SWANA®
NEWS
FROM THE SOLID WASTE
ASSOCIATION OF NORTH AMERICA

CONTENTS

Trends in Solid Waste Collection —What's the Future, Part II

By Marc J. Rogoff and Robert B. Gardner, P.E., BCEE

Last issue, we initiated this series on trends in solid waste collection with a review of solid waste automation and compressed natural gas. Equally important are the development of hybrid vehicle technology and improved tracking and monitoring electronics.

HYBRID VEHICLE TECHNOLOGY

With fuel costs rapidly escalating over the last several years, car manufacturers like Toyota have been successful in launching products like the Prius with gasoline-electric hybrid engines to boost fuel economy to levels approaching 60 miles to the gallon. Over the past few years, engine manufacturers for waste collection equipment have developed diesel engine designs with extensive post-combustion control and advanced-combustion control to meet the stringent diesel standards mandated by the Federal Clean Air Act. Even more advanced systems are planned in the upcoming years as the Federal diesel standards become even more stringent. All of these design changes have resulted in increasing purchase, operating, and maintenance costs for diesel solid waste collection trucks.

Typically, the normal solid waste collection vehicle can service upwards of a thousand stops per day on a route, and oftentimes stop and go hundreds of times. Approximately 75% of an average duty cycle of a garbage truck is spent collecting refuse, with the balance used to transport the waste to the ultimate disposal point. Each time the vehicle is started, large amounts of fuel is consumed to get the vehicle back up to operating speed. Further, when the brakes are applied to slow down or stop, energy is lost as heat. Typically, 40% to 50% of the fuel used to collect refuse is used to generate all of the truck's hydraulic needs. All of the energy needs for a typical diesel, solid waste collection truck commonly equates to an average fuel consumption of roughly two to three miles per gallon.

Current regenerative braking systems employed on passenger hybrid cars like the Prius and other popular domestic hybrids store the kinetic energy from braking as electric energy in specially designed, battery packs, which are then used to power an electric engine that is installed in the vehicle. Can these hybrid technologies find their way into the municipal waste collection systems? We are happy to report that this day is not long off.


Marc Rogoff


Robert Gardner

One of the most exciting hybrid technologies is focused on using what is called hydraulic regenerative braking (Exhibit 1). As opposed to the technology used by the Prius and other popular hybrids to convert the energy produced by braking into electrical energy, hydraulic regenerative braking recovers energy and stores it as high-pressure hydraulic fluid in a pair of tanks (an accumulator) that is built into a vehicle's drive train. During the braking process, the energy produced by the vehicle's brakes is used to pump the hydraulic fluid from the reservoir into a second tank. There, as the second tank tills with the fluid, the gas is compressed allowing the energy to be stored. Then, during vehicle acceleration, the high-pressure hydraulic fluid is fed back through the pump, which then supplies additional torque so that the engine has to work less and use less fuel. Recent research suggests that this specially designed

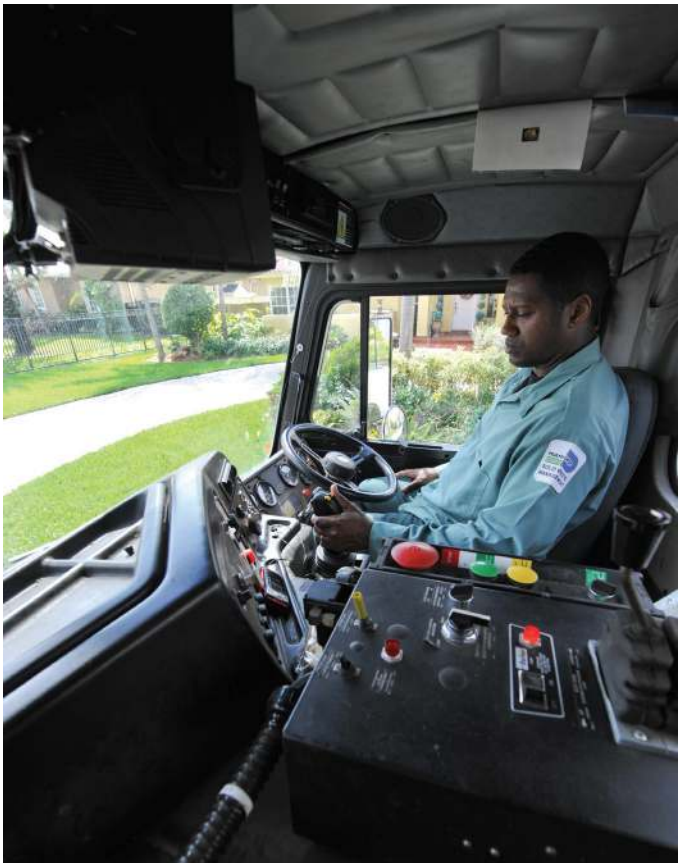
Ryan Holloway, Photographer, Miami-Dade County

Exhibit 1. Collection truck

hybrid hydraulic system captures nearly 70% of the vehicle's braking energy. This is an added advantage for refuse trucks, which need an additional boost of power during sudden starts and stops.

In 2010, a prototype of this new type of vehicle manufactured by a consortium of Parker Hannifin and Autocar, using the hydraulic hybrid technology known as RunWise, was provided to Miami-Dade County, Florida. The goal was to help the hybrid system manufacturer, Parker Hannifin, fine-tune its product before launching it into mass production. The perfect place to test it out was in Dade County, home to one of the largest municipal solid waste fleets in the United States (193 truck fleet servicing 340,000 homes per day). The single test truck was enough to convince the County's Fleet Manager to purchase additional hybrid vehicles over the next four years for a total of 64 as of this writing. Based on this experience, dozens of cities around the United States (e.g., Orlando, Florida; Chicago, Illinois; Austin, Texas; and Tacoma, Washington) have also purchased these hybrid refuse vehicles in recent years, a few with grant funds available under the National Diesel Funding Assistance Program.

So far, these solid waste agencies report savings of about 33% over a traditional diesel powered solid waste collection vehicle. This amounts to average annual fuel savings of about $8,000 to $10,000 per year per vehicle. The hybrid vehicles are reported to cost in the range of $350,000 to $400,000, which is about 25% more expensive than traditional solid waste collection models. Fleet managers report that the hybrid vehicles require less maintenance. For example, brake pads seem to last longer because the brakes typically do not come in contact with the brake drums until the truck slows to about two miles per hour. Normally, brakes for diesel refuse trucks are replaced by most fleet operations every four to five months, but the brakes on hybrid vehicles may need to be changed every six years. Further, vehicle truck tires appear to last longer as well due to reduced friction heat on the wheels. Lastly, an added benefit in fuel reduction and reduced maintenance is that it improves air quality and supports many community climate action plans goals to reduce greenhouse gas emissions.



Ryan Holloway, Photographer, Miami-Dade County

Exhibit 2. Collection truck driver

Another exciting hybrid technology for refuse collection application has been developed by Oshkosh, named the ProPlus Hybrid Electric Drive. Instead of having a mechanical drive train, it utilizes a diesel engine that powers an electric generator, which in turn powers electric motors that run the vehicle's wheels. This design effectively eliminates the need for a transmission, torque converter, transfer case, and drive shaft. Lastly, the design does not utilize batteries to store electricity, but instead uses ultra capacitors. Recent results published by Oshkosh suggest fuel savings of 40% over conventional diesel refuse trucks.

Following a trial of a single hybrid-electric solid waste collection truck manufactured by a consortium of Volvo, Mack, and Bosch, the New York City Department of Sanitation has taken delivery of five more. These trucks have 325-horsepower Mack MP7 diesel engines used for its TerraPro, low entry vehicles with a 630-volt, liquid-cooled lithium ion battery for energy storage. These pilot vehicles are reported to show fuel efficiency by about 30% as compared with vehicles powered solely by a diesel engine. As of this writing no additional operating data and results are available.

ENHANCED ELECTRONICS

The use of enhanced electronics is another emerging trend for solid waste collection. In recent years, many agencies have installed cameras on the outside of the residential collection vehicles to help improve safety. DVD recorders have also been installed to track backup and potential safety events. This equipment provides a second, third, or fourth pair of eyes for drivers (Exhibit 2) and has

proven beneficial in improving safety.

The use of advanced onboard electronics is also another hot trend in solid waste collection as a means to go "paperless." The goal of every hauler is to pick up 100% of the trash 100% of the time. If haulers miss this goal regularly, they are usually beset with runbacks and customer complaints, adversely affecting efficiency and eroding morale. To guard against this, haulers have relied on their routing/billing software to manage route sequencing and optimization, as well as the customer service representative to manage any issues that arise while the route is being run.

This is a "point-of-sale" model that depends on the driver manually relaying route information to the office. With no eyes or ears in the field to corroborate the driver's account of what is taking place, the office has no choice but to rely solely on what they are being told or what drivers write down on their route sheets.

Adding on-board technology dramatically changes that paradigm. It introduces a new and powerful element to the workflow which is termed "point of service." In this scenario, the on-board technology sends objective, detailed information to the office on exactly what is taking place in the field, from pickups to vehicle metrics. This improves the awareness of the organization with regard to route activity.

Equally as important, the driver is now fully empowered to manage what is taking place on his route. Involving him in the workflow and acknowledging his critical role in customer service is a win-win for both the drivers and the supervisory staff. Initial reactions from some drivers may be muted as they perceive technology as "big brother on board." However, recent experience with agencies adapting this kind of advanced electronics has shown that if the system is easy to use, the time-savings and convenience it offers quickly overcomes these objections and drivers soon embrace the system as much easier to use than a route sheet.

REFERENCES

"A Quiet Revolution in Garbage Trucks", *Governing*, July 2014.
"Hybrid Garbage Trucks Saving Miami-Dade Big Money", *Government Technology*, April 2011.
Hybrid Technology Cuts Collection Costs", *American City and County*, June 2012.

THE AUTHORS

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

Senior Vice President ***Robert Gardner****, P.E., BCEE, 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* **rgardner@scsengineers.com**.

What are YOUR Career Highlights?

I Am SWANA *Training@HQ*

SWANA'S TRAINING@HQ PRESENTS… MOLO CERTIFICATION BOOT CAMP

SWANA is offering you a unique experience to optimize your time, energy, and money by attending our intense, four-day Manager of Landfill Operations (MOLO) Certification Boot Camp.

When you register for our inaugural MOLO Certification Boot Camp, you'll get a national SWANA conference experience, in a small group setting in the Washington DC area!

WHY MOLO BOOT CAMP?

- Experience a hands-on, interactive training program with senior faculty and industry subject matter experts.
- Learn best practices in daily operations, employee safety, and cost control.
- Learn how to minimize time consuming trial and error and reduce costly mistakes on the job.
- Network with other solid waste professionals and SWANA staff.
- Advance your career in solid waste management with a recognized credential from SWANA.

MOLO CERTIFICATION BOOT CAMP INCLUDES:

- Three-day certification training course
- Certification Exam
- Landfill Facility Tour
- Networking Event

This event is a unique opportunity to meet, share, learn, and grow. Don't miss out.

Advanced pricing for the inaugural event ends on May 31, 2015. Register at ***www.SWANA.org/training***.

Looking for an Industry Job? Hiring a Solid Waste Professional?

SWANA CAREER CENTER

Whether you're looking for a new employee, or ready to take the next step in your career, we'll help you find the opportunity that's right for you. SWANA Career Center is the premier electronic recruitment resource for the industry.

Employers and recruiters post jobs for the most qualified talent pool with relevant work experience to fulfill staffing needs. Job seekers can post resumes and search jobs, free of charge. ***careers.swana.org***.