

CITY OF PHILADELPHIA

CASE STUDY:

**COST-SAVINGS FROM SOLAR-POWERED COMPACTORS FOR  
TRASH AND RECYCLING**

**Impacts of Solar-Powered Trash Compactors, Companion Recycling Units and  
Wireless Notification Technology on Operating Costs, Fuel Consumption and  
Vehicle Emissions in Center City Philadelphia**



**Inaugural Report**

**June 2009**

## Executive Summary

On April 30, 2009, Mayor Michael Nutter unveiled the first of 500 solar-powered trash compactors and 210 companion single-stream recycling units to be installed throughout Center City Philadelphia. The City had been making 17 trips each week to empty 700 wire baskets throughout Center City, at an annual cost of about \$2.3 million. After replacing those 700 receptacles with 500 solar-powered compactors and 210 recycling units, the City collects only 5 times a week, at an annual operating cost of about \$720,000 – representing a 70% savings. Performing those 17 collections each week required 33 workers on 3 shifts, while performing the 5 collections per week under the new program requires only 9 workers on a single shift. The other workers have been re-assigned to other, more productive tasks. The deployment plan was a comprehensive package including a 3-year financing program, a 4-year extended warranty and service plan, and a wireless monitoring system on all 500 units.

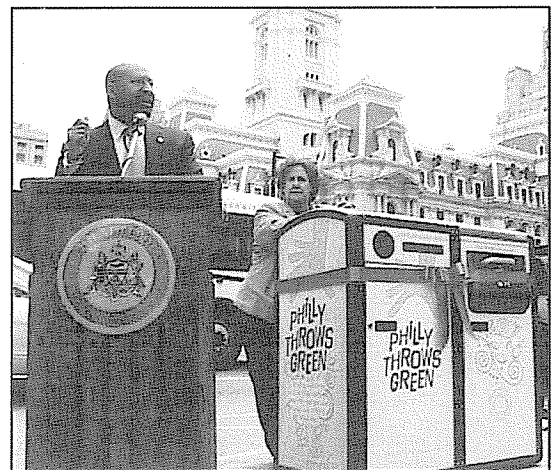
Highlights of the program include:

- Immediate savings: By entering into a 3-year financing arrangement, the City has no up-front capital cost and will realize collection cost savings in the first year of approximately \$850,000.
- Ongoing savings: The City will save nearly \$13 million in cumulative collection cost savings over the next 10 years, net of the equipment cost.
- Annual operating cost reduction of 70 percent: compaction reduces collection demand, which directly reduces operating costs and associated vehicle fuel use and emissions.

	Before	After	Savings
<b>Collection frequency</b>	17/week	5/week	12/week (70%)
<b>Annual operating cost</b>	\$2,300,000	\$720,000	\$1,580,000 (70%)
<b>Cumulative 10-year cost</b>	\$23 million	\$10 million	\$13 million (70%)

In conjunction with the installation of the solar-powered trash compactors, the City introduced public space recycling for the very first time in Philadelphia. Mayor Nutter has launched a major public relations and neighborhood education campaign called "Philly Throws Green" with a ([www.phillythrowsgreen.org](http://www.phillythrowsgreen.org)). This program is part of the Mayor's broader initiative called "Greenworks Philadelphia" ([www.greenworkspbila.org](http://www.greenworkspbila.org)), the new comprehensive sustainability framework designed to help the City meet its proclaimed goal of becoming "America's number one green city."

In the current economy, many cities and towns are actively seeking ways to reduce operating costs and balance their budgets. The City of Philadelphia is demonstrating that solar compactors can significantly reduce annual operating costs in the first year, and for years thereafter, by reducing collection frequency requirements. Providing the City's first public-space recycling program and having the ability to track operations are additional features of the program, which offers clear economic, environmental and educational benefits.



## Frequently Asked Questions

### How much sunlight is needed?

The BigBelly needs no direct sunlight. It runs on a 12-Volt battery that is kept charged by its solar panel on sunny or cloudy days. The battery provides a power reserve for several weeks, so it performs well even in northern latitudes.

### Do the bags get too heavy?

Customers have not had problems with bag weight. We have designed the BigBelly to be simple and ergonomically friendly to use. Weight can also be controlled using a 5-position switch.

### Is the machine safe to use?

Yes. The hopper prevents hands from reaching the compaction area, and the unit locks. The motor will not operate with the door open. The machine also runs on a safe, low voltage.

### Does holding compacted trash create odor problems?

No. The BigBelly is an enclosed system, so odors are contained inside. Customers have reported improved odor control compared to open-air cans.

### Is it expensive?

While more expensive than a regular trash can, the BigBelly reduces collection requirements 4 times or more, saving

thousands over its lifetime. Contact WM for a custom savings analysis.

### Is it susceptible to vandalism?

BigBelly is made tough from heavy-gauge galvanized steel, polycarbonate shield and high impact ABS plastic sides. The

BigBelly resists scratches, dents and graffiti and units are bolted down for added security.

### Is it resistant to sand and water?

Yes. The exterior has passed a 10-year accelerated life-cycle corrosion test. BigBelly has few moving parts, and the simple, enclosed design helps keep out sand. The powder-coat finish is designed for long life in icy and marine environments.

### How hard it is to maintain?

Maintaining the BigBelly is easy. Routine maintenance is simply battery replacement and chain lubrication about every 4-5 years.



#### Specifications

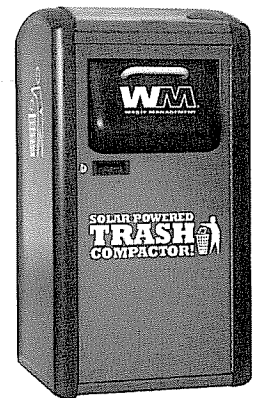
Dimensions: 26.1"W x 25.9"D x 50.4"H (66.3 cm W x 65.8 cm D x 128 cm H) Weight: 300 lbs. (137 kg)  
Compaction Force: 1250 lbs. (568 kg) Capacity: 160-240 gal. uncompacted (606-908 liters) Drive System: Gear-motor with chain drive. Controls: fully automated, IC processor controlled system senses trash level, fullness and machine status. Electronics: 12-Volt DC system with 30-Watt PV module Materials: Galvanized steel with powder-coat finish and heavy-duty recyclable ABS plastic sides.

Powered by



**The Waste Management Solar Compactor  
Is A Powerful Promotional Tool**

An innovative and highly visible application of renewable energy, the Waste Management Solar Compactor powered by BigBelly Solar attracts attention wherever it is deployed. Get your message across with custom decals, silk screens, ad panels and wraps. Perfect for your business, school, city or town.

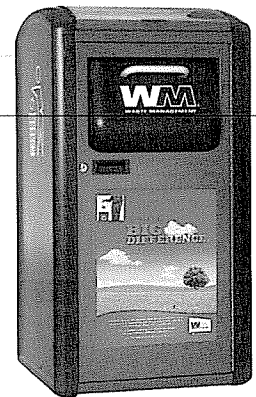


**SILK SCREEN**

- Custom silk screening is applied in the factory
- Durable and weather resistant treatment

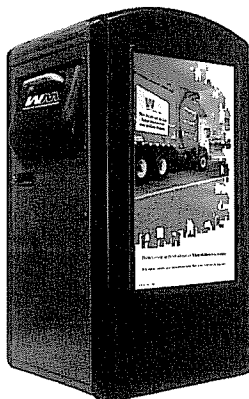
**DECAL**

- 18" x 22" front decal or 18" x 30" side decal, contains vinyl coating for durability and weather resistance
- Decal can be applied in the factory or in the field



**WRAP**

- Waste Management Solar Compactor can be wrapped just like a bus or automobile
- Wrap applied in the factory using customer-supplied artwork

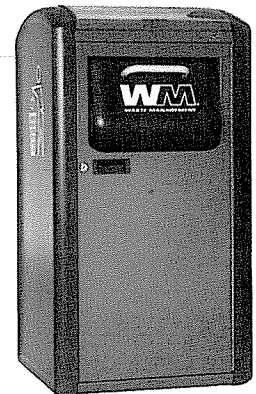


**AD PANELS**

- Framed graphic dimensions are 18" x 30"
- Tamper-Resistant Torx screws secure top of frame for easy change of graphics
- Powder coated aluminum with clear polycarbonate face for durability & weather resistance

**COLOR**

- Black is standard color and contains 80-100% post consumer recycled content!



**Durability/Longevity**Powered By **BigBelly**  
**SOLAR**

**Waste Management's Solar Powered Compactor is built to last! It is 100% made in the USA with 99% U.S. manufactured parts.**

**Design & Engineering:**

The system is the world's only on-site solar compaction system designed to reduce collection frequency, lower costs and ensure a cleaner, greener environment.

- The unit is designed and tested to last in excess of 10 years
- It is fully weatherized and can be power washed (interior and exterior)
- All chosen materials thickness exceed the minimum requirements

**Materials:**

The materials used in a WM Solar Powered Compactor have been chosen specifically for their durable performance and aesthetics.

**Plastics:**

- The protective cover of the solar panel (solar bubble) is made from strong, flexible 0.300" thick polycarbonate which is UV stable and able to withstand years of sun exposure. This material is used in hockey rinks and is resistant to significant impact as tested with baseball bats and cinder blocks dropped from varying heights.
- ABS (Acrylonitrile Butadiene Styrene) plastic is used for the 0.125" thick side panels and hopper cover. The black colored plastic is made from 100% post-consumer recycled material. Custom color plastic is manufactured with pigments incorporated throughout the material, so scratches will not visibly stand out.

ABS plastic is:

- Impact, dent and abrasion resistant
  - UV stable
  - Able to maintain protective performance in extreme temperatures (as hot as 130°F in Dubai to as cold as -25°F in Western Canada) without blistering, warping or becoming brittle.
- The leak-proof interior bin is made from 0.125" thick polyethylene plastic that is durable and light weight. The 32-gallon bin can hold up to 150 gallons of uncompacted trash.

**Metals:**

- The WM Solar Powered Compactor is constructed of rust-resistant pre-galvanized sheet metal. The gauge thickness (12/14/16/18 or 20) varies depending on use.
- Weather resistant, UV stabilized (TGIF Polyester) powder coat paint is applied to all external parts for additional protection.
- The WM Solar Powered Compactor was tested for durability in harsh temperate conditions of icy and marine environments, such as an ocean-side beach. 1,000 hours of continuous salt-spray (ASTM B117-03) testing was performed to simulate a 10-year exposure to the elements. Tests conclude that the WM Solar Powered Compactor system had excellent corrosion protection. (Report is attached as Exhibit A).
- Stainless steel is used for the two metal hinges to resist corrosion and rust.
- The aluminum hopper handle provides advantages in durability and corrosion resistance.

## Durability/Longevity

### Components:

The components used in the unit are also designed and built for long lives of service:

- The 30-Watt solar panel carries a 20-year warranty and is mounted in a shock-dampening bracket.
- The 1/6-HP DC motor used to drive the chains has specially machined gearing sealed into a cast housing.
- The motor body is also sealed and designed to run intermittent duty cycles. To date we have experienced 0.033% failed motor rate (in nearly 3,000 machines).
- Durable ANSI. 40 chains are used to drive the non-hydraulic compactor ram of the WM Solar Powered Compactor. The chains will travel approximately 60 miles over the course of 15 years of very heavy use and are each rated for maximum loads of 3,125 lbs. A WM Solar Powered Compactor requires a maximum compaction force of 1,250 lbs. Similar chains are typically used on motorcycles.
- The sealed 12V battery is spill-proof and maintenance-free.
- The electronic components of a WM Solar Powered Compactor have a minimum temperature range of -40°F to +185°F.

### Miscellaneous:

- A WM Solar Powered Compactor correctly installed is sturdy and cannot be moved. Each unit weighs 300 lbs. and is mounted on a metal plate that is bolted to the ground.
- The electronic components are contained within a weather resistant enclosure located inside the locked top service access section. The front trash removal door is also controlled by key.
- The enclosed design keeps animals/pests out and away from the internal mechanisms/electronics.
- The unit is fully weatherized, but in the event of a flood, it can withstand up to 20" of water without harming the electronics and up to 36" of water with only minor damage to the electronics.
- A heavily used unit can run up to 4 compaction cycles a day (each lasting 41 seconds). 30 minutes of direct sunlight on the solar panel can store enough energy (in the battery) for up to 30 compaction cycles. The unit comes installed with a fully charged battery.
- Rubber gaskets line the hood of the solar bubble to keep out rain.
- A unit has 275 rivets which won't loosen over time while allowing field repairs.
- The applied graphics on a unit are UV stable to resist peeling or fading.
- Loctite adhesive is used to secure all fasteners from loosening.
- Conformal coating is sprayed on all electronic circuitry to protect against moisture, fungus, dust, corrosion, and other environmental stresses.
- All connector contacts are gold-plated to prevent corrosion and provide better conductivity.

### Field Experience:

The longest standing deployments of our current commercial model include three years in Boston, MA. These units successfully operate in an active part of the city with heavy local and tourist foot traffic. The units are washed periodically (up to 4 times a year) with a basic power washer and are still operating on their original batteries after three long winters. Successful deployments in extreme weather locations:

- Dubai (130°F)
- Western Canada (-25°F)
- Washington State, USA (most precipitation)
- Arizona, USA (driest climate)

WM Solar Powered Compactors have a worldwide uptime rate of 99.97%



## Driving Down Costs in Philadelphia

In July 2009, the city of Philadelphia will deploy 500 Solar-Powered Trash Compactors within the downtown district known as Center City. With the new compactors, the city expects to reduce weekly collections from 17 to only five to seven. Over the course of ten years, these reductions are projected to yield cash savings of more than \$12 million.

### AT A GLANCE

#### KEEPS YOUR CITY CLEANER

- Eliminates unsightly trash strewn by wind, animals, and people
- Enclosed design keeps scavenging animals out, and litter in
- Safe and easy to use

#### LOWERS THE EXPENSE OF TRASH REMOVAL

- Greater capacity means four out of five pick-ups can be eliminated
- Reduces fuel, maintenance costs, and greenhouse gas emissions by 80%
- Allows for more productive allocation of city resources and staff
- Typically pays for itself within two to four years because fewer collections are needed
- Available for lease or purchase with minimal capital outlay

#### MAKES TRASH COLLECTION MORE EFFICIENT

- Can hold 180 gallons of trash (about five times the volume of ordinary streetside trash receptacles)
- Gets 100% of its energy from the sun and uses less than five watt hours/day
- Works in cold weather, hot weather, in the shade or when covered with snow
- Made in America, it provides "green economy" jobs and uses sustainable energy resources

### What They're Saying

*"Based on our experience thus far, we are confident that these compactors will reduce carbon dioxide emissions from vehicles by as much as 79 percent over a five-year period."*

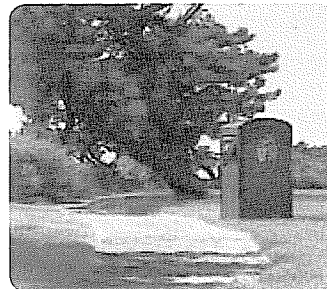
-- TROY BUTZLAFF, Assistant City Manager for Palm Springs, California

*"Utilizing these compactors, we have saved money by reducing collections while at the same time eliminating unsightly overflowing trash cans and reducing pests and odor. The trash compactors exemplify our willingness to find innovative, environmentally friendly projects to enhance our community."*

-- MAYOR DAVID COHEN, City of Newton, Massachusetts

*"With the time savings from using this system, our trash collectors will be reassigned to other tasks, creating opportunities to do work that was not being done for lack of resources. There is always lots to do - painting buildings, cutting grass, fixing our 60-mile trail system, and so on. We will have more time to do other important tasks - tasks that make us do our jobs better."*

-- GERALD CHECCO, Park Board Superintendent, Cincinnati, Ohio



#### A few of the places you can spot Solar-Powered Trash Compactors

The Alamo, San Antonio | Andover, Massachusetts | Baltimore Inner Harbour | Millennium Park, Chicago  
College Station, Texas | Dallas, Texas | Fairfax, Virginia | Fenway Park, Boston | Fort Meade, Maryland,  
and many more.



From everyday collection to environmental protection,  
Think Green. Think Waste Management.

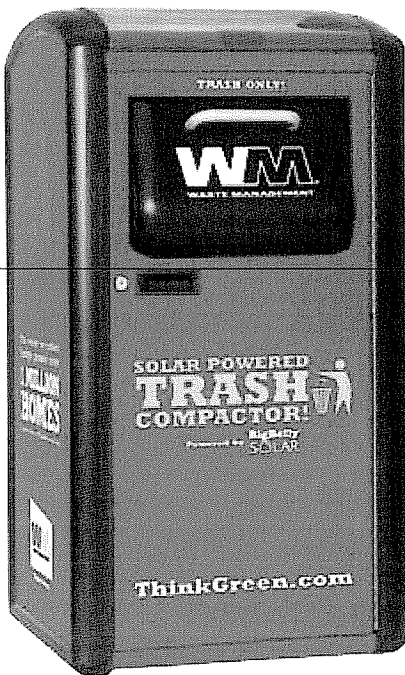
**Think Green.**



# SOLAR-POWERED TRASH COMPACTOR

Powered by BigBelly® Solar

*The Waste Management Solar-Powered Trash Compactor uses renewable energy to turn public spaces into clean, eco-friendly zones. Powered by the sun, it encourages recycling and reduces both greenhouse gas emissions and trash collection expenses. So it's good for the environment – and the economy.*



## **A better way to keep public spaces clean.**

Ordinary municipal trash barrels often overflow. The Waste Management Solar-Powered Trash Compactor holds five times as much refuse – and signals when it's ready for pick-up.



## **Vastly reduces waste collection expenses.**

Because it has five times greater capacity, the compactor can reduce the number of collection trips by 80%. Fewer collections mean 80% savings in fuel, labor and maintenance costs, and an 80% reduction in greenhouse gas emissions.



## **Affordable lease options.**

Municipalities can opt for a convenient leasing program that provides an affordable alternative to purchase. Leasing lets customers achieve immediate savings instead of expending major cash resources.



## **Powered by the sun.**

Made from recycled materials, the Waste Management Solar-Powered Trash Compactor works even in areas that don't receive direct sunlight.



## **Small, but with huge capacity.**

About the same size as a standard 35-gallon trash barrel, the compactors have a small footprint. But, thanks to patented solar-powered compression technology, they can hold about five times as much trash.



## **So tech-savvy it tells you when it's full.**

When a unit reaches capacity, sensors trigger an internal compactor that flattens the contents, converting 180 gallons of waste into easy-to-collect bags. A wireless system then signals that the can is ready to be picked up.



## **Recycling functionality.**

The kiosk unit includes receptacles for collecting plastic bottles, newspapers, glass and other recyclables. By making recycling easy, it improves recycling rates, helps keep recyclables clean, and preserves valuable resources.