How RFID is Helping Companies Reduce their Carbon Footprints

From retail to waste management to forestry, many industries are coming to realize that RFID is a green technology.

The green economy doesn't begin with solar panels and wind turbines and electric vehicles. In fact, when it comes to reducing negative environmental impacts, the best first step is to put energy efficiency measures into place. In other words, we don't need to reinvent the wheel, we just need to use it better.

While RFID tags are often referred to off-handedly as "bar codes on steroids," they are actually much more powerful tools, with a much wider range of applications than bar codes. In this paper, we'll take a look at the many ways in which RFID technology is proving an effective tool in reducing the negative impacts that business and industry make on the environment.

Supply Chain Management

While it wasn't the first large corporation to promote the role that energy efficiency plays in building more sustainable businesses, Walmart was the first to tie its sustainability program with its RFID program. As Walmart chief information officer, Rollin Ford, told attendees of the RFID Journal LIVE! conference in 2007: "Using RFID to locate errors, get to root causes and achieve accurate forecasts leads to efficiency, which leads to sustainability."

From the point of manufacture all the way to the point of sale, supply chain partners are using RFID to boost efficiencies. Manufacturing is an energy-intensive process, whether the product being produced is a vehicle or a picture frame, so anything that can reduce errors and waste in the production process will reduce energy consumption.

By attaching RFID tags to totes used to store and transport parts or sub-assemblies, manufacturers can keep tabs on the parts as they move through their facilities and into the production process. RFID tags attached to tools used in the production process can help a company ensure that these tools are where they need to be, when they need to be, so that it can stay on top of production goals.

Once products are in transport, the technology again plays an important role. Around a third of the United States' total energy consumption is tied to the transportation sector, according to the U.S. Department of Transportation's Bureau of Transportation Statistics, and supply chain activities account for a significant percentage of that total. Taking a wider look, the environmental impact of the supply chain is a worldwide problem—as well as a worldwide opportunity for improved efficiencies, which will not only reduce emissions but also lower costs and improve customer satisfaction.

A Port of Call

While much has been made about the ways in which RFID can reduce costs and improve product and asset tracking in the logistics industry, less focus has been placed on the ways in which RFID can reduce fuel consumption.

Many shipping companies have deployed RFID tags attached to cargo containers in order to track the arrival and movement of the containers in large ports, such as in Long Beach, Calif. But by extending the RFID reader infrastructure to cover the storage yards in these ports and using the tags to identify trucks entering and leaving the yard, logistics companies are able to quickly identify the trucks and their loads inside these yards. This reduces the amount of time the yard managers spend determining which trucks are entering and where to direct them to the yard. As a result, they significantly reduce the amount of time trucks spend idling, waiting for their directions and needlessly burning fuel.

And at the Department of Energy's Oak Ridge Reservation, RFID tags are used to identify trucks that move building materials and soil—contaminated with radioactive elements and other hazardous materials—from a deconstruction site to secure landfills. Passive EPC Gen 2 tags attached to the trucks are read at key points established along the route and at the landfill, where a scale is used to weigh the load.

Workers are able to use the data collected to determine where all trucks are at all times, as well as what types of materials they are carrying. As soon as a truck arrives at the landfill site, therefore, workers on the ground quickly route the truck to its destination. Because the drivers do not sit, with their engines idling, awaiting directions, the program has saved an estimated 891 gallons of diesel fuel.

Automated vehicle identification systems can lead to fuel savings in other applications, as well, such as in busy office or apartment buildings. Contact-based cards are commonly used, which provide employees or residents relatively quick access to secured gates into or out of parking structures. But switching to RFID-based access cards allows faster entrance or exit transactions, since drivers don't need to bother opening their windows and inserting cards into machines. The improved flow of traffic might not seem like it would be significant, in terms of gas savings, but cumulative savings can be very big—on the order of thousands of pounds of CO_2 emissions avoided each year, per facility.

Food Tracking, Reducing Waste

The United Nations Food and Agriculture Organization (FAO) released a report in June stating that roughly one-third of the food produced worldwide for human consumption is lost or wasted, amounting to some 1.3 billion tons per year.

Wasted food is a contributing factor in worldwide hunger but it's also an environmental issue. When food is grown and not used, not only is it wasted, but so are the water, fuel, fertilizers and other resources that go into growing, harvesting, cooking and transporting the product. Plus, while agriculture does sequester some carbon dioxide during the growing season, food items that end up in landfills produce methane as they break down during anaerobic digestion. And methane is a significantly more harmful greenhouse gas than carbon dioxide.

RFID is increasingly used to improve efficiencies across the entire food supply chain, from farm to fork, and this translates directly into less food waste.

Perhaps RFID's biggest impact on the food supply chain is through the use of temperature sensors with integrated RFID tags. These tags range widely in terms of their composition—some are fully battery-powered, others are passive RFID tags with integrated batteries that are used to power a temperature sensor. Costs and capabilities also vary, but the benefits to food producers and growers are clear: improved visibility into the conditions to which perishable products are exposed during transport.

Growers have for many years used temperature trackers to record the temperatures of pallets or cases of produce, for example, as it is transported. But lacking a radio frequency interface, the temperature must be downloaded manually once the shipment arrives at its destination. This is time-consuming, whereas RFID tags can be read quickly and easily—without having to remove the tags from the cases or pallets.

Plus, with some RFID systems, temperature data can be captured and transmitted over a cellular network while the cargo is in transit. This adds a key benefit: if the data shows that the temperature inside the truck is nearing dangerously high or low levels, the shipping company will see this in the real-time data and will be able to communicate this alert to the truck driver, who can then react quickly to remedy the problem.

Of course, shippers aren't attracted to this technology purely because it helps them avoid food waste. If a truckload of perishable food or medicine is allowed to fall outside of a safe temperature zone during transit, it can cost the shipper tens of thousands of dollars.

Boxed Out

Single-use cardboard containers are nearly ubiquitous in the supply chain—and also at the end of the supply chain, in dumpsters. While many are reclaimed and recycled, cardboard boxes still represent an environmental impact. The Environmental Protection Agency has found that paper and paperboard account for the largest single portion (34 percent, as of 2005) of the municipal

solid waste stream. Cardboard is also a recurring cost, but many forward-thinking companies have realized that switching to reusable totes instead of cardboard, for everything from shipping products to transporting parts throughout an assembly plant, can make both financial and environmental good sense.

Once they make the decision to deploy reusable boxes or totes instead of cardboard, companies can take the next step and embed RFID tags into the containers, in order to be able to track the goods they carry, as well as to track the containers themselves, thereby reducing waste and improving asset utilization.

Mission Foods, which manufacturers tortillas and chips, switched from cardboard boxes to reusable totes embedded with RFID tags to handle its products at just one its many U.S. warehouses. Doing so has saved the company nearly $700,000 since 2009, thanks to better visibility and less waste.

Plus, the company has avoided the use of 1 million boxes.

Lifecycle Management

Over the past century, modernizing society was synonymous with creating cheaper, more disposable consumer goods. But the environmental scars that electronic waste has inflicted on both the planet and developing nations drives home the need to design products with their full lifecycle in mind.

Also, the concept of producer responsibility, which says that manufacturers are ultimately responsible for collecting and responsibly recycling, reusing or (if no other options exist) disposing of their products after their useful lives, is taking hold in the U.S. and it has long been an industry standard in parts of Europe.

By integrating RFID technology into products—particularly electronic products—manufacturers can not only enjoy the improved product visibility the technology provides throughout the manufacturing and shipping processes, but they can extend the value of each embedded RFID tag by also using them in reverse supply chains.

Electronics companies can tie each product's embedded tag to its shipping, sales and warranty records and also use the tags to track the location of products returned for repair. Once the product reaches the end of its useful life, the manufacturer or third party can use the tag to determine how best to de-manufacture and recycle its components. This also solves a tricky disposal problem, since most electronics contain cadmium, beryllium and other toxic elements.

At the End of the Line

The waste management industry is using RFID to better manage assets, improve efficiencies and decrease, well, waste.

RFID isn't new to the waste management industry. In fact, it was first put to use in the mid 1990s. Its use grew slowly, and was fostered by the growth of automated collection trucks, which are

best suited for RFID tracking and dropping RFID hardware costs. As these trucks have become popular across the industry, so has RFID.

Tight municipal budgets mean waste management companies have been forced to do more, with less. From Mississippi to Portugal, RFID is being put to work in identifying, tracking and safely collecting and transporting material across the waste management industry.

Passive RFID tags are embedded into collection carts—generally EPC Gen 2 tags but sometimes passive low frequency 134 KHz tags are used—and RFID readers mounted on the trucks used to collect the garbage or recycling materials inside the carts are used to capture the tag ID numbers. Software running on mobile computers inside the trucks, can then associate the tag IDs with the household or business accounts to which they are assigned.

There are a number of environmental benefits from the use of RFID in the waste management industry. The technology has improved efficiencies by helping collection companies decrease the amount of time they spend driving through routes and in some cases it allows them to automate their billing systems, which reduces energy and paper use.

Various municipalities and organizations, such as Recyclebank, are looking for ways to improve recycling efforts. RFID has emerged as a low-cost, easy-to-implement means of tracking the rate at which participants recycle. By incorporating scales into collections trucks that capture of the weight of recycling carts, and associating this data with the RFID tag embedded in each cart, organizations can track the amount of material each household recycles, then reward each household (with, for example, coupons or other special offers) based on how much it recycles.

Other RFID Applications

Energy

RFID is serving an increasingly important role in the energy industry, through asset tracking and safety applications aimed at quickly and easily locating tools, for example, or ensuring that workers on offshore drilling platforms are accounted for at all times.

But the technology is now also being adopted in the renewable energy sector. India has made RFID-tracking of solar panel modules part of its National Solar Mission. The program's goal is to generate 20 gigawatts of solar power by the year 2022 (the country currently generates roughly 700 megawatts) and this will require up to ten million solar modules to be installed throughout the country. Per the mandate, an RFID tag is attached to each module at the point of manufacture. Written to the tag is not only its identification number, but also useful metrics regarding the module's optimal performance.

Over time, the modules need to be taken offline for regular maintenance or repair, and the tags are used to track them through the maintenance process. Additionally, energy companies can capture the module's expected performance metrics from the tags and then compare the

module's actual performance to these metrics, to determine whether it is producing as much energy as it should.

Forestry

While the developers of RFID technology likely never imagined it, tags are playing an increasingly important role in sustainable forestry practices. From the moment of harvesting, to the mill and to the final product manufacturing process, tags are being used to identify the wood and ensure that the tree was properly harvested.

And by linking a tree's characteristics (its hardness, for instance, or its moisture level) to its RFID tag, forestry companies can easily sort timber based on this data. They can then match the harvested timber to its most appropriate application.

Environmental Monitoring

As our climate continues to rapidly change, climate scientists and biologists need sophisticated tools that allow them to monitor temperature, humidity, water conditions and other factors. RFID plays an important role in these applications. By integrated them into wireless sensors, scientists create intelligent RFID tags that can be distributed across remote and inhospitable regions of the world.

Using a mesh network communication protocol, these sensors can send and receive sensor data across ad-hoc networks. Using cellular or satellite-based communication systems, scientists can collect this data quickly from anywhere on the globe and therefore become aware of environmental changes as they happen.

This type of data is no longer just interesting to scientists, however. Lawmakers and industrial groups also hold a stake in tracking the changing climate, since carbon costs and shifting resources across the globe will impact everything from trade routes to agricultural growing seasons.

In Summary

Does your firm have an environmental problem or opportunity that you think RFID could help address? NXP's RFID Applications and Support Center and our qualified embedded partners are ready to help you determine the optimal methods for deploying RFID solutions into your consumer products. NXP provides assistance from concept and design to compliance and production, insuring quick and trouble free implementations to maximize your ROI and time to market. Let us know how we can help.

Plus, NXP is a member of the European Supply Chain Institute (ESCI) and its Supply Chain Carbon Council, which is developing programs to help companies measure and reduce carbon emissions associated with their supply chains. NXP is a lead sponsor of a multi-year effort that promotes the use of wireless technologies, such as RFID and NFC, to accurately tracking emissions associated with the movement of products.

About NXP

NXP Semiconductors (Nasdaq: NXPI) is the leading global provider of RFID ICs. NXP creates semiconductors, system solutions and software that deliver better sensory experiences in RFID identification applications, eDocuments, mobile phones, TVs, set-top boxes, automobiles and a wide range of other electronic devices. A global semiconductor company with operations in more than 25 countries, NXP posted revenue of $4.4 billion in 2010. For additional information, please visit www.NXP.com or our RFID specific website at www.NXP-RFID.com.

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