SWANA®
NEWS
FROM THE SOLID WASTE
ASSOCIATION OF NORTH AMERICA

CONTENTS

Trends in Solid Waste Collection —What's the Future?

By Marc J. Rogoff and Robert B. Gardner

Marc Rogoff

Robert Gardner

Solid waste collection programs are undergoing unprecedented changes in the way municipal solid waste is being collected curbside and the levels of services provided to customers. Layered on these trends are the stresses of "doing more with less" by both public and private service providers. Technology is being adopted by many agencies to become more efficient, reduce costs to their customers, and reduce worker injuries.

We will attempt, through this series of articles over the upcoming year, to give *MSW Management* readers an unvarnished view into ten major trends (Table 1) impacting the solid waste collection industry, what works, and does not work, and their overall customer costs. Each article will cover a few of these in depth.

AUTOMATION

Early History of Automated Collection

Automated side-loader trucks were first implemented in the City of Phoenix in the 1970s, with the aim of ending the backbreaking nature of residential, solid waste collection, and to minimize worker injuries. Since then, thousands of public agencies and private haulers have moved from the once, traditional rear-loader method of waste collection to one that also provides the customer with a variety of choices in standardized, rollout carts. These have enabled communities throughout the country to significantly reduce worker compensation claims and minimize insurance expenses, while at the same time offering opportunities to workers who are not selected for their work assignment based solely on physical skills.

Table 1. Solid Waste Collection Trends

Automation	Containerized Organics Collection
Hybrid Vehicles	Retaining the Work Force
CNG	Special Pay Schedules
Routing Software	Once a Week Collection
Vehicle Electronics	Customer Service

The evolution of solid waste collection vehicles has been historically driven by an overwhelming desire by solid waste professionals to collect more waste for less money, as well as lessening the physical demands on sanitation workers. Residential waste collection over the past century has evolved from the horse-drawn and human powered carts to motor-operated vehicles specifically designed for solid waste collection. These included the first collection vehicles in the 1940s and 1950s, which incorporated the cab over engine chassis design and improved winch and compaction technologies, to address the need for a shorter turning radius vehicle and for improved waste capacity on each truck that was needed for more efficient residential collection.

It was not until the early 1960s, however, that solid waste collection took a monumental leap in technology to improve overall efficiency. During this era, public works departments in communities in mostly western states, which were experiencing rapid customer growth in suburbia in the post-World War II period, were exploring the concept of improving their labor productivity with their oftentimes limited resources. These cities and agencies were less

constrained by formal labor agreements, which were more typical of their larger sister, communities in the east and the Midwest. Consequently, they began to explore ways of moving in the direction of improved vehicle automation as a substitute for labor to lift, tip, and empty garbage containers that were placed curbside.

About this same time, the Federal government also began to study ways of improving solid waste management in the United States. Between 1965 and 1975, the US Public Health Service (the predecessor agency of the US Environmental Protection Agency) provided support for consultant and research studies to develop improved solid waste collection equipment with the aim of eliminating the need for multiple collection workers on each truck to manually lift and empty containers. Major truck manufacturers such as Lodal and Maxxon worked with various cities in the west (Santa Clara, California; Scottsdale and Phoenix, Arizona) to pioneer the development of a drop-frame truck chassis, stand-up driver stations, the use of both right and left hand steering wheels, and the standardization of refuse containers.

For this type of collection system, residents are provided a standardized container into which they place their waste (Exhibit 1). Residents must place their cart at the curb on collection day. During collection, the driver positions the collection vehicle beside the cart. Using controls inside the cab of the vehicle, the driver maneuvers a side-mounted arm to pick up the container and dump its contents into the hopper of the vehicle. The driver then uses the arm to place the container back onto the curb. Under this type of collection system, the driver is able to service the entire route; the need for additional manual labor is eliminated. The savings in personnel and worker's compensation costs, as well as the increase in crew productivity for automated collected, are well documented throughout the solid waste industry.

Exhibit 1. Example of Automated Carts/Container

Currently, the Waste Equipment Technology Association (WASTEC) estimates that there are roughly about 120,000 solid waste vehicles on the road in the United States with about half of all new waste collection vehicles purchased in 2013 (the most recent statistics available) were automated. There is a real sense in the solid waste industry today that automated trucks are significantly

increasing their share of the new sales in recent years. This trend is rapidly increasing as many agencies and private haulers attempt to minimize their increasing insurance costs and more effectively control their cost of labor, while at the same time provide increased customer service levels and opportunities for an aging work force.

Advantages of Automation

Some of the general advantages of automated collection often touted by its proponents include the following:

For Residents:

- It's a convenient and easy method for residents to dispose of trash.
- Wheeled containers are easier, more maneuverable, and safer for residents because there is no carrying or lifting of heavy trash cans.
- The capacity of most cans provided in these programs is equal to three or four regular trash cans.
- The containers keep rodents and pets out of trash given the tight lids.
- The neighborhoods are cleaner and healthier, with no litter on streets after pickup.

For the Community/Agency:

- Improved collection efficiency
- Reduced employee injuries
- Lower turnover rate and increased productivity due to less time missed by injured employees
- Reduced Worker's Compensation claims and insurance premiums
- Reduced rodent problems

Improving Safety and Reducing Work Injuries

Solid waste collection workers are exposed to health and environmental safety risks due to exposure to volatile compounds and potentially hazardous or even infectious materials resulting in musculoskeletal, dermal, respiratory, and gastrointestinal problems. Typical rear-loader operations require manually lifting materials into the collection vehicles. Statistics from such programs suggest that collection crews lift on average, over six tons (13,000 lbs.) per worker per day. In general, this heavy, repetitive, manual lifting, combined with an aging workforce, tends to generate an increasing number of injured staff.

A fully automated collection program enhances worker safety and comfort, and minimizes manual lifting and exposure to possible hazards in the waste such as sharp objects. Fully automated collection eliminates heavy lifting, walking between setouts, and frequent steps on and off the truck. The mechanical arms on modern, fully automated trucks are typically operated by the driver using a joystick control. Rather than slogging through rain and high temperature environments, operators of automated refuse collection systems spend their shifts in climate-controlled comfort. The reduced physical requirement increases the diversity and longevity of the workforce that is able to collect waste. Automated collection has proven to significantly reduce collection worker injuries resulting in reduced workers compensation costs, decreasing disability claims, decreasing the number and cost of light duty assignments, and reducing salary fringe benefit costs in the future.

COMPRESSED NATURAL GAS (CNG)

Two current significant trends in solid waste management are the transition by waste haulers and municipalities of their collection fleets from diesel to compressed natural gas


TruStar Energy 2014

Exhibit 2. Time-Fill CNG Station

(CNG) or liquefied natural gas (LNG) fuels and expanding investment in natural gas fueling stations. Waste collection manufacturers report that within the last three years, more than half of their new vehicle sales include those designed to burn natural gas.

The reasons for the conversion from conventional fossil fuels to natural gas include a variety of economic, environmental, and political considerations. Foremost among these is that natural gas produced in the United States appears to be the lowest cost alternative fuel source. Traditionally, the price of a barrel of oil has been about six times that of a thousand cubic feet of natural gas. With the widespread use of fracking technology to recover significant quantities of natural gas, this ratio has jumped to as high as 12:1. Depending on geographic location and proximity to gas lines, the average price of natural gas today can cost $1.50 to $2.00 less per diesel gallon equivalent (DGE). Projections from government, corporate, and non-profit prognosticators suggest that natural gas will continue to be plentiful and relatively cheap compared to diesel fuel.

Typical refuse truck fuel use averages between 8,500 to 10,000 gallons per year at an average fuel efficiency of 2.5 to 3 gallons per mile. Thus, the growing differential between natural gas and diesel fuel, municipal or hauler operated trucks can shave as much as 30 to 50% on fuel costs. What was once prompted by environmentalism due to the promulgation by United States Environmental Protection Agency (USEPA) of new restrictive federal heavy-vehicle emission regulations has now been largely driven by the promise of significant long-term fuel savings.

Several of the major waste hauling firms in the United States such as Waste Management Inc., Republic Services Inc., and Progressive Waste Solutions have already made capital replacement plans to replace their existing diesel-fuel refuse collection vehicles with natural gas vehicles as they are scheduled for replacement. A few municipalities as well are entering the arena as "early adopters" on this wave to natural gas.

How Is It Dispensed?

CNG is dispensed either through a time fill, quick fill station, or combination time fill and quick fill. A time-fill station slowly fills the vehicle fleet over an extended period (8 to 12 hours). A quick fill station performs similar to a normal diesel or gasoline pump. The number of vehicles, the filling frequency, and the total quantity of fuel to be dispensed during the filling period is used to size the facility compression and storage components.

Time-fill (also known as slow-fill) fueling is usually recommended for solid waste fleets that utilize onsite fueling with vehicles that return to a central location for a period of six to eight hours, during which they can be refueled. Many solid waste operators use time-fill fueling because the fueling station equipment required is often the least expensive. Exhibit 2 is an example of a "portable" time-fill CNG station.

The major components of a typical time-fill natural gas fueling station include a compressor and time-fill dispensers.

Using time-fill, vehicles refuel more slowly, and therefore receive gas directly from the compressor through special time-fill dispensers. This eliminates the need for a high-pressure storage system. Time-fill fueling stations are available in a variety of sizes to meet all kinds of customer needs, including the vehicle-refueling appliance that can fuel vehicles at home or at a business.

Quick-fill (also known as fast-fill) is usually used when vehicles must be refueled in a time period similar to that of other conventional fuels, approximately three to seven minutes for automobiles and light-duty trucks. All public natural gas fueling stations are quick-fill.

The major components of a typical quick-fill natural gas fueling station include (Exhibit 3):

- Compressor
- High-Pressure Storage
- Gas Reservoirs
- Gas Dryer
- Expansion Tank
- Quick-Fill Dispenser(s)

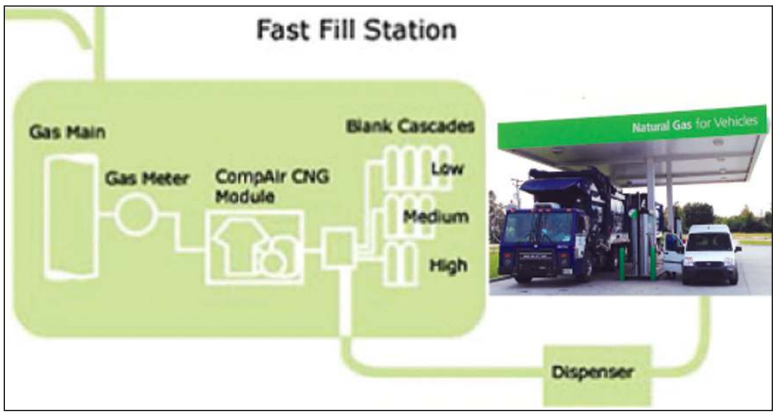

Exhibit 3. CNG Quick-Fill Station

At a quick-fill fueling station, natural gas is compressed by the compressor and stored in the high-pressure storage system. The compressor of a fuel station receives natural gas from a connection pipe. After drying (removing any condensate and impurities), gas is pressurized in several compression stages to 30 Mpa (4,350 psi). Compressed natural gas is stored in high-pressure reservoirs.

What Do CNG Vehicles Cost?

Typical natural gas refuse collection trucks typically range in costs between $210,000, to $250,000, some 15 to 25% more expensive than comparable diesel-fuel vehicles. The American Trucking Association reports that natural gas trucks sell at a large premium ($45,000 –$75,000), compared to diesel-powered, heavy duty Class 8 trucks. The primary reasons for the increased cost is their more expensive engine and complex fuel system.

CNG Vehicle Maintenance Experiences

Many operators report that maintenance costs for CNG vehicles are about the same as that for diesel vehicles. However, maintenance costs for natural gas refuse trucks can also be higher when a fleet is largely composed of diesel trucks, because of additional training requirements for technicians and duplication of maintenance equipment.

If a fleet has both diesel and CNG vehicles and equipment, separate maintenance facilities or areas are required for CNG and diesel vehicles because of different maintenance protocols and building code requirements for the two fuel types. When an entire fleet is replaced with CNG, more efficiency of equipment and personnel can be realized. Several features that must be incorporated into a CNG maintenance area are summarized below.

- Installation of a high-powered ventilation system quickly removes gas from the area in case of gas line leaks or ruptures.
- The ventilation system must work in concert with an advanced combustible gas detection system that engages when fumes reach a certain level.
- All emergency HVAC, electrical, and mechanical systems must be designed to be "explosion proof."
- The design of the building must also incorporate the conversion of existing maintenance bays to support CNG vehicles, erecting a firewall to separate that area from the diesel bays.

Are Grants or Tax Incentives Available?

Over the last several years, there have been several grants and tax incentive programs available to private and municipal entities considering converting or purchasing alternative fuel vehicles such as CNG. Tax incentives or grant funds can significantly reduce the purchase price premium for natural gas trucks so the remaining premium is quickly paid back in operating savings, generating savings over the rest of the life of the vehicle. These are offered by the federal government, state agencies, and local planning and air quality control districts.

Like any grant or tax incentive program, it is important to utilize grant specialists who are knowledgeable about the regulations, have the ability to fill out the required packages or forms correctly, and understand time constraints in light of rapidly changing regulations. Many of the federal grant and incentive programs established under the Energy Policy Act (income tax credit for alternative fuel infrastructure and vehicles) and the Safe, Accountable, Flexible, Efficient Transportation Equity Act (excise tax credit to seller of CNG or LNG) were extended through December 31, 2013. However, further extension of these programs will need to be considered by the 113th Congress.

Feasibility Assessment

There are both qualitative and quantitative factors in assessing whether or not CNG makes sense a municipality's solid waste collection fleet. Exhibit 25 lists some of the major qualitative advantages and disadvantages of CNG. To better quantify the CNG alternative, a pro forma life-cycle cost model can be used compare the cost-effectiveness of deploying a CNG vehicle fleet to a conventional diesel fleet. The pro forma model should include the life-cycle costs associated with using CNG versus diesel, including capital costs for fueling infrastructure (time fill or quick fill or combination thereof) and vehicle costs, operational and maintenance costs, fuel efficiency, and fuel costs. The payback and life-cycle savings will vary based on local fuel costs, tax incentives, credits, and available federal, state, and regional grants.

Marc Rogoff *is National Partner for SCS Engineers in solid waste planning and rate analysis. He is based in SCS's Tampa regional office. Marc is a former Chair of SWANA's Collection and Transfer Division. He can be reached at (813) 804-6729, or* **mrogoff@scsengineers.com**.

As a Senior Vice President, ***Robert Gardner****, P.E., is responsible for overseeing SCS's nationwide solid waste management practice, which includes landfill engineering, landfill gas management, solid waste studies, landfill environmental systems, operation and maintenance, and construction. He can be reached at (757) 466-3364, or* **bgardner@scsengineers.com**.