker, replicable across the country.

USING DATA TO ELIMINATE WASTE

Data has become increasingly important to the drive for zero waste. The AOZWI database is helping divert waste from landfills at the grassroots level by connecting suppliers and buyers within the organization’s regional marketplace. Rubicon Global’s database is helping the organization connect suppliers and buyers nationwide. Suppliers see information about the accounts they are invited to bid on, and customers see information about available solutions and costs.

“Big Data” is also being used to reduce waste at the global level. SAP, the multi-national software company, recently spent \$4.3 billion to purchase Ariba, which Thomas Odenwald, senior vice president of sustainability at SAP, describes as “one of the largest B2B network communities in the world, where buyers and sellers can meet and exchange data.”

According to Odenwald, a segment of the Ariba network, the Product Stewardship Network (SAP PSN), is already allowing suppliers and product manufacturers to share relevant sustainability data, including, for example, detailed information about the waste generated in the manufacturing of a product. Companies using PSN can then “put their own scoring algorithm on top of that,” says Odenwald.

The resulting scorecard helps buyers make more sustainable sourcing decisions, which in turn, encourages suppliers to improve their scores by offering more sustainable raw materials and products. “I believe this form of network, allowing companies to collaborate and differentiate, will play an absolutely critical role in everything having to do with waste management or recycling in the future,” says Odenwald.

A similar approach is underway at Walmart. The company’s Sustainability Index, a measurement system used to track the environmental impact of products, has been rolled out across hundreds of product categories and thousands of suppliers. CEO Mike Duke announced in 2012 that

by the end of 2017, the giant retailer will buy 70% of the goods it sells in U.S. stores only from suppliers who use the Sustainability Index to evaluate and share information about the sustainability of their products.

In addition to helping companies connect, Big Data is likely to become a vital asset if, as many expect, sustainability regulations continue to expand. Bob Wickham, a partner in the investment firm Rotunda Capital Partners and a member of the Rubicon’s global advisory board, sees “growing scrutiny around sustainability reporting, particularly for public companies.” And Perry Moss, president of Rubicon Global, believes regulations and restrictions that are already law in some states will spread nationwide, making compliance and sustainability reporting critical for U.S. companies.

Whether it’s the carrot of better business decisions or the stick of growing regulation, databases that provide easy access to sustainability data are only going to grow more essential to the drive for zero waste.





Zero Waste: ‘Nil to Landfill’ Is Now a Practical Goal

THE PUSH TO DIVERT VIRTUALLY ALL MATERIAL FROM LANDFILLS and incinerators is strongest in Europe, but it has also gained a foothold in the U.S. Zero waste goals are increasingly being embraced by progressive communities and companies that see value in turning waste streams into profit streams. And with more than 70 extended producer responsibility (EPR) laws enacted on the state and local level, some with industry support, corporate America is becoming a partner in waste reduction.

Europe is the world’s high achiever when it comes to zero waste. Some municipalities there are well on their way to conserving and recovering all the resources that used to be lost to landfills and incinerators, without burying or burning any waste at all — the definition of zero-waste established by the international alliance on the subject.

“We’re proud of the 80% [waste] diversion rate — the highest in the country, certainly of any city in North America... We want 100% zero waste.”

— Mayor Ed Lee, San Francisco

Capannori, Italy, for instance, has earned enough from selling its former “garbage” to recycling plants that its zero waste scheme (now at more than 80% diversion) is self-sufficient, and even saved the local council more than \$2.7 million in 2009. The city has plowed the savings back into further waste-reduction efforts.

Capannori is likely to achieve zero waste by 2020, which is an overall European Union goal. In 2012, the European Commission and the European Parliament outlined their

ambitions: “By 2020 waste is managed as a resource. Waste generated per capita is in absolute decline.” That remains a big challenge, especially with Europe’s economic downturn. According to Zero Waste Europe, a non-profit coalition bringing together groups and governments, in 2011 the European Union countries were still burning or burying 60% of their waste, and recycling or composting just 40%. That’s a long way from the ultimate goal, but better than the United States.

Another early zero waste pioneer is New Zealand. As noted in Paul Connett’s *The Zero Waste Solution*, by early 2005 some 72% of the country’s local councils had established no-landfill targets, and by 2008 it was adopted as a national goal. New Zealand’s effort later lost momentum, but it has pockets of great success, including a 90% diversion rate by the Opotiki District Council.

AMERICAN GRASSROOTS PROGRESS

According to the Environmental Protection Agency (EPA), America recycled only 35% of its municipal solid waste in 2011, a considerable improvement from the 6% rate of 1960, but far behind other nations. In fact, according to Elizabeth Royte in her book *Garbage Land*, Americans throw out “more stuff, per capita, than any other nation in the world, and 2.5 times the per-capita rate of Oslo, Norway.” The latest per-person figure is 4.4 pounds daily (with 1.53 pounds of that recycled or composted).

And yet achieving zero waste has become part of the national conversation, embraced by American corporations with a zeal that would have been unthinkable a decade ago. As the Initiative for Global Environmental Leadership (IGEL) noted in its recent report, The Green Sports Movement, professional and college leagues and teams have endorsed zero waste concepts with fervor, and many have achieved high diversion rates.

To a significant degree, zero waste in the U.S. is being driven by regional, state and private initiatives, including strong corporate participation, without any foreseeable support from Washington. In California, the statewide Integrated Waste Management Board has a zero waste goal, as do the counties of Santa Cruz, Del Norte, San Luis Obispo and San Diego. California cities voting for zero waste include San Francisco, Berkeley and Palo Alto. Austin and San Antonio in Texas, New York City and Seattle are also leaders.

San Francisco makes an interesting case study, because with partner Recology, an employee-owned and locally based waste management company, it is vying to become the first zero waste city in the U.S., with a goal of 2020.

As recently as 1989, 90% of San Francisco's garbage ended up in landfills (some 900,000 tons annually). But now that ratio has been nearly reversed. Among the repurposed waste streams in the city are soda cans that have been crushed and baled as raw material for more aluminum cans, used construction materials that are reused for new buildings, and food scraps and yard clippings (some 400 tons a day) that are turned into compost.

In some San Francisco neighborhoods, consumers can get a 10% discount off the trash bill for each week they don't put out their garbage cans. If they skip collection day twice in one month, they get a 20% discount. Businesses can get waste audits, and households can schedule meetings to talk about reducing garbage streams.

"We're proud of the 80% diversion rate, the highest in the country, certainly of any city in North America," Mayor Ed Lee told *PBS*. "And we're not going to be satisfied with that. We want 100% zero waste. This is where we're going."

According to Heather Achilles, an engineer from IBM's Next Generation Computing Research, "Cities have a lot of data related to the collection of trash, including billing, truck routing, frequency of pickup and materials taken in. The problem is that there are no standards, so it's hard to put the information together and use it to make good decisions — such as maybe having only one pickup a week instead of two, if the collections are going out half empty. Our software takes data from many sources and pulls it into IBM's Smarter Cities computing platform that many cities are already using. The data can be analyzed and used to put pilot programs in place for zero waste, if that's the city's goal."

Many cities perform annual trash inventories known as waste audits, Achilles said, but don't always optimize their use of the information that comes out of them. "We can take that data and produce a breakdown that will help identify which waste streams can and should be diverted — like valuable scrap aluminum, if there's enough of it being

collected." The city of Dubuque, Iowa is also working with IBM on more efficient waste management.

According to the Institute for Local Self-Reliance, some 30 years ago, "many solid waste planners thought no more than 15% to 20% of the municipal waste stream could be recycled. Today, numerous communities have surpassed 50% recycling, and many individual establishments — public and private sector — such as office buildings, schools, hospitals, restaurants, and supermarkets, have approached 90% and higher levels."

"Our software takes data from many sources and pulls it into IBM's Smarter Cities computing platform.... The data can be analyzed and used to put pilot programs in place for zero waste...."

— Heather Achilles, an engineer from IBM's Next Generation Computing Research

The growing zero waste buy-in on the corporate level is impressive. Zero waste programs that advanced rapidly in Europe, Canada, Japan, Israel and China have run into business lobbying roadblocks in the United States, but that opposition is eroding as companies, realizing there is revenue in waste, set their own ambitious waste reduction goals.

Industries have begun to make striking zero waste claims. General Motors has 110 landfill-free facilities worldwide, with 97% of generated waste either recycled or reused — an average of 3% is converted to energy, a process not allowed by some zero waste guidelines. For its 109th plant, in Rochester, New York, GM spent four years and seven attempts to figure out a recycling process for a stubborn, oily filter sludge. The 110th was GM's 12,000-worker, 5.5-million-square-foot corporate headquarters in Detroit, announced in December of 2013.

Other U.S. automakers are not far behind. According to Andy Hobbs, director of the Ford Environmental Quality Office, 14 of the company's plants worldwide are "nil to landfill." In 2012, Ford recycled 586,000 tons of scrap metal in North America, and generated \$225 million in revenue through the process. Ten of Honda's 14 American plants are also zero waste to landfill.

In something of a milestone, California's Sierra Nevada Brewing Company, with a closed-loop approach, has achieved a 99.8% diversion rate from landfill, incineration and the environment. A number of things helped Sierra get there, including reducing packaging and ensuring it

was recyclable, capturing and reusing carbon dioxide (such as for pressurizing tanks), addressing transportation, and recycling or composting nearly all the solid waste produced in the brewing process.

Founding members of the U.S. Zero Waste Business Council (USZWBC) include the City of Los Angeles, Austin Resource Recovery (with a 90% reduction goal by 2040 or sooner), the Walt Disney Company (which calls zero waste a “journey”), Raytheon, Earth Friendly Products and the American Licorice Company.

“... Numerous communities have surpassed 50% recycling, and many individual establishments — public and private sector — such as office buildings, schools, hospitals, restaurants and supermarkets, have approached 90% and higher levels.”

— The Institute for Local Self-Reliance

In March of 2013, the USZWBC issued zero waste business certificates to Whole Foods for its achievement at three stores in San Diego County. The stores achieved more than 90% diversion from landfill, incinerator and the environment, and that entitled them to a bronze-level award. Sierra Nevada was the first to reach the highest level, which is platinum.

IS ZERO WASTE POSSIBLE?

Many experts say it’s possible to divert all of America’s waste from its landfills. But such a zero waste achievement would require a national consensus involving manufacturers, the federal government, the non-profit sector, states, municipalities and consumers.

“Yes, zero waste is possible, but I don’t think it’s likely,” said Robert Giegengack, a professor in the department of earth and environmental science at the University of Pennsylvania. “It’s not a new idea — it characterized subsistence agrarian societies for millennia; it was sought as a goal during World War II, and it has been resurrected in the last 30 years or so — and we are making progress in getting there. People are working together on the common goal, particularly on food waste.”

Giegengack pointed out that landfill dependence is in many ways a post-World War II phenomenon, as the U.S. switched to a disposable society.

High diversion rates — and even zero waste — are increasingly practical as waste streams are turned into revenue streams for companies and municipalities. For companies such as Rubicon Global, Terracycle and Heritage Interactive, the prime directive is repurposing materials and keeping them out of landfills.

“Zero waste is absolutely possible,” said Nate Morris, co-founder and CEO of Rubicon Global, which services clients such as 7-Eleven, and Wegmans. Wegmans’ uniforms, for example, are transformed into car insulation. “Waste is the biggest piece of low-hanging fruit out there, with bigger environmental results than installing solar panels or changing fleets to biodiesel. Eighty percent to 90% diversion is possible today.”

“A future without waste and toxic materials is not just a dream, it’s a necessity,” says the Zero Waste Alliance (ZWA), based in Oregon. “Waste reduces the effectiveness of our businesses and harms the vitality of our communities.” ZWA counsels companies to “map” their waste streams, identifying volume, make-up and sources, and locate opportunities to turn that often-useful material into a revenue stream. If your organization wants to compost its garbage stream, is there local infrastructure that can accept the material?

According to Lynn Landes, founder of Zero Waste America, “Under current conditions, it is possible to achieve zero waste. It has to be that way, so we don’t burn or bury our waste. Landfills and incineration should be off the table. Zero waste is the only practical way of managing our resources — and minimizing the harmful results of manufacturing and production.”

The federal government has zero waste on its radar screen. According to Mathy Stanislaus, assistant administrator in the Environmental Protection Agency’s (EPA) Office of Solid Waste and Emergency Response, “It’s being discussed at every level, including states, local governments and the corporate sector. We’re seeing a big trend to re-engineer and remanufacture material that would otherwise go to landfills. We’re not sure how many companies and organizations have actually adopted zero waste policies, but many are set on reusing as many materials as possible.”

The EPA, Stanislaus said, is “moving the marketplace” by recognizing companies that have voluntarily committed to achieving a certain recovery rate — and then achieved that goal. For stakeholders looking at zero waste, the agency provides scientific information and risk analysis. “And we’re working on streamlining regulations to foster innovation in the recycling realm. We’re providing more certainty for manufacturers that reuse materials.”

The EPA believes that recycling is good for the economy. “If you divert one ton of waste from landfills, it pays \$101 more than if it were just managed as waste,” Stanislaus said. “There’s a delta of increase in salary and wages. And with that same diversion, sales go up \$135.” He also noted the value hidden in the waste stream, since a metric ton of obsolete cell phones contains 6.6 pounds of silver, more than half a pound of gold and almost three tenths of a pound of palladium. Landfill elimination “is a goal we want to strive for. If waste goes to landfills, it means we’re not doing a good job of managing it.”

ZERO WASTE AT THE UNIVERSITY OF PENNSYLVANIA

In July of 2013, Wharton turned its annual human resources lunch into its first-ever zero waste event. According to Rafael de Luna III, the associate director of sustainability for Wharton Operations, the plates and utensils at the lunch were compostable, and not only were waste bins set up with explanatory signage, but three of the five stations had volunteer monitors making sure waste was properly directed. That last precaution proved vital. “The stations with monitors had no contamination,” de Luna said. “And those without people being stationed were in some cases so contaminated with non-compostable material that the contents just ended up being thrown out as trash.”

Wharton is averaging between 75% and 90% diversion rate at its zero waste events. On average the school hosts 15,000 annual events, many of which serve food (almost half of the school’s garbage stream) and now many of the event planners are working with Wharton Operations to make them zero waste. “I approached Amy Reese, the special events manager at Wharton Operations, and asked for an audience with the caterers,” de Luna said. “We explained what we’re trying to do, and that we want zero waste events to be an option. We don’t think we’ve even scratched the surface of what we can achieve with zero waste, and now we’re getting weekly requests for it.”

Wharton was the first school within the university to perform a waste stream audit, initially only for one of its academic buildings and one of its cafes. Now in its fourth year, the audit program has expanded to Steinberg Hall and Dietrich Hall (a Wharton building), and other schools at Penn are doing the same for their buildings. Besides food waste, the largest categories are plastic (11%) and Styrofoam (10%) containers, reflecting the large amount of takeout meals consumed. Paper in its myriad forms is 18%. After one event, de Luna said he found “200 pounds of perfectly good food that was being thrown away,” and the university is taking steps to minimize that kind of waste.

The road to zero waste can be bumpy, says Dan Garofalo, environmental sustainability director for the University of Pennsylvania. “Although we’re on a good trajectory for traditional recycling, food waste is really a challenge for us right now.” But Penn came up with a comprehensive solution — beginning in 2010, it began sending four tons of organic waste per week to the Wilmington Organic Recycling Center in Delaware, the largest composting facility on the East Coast.

“In theory, it’s pretty straightforward,” Garofalo said. “Students scrape waste into compost bins, and the material ends up on the loading docks, where it’s collected twice a week by Waste Management. Unfortunately, it wasn’t happening.” Garofalo noticed during spot checks that the bins were often empty at the end of a shift, and he discovered that although the system was in place, it was poorly understood by a kitchen staff with high turnover. “The process had temporarily broken down. And there was no feedback loop to report when it wasn’t working.” The university facilities and dining staff worked together over the winter break to get the system back on track — first by holding a training program for all kitchen staff and cafeteria managers, and then implementing a program for regular review and quality control.

Composting has been a trial and error process at the university, with some early experiments in on-site processing failing (in part because of challenges in finding on-campus uses for the end product). Now, Garofalo says, BiobiNs (locally made containers based on a design licensed from an Australian company) are used to store organic waste in an aerobic and odor-free state before it’s collected.

The university uses its own garbage compactor trucks to collect municipal solid waste in the morning and recycling in the afternoon. “I’m confident that what is supposed to get recycled actually does,” Garofalo said. Meanwhile the university purchasing department is “doing an incredible job” of reducing packaging for office supplies and other projects. A printer management project, using consultants, has greatly reduced the amount of campus paper waste.

And students are being recruited through a program called Rethink Your Footprint that includes the distribution of reusable water bottles and coffee cups. As part of the campaign, student Eco Reps set up a mini-bin challenge. At one Penn zero-waste event, QuakerFest 2013 (staffed by student volunteers), 600 pounds of waste was diverted by the 1,400 participants, and only 37 pounds ended up in landfills.

The university’s overall recycling rate, if construction waste diversion is included, is 50%. Total waste to landfill

is going down 2% per capita annually. The University of Pennsylvania does not yet have a zero waste goal, but it's heading in that direction.

EXTENDED PRODUCER RESPONSIBILITY

Zero waste made a giant leap forward in 1990, when the Der Grüne Punkt ("Green Dot") program was first enacted in Germany. It made practical the tough national packaging law passed the following year in response to a growing landfill crisis. The law requires companies to either take back their own packaging, or (far more likely) pay a licensing fee and have it recycled through a scheme set up by Duales System Holding. By 1993, 12,000 companies (often branches of U.S. firms that loaded up on packaging at home) had become members. When packaging bears the Green Dot label (now seen in 28 countries) it can be dropped into household bins (paralleling already well-established recycling programs).

Green Dot gave companies a powerful incentive to reduce their packaging, and that's exactly what happened as what's known as Extended Producer Responsibility (EPR) spread throughout Europe and on to Canada, Japan, Israel, Brazil and other countries. "There are more than 30 EPR packaging laws in Europe alone, many of them in place for more than 20 years," says Scott Cassel, CEO of the Product Stewardship Institute (PSI), a U.S. organization that focuses on sustainable end-of-life management for waste streams.

In the 1990s, EPR remained below the radar in the U.S., with only a few determined advocates pointing to the success of the German program. Bette Fishbein of the group INFORM, one such pioneer, wrote in 2000, "Since it is the producer that decides how products are designed, providing industry with a direct economic incentive seems the most efficient and effective approach [to reducing waste]."

PSI has been working to change the U.S. status quo. According to Cassel, Massachusetts' director of waste planning from 1993 to 2000, "I came to the conclusion that a key barrier for state waste programs was financing — there wasn't enough money in the system. And so I decided to start an institute aimed at bringing the EPR concept to the U.S." That led to PSI's founding in 2000 as a joint project with the state of Massachusetts. Its first forum that year brought together 100 government officials from 20 states.

According to Cassel, 32 states now have at least one EPR law, and more than 76 individual "producer pays" statutes have been enacted. In 2013 alone, nine state or local bills became law. EPR programs for electronics are also growing at the state and local level. More than 25 laws have already been enacted, spurred in part by horrific images of unsafe dismantling operations in Asia.

Connecticut is currently working with PSI through the state's environmental agency to set up product stewardship policies. The initial focus, announced in late 2013, will be on carpeting, batteries, packaging, pesticides and fertilizers. "Recovering the materials in discarded products helps protect the environment, creates jobs and boosts the economy," said Daniel Esty, former commissioner of the Connecticut Department of Energy and the Environment.

The prospect for any federal legislation is still slim, though there's been legislative interest in bills on pharmaceuticals and electronics. "Over the next five years, I expect the concept to become much more prevalent at the national level," Cassel said. "It's more efficient to cover all the states with one EPR policy."

Today, companies such as Nestlé Waters North America are embracing EPR. "We've seen the potential power of EPR, and we are bullish on its prospects for recycling in the United States," said Kim Jeffrey, the former president and CEO of Nestlé Waters.

When industry signs on, EPR laws can move quickly. The paint industry, via the American Coatings Association (ACA), signed on to an initiative sponsored by PSI to do something about the 75 million gallons of leftover paint, worth \$500 million, that is generated annually and usually ends up in landfills or incinerators. Municipalities spend an average of \$8 a gallon to manage unused consumer paint. The first state law — with manufacturers responsible for collecting and processing waste paint — was enacted by Oregon in 2009, but Cassel says another seven to 10 states are likely to pass similar laws, and seven (including Oregon) already have.

The path isn't always smooth — ACA sued California's environmental agency in 2012, claiming that it had overreached in implementing its paint EPR statute by requiring too much data. According to Alison Keane, a vice president of government affairs at ACA, the state's program was upheld in court, but an appeal is underway. "We want regulatory relief, because the law as currently constituted is unnecessarily burdensome," she said. "But we absolutely remain supportive of EPR laws, and the program in California is ongoing as the case proceeds."

Zero waste, said Cassel, "is a concept and a motivator — it's what we all want to see. As we breathe and live, there will always be waste, and getting it down to zero will always be a goal."

The good news is that the goal is a lot closer than it has ever been, and an increasing number of advocates dare to think that it's achievable.

USEFUL LINKS:

U.S. Zero Waste Business Council

<http://www.uszwbc.org/>

Product Stewardship Institute

<http://www.productstewardship.us/>

Waste Management

<http://www.wm.com>

Republic Services

<http://www.republicservices.com/corporate/home.aspx>

Rubicon Global

<http://rubiconglobal.com/>

Rural Action

<http://ruralaction.org/>

When Recycling, Remember to Separate Bones, Flint and Animal Skins

http://www.denverpost.com/ci_24292454/when-recycling-remember-separate-bones-flint-and-animal

The Case for Zero Waste

<http://www.zerowaste.org/case.htm>

Zero Waste Emissions From Factories

http://panasonic.net/sustainability/en/eco/resources_recycling/zero_emission/

The Zero Waste Office: Is it Possible?

<http://www.greenbiz.com/news/2008/04/09/zero-waste-office-it-possible>

Eliminating Plant Waste to Keep the Earth Clean

<http://web-japan.org/atlas/technology/tec13.html>

Zero Waste is Not Zero Waste Emissions

<http://terrapass.com/uncategorized/wasted-opportunity-reduce-emissions/>

Promotion of Zero Emission (At Production Sites)

http://www.fujixerox.com/eng/company/ecology/internal/zero_establishment/index.html

Zero Waste at Walmart

<http://corporate.walmart.com/global-responsibility/environment-sustainability/waste>

Waste Reduction at Nikon

http://www.nikon.com/about/csr/environment/plants/plants_03/index.htm

Russia's Zero Waste Olympic Pledge

http://www.huffingtonpost.com/2013/10/29/russia-zero-waste-olympics_n_4175374.html

Disney Targets Zero Emissions

http://www.sustainablebrands.com/news_and_views/articles/disney-targets-zero-emissions-zero-waste

A Zero Waste Olympics? Nice Try, But No Gold Medal.

<http://www.alternet.org/visions/zero-waste-olympics-nice-try-no-gold-medal>

Zero Waste Projects Becoming Firmly Established Throughout the World

<http://www.natureinterface.com/e/ni04/P060-061/>

Is Zero Waste Conceivable?

<http://www.zerowaste.co.nz/assets/Conferencepaperfinal.pdf>

Zero Waste

http://www.sfenvironment.org/sites/default/files/editor-uploads/zero_waste/sfe_zw_strategic_plan_14.pdf

CASE STUDY: Altamont Landfill and Resource Recovery Facility

http://www.wm.com/documents/pdfs-for-services-section/Case-studies-municipal/PSS_CsStdyAltamLndfillREVISE_rFjg.pdf

The Future of Garbage...Is No More Garbage

<http://www.cnbc.com/id/100470730>

Municipal Solid Waste

<http://www.epa.gov/epawaste/nonhaz/municipal/index.htm>

Zero Waste Communities

<http://zwia.org/news/zero-waste-communities/>

Automakers Work to Achieve Zero Waste Goals

http://wheels.blogs.nytimes.com/2013/03/01/automakers-work-to-achieve-zero-waste-goals/?_r=0

Iconic GM World Headquarters Sends No Waste to Landfill

<http://fastlane.gm.com/2013/12/10/iconic-gm-world-headquarters-sends-no-waste-to-landfill/>

Garbage In, Nutrient-Rich Compost Out

<http://www.upenn.edu/pennnews/current/node/3410>

The Story of Capannori, a Zero Waste Champion

<http://www.zerowasteurope.eu/2013/09/the-story-of-capannori-a-zero-waste-champion/>

Duales System Holding: Sustainability is our Business Objective

http://www.dsd-holding.de/fileadmin/dsd-holding/doc/pdfs/NBH_2012_engl.pdf

Sending Waste Back to the Source

<http://www.utne.com/environment/sending-waste-back-to-the-source.aspx#ixzz2pZ1sCodv>

Paint Industries File Lawsuit

http://www.cmta.net/page/legupdate-article.php?legupdate_id=21425



IGEL SPONSORS

- Bank of America
- BASF
- Dow
- Enterprise Holdings
- GE
- FMC
- International Paper
- Johnson & Johnson
- Merck
- Rubicon Global
- SAP
- Shell
- United Water
- Xerox

Special Report

DISRUPTING THE WORLD'S OLDEST INDUSTRY

IGEL

INITIATIVE *for* GLOBAL
ENVIRONMENTAL LEADERSHIP

<http://environment.wharton.upenn.edu>

KNOWLEDGE @ WHARTON

<http://knowledge.wharton.upenn.edu>

Eric Orts

Faculty Director
Initiative for Global Environmental Leadership (IGEL)
The Wharton School, University of Pennsylvania
ortse@wharton.upenn.edu

Joanne Spigonardo

Senior Associate Director of Business Development
Initiative for Global Environmental Leadership (IGEL)
The Wharton School, University of Pennsylvania
spigonaj@wharton.upenn.edu