International Post Corporation

July 2008

IPC Strategic Perspectives

print | next

Alternative Fuel Vehicles

"You must be the change you wish to see in the world."

Mahatma Gandhi

Several IPC members have stated their commitment to reducing CO_2 emissions by ten percent over the next four years. In order to do so, members have been looking at and testing alternative fuels and technologies such as electric or hybrid vehicles that produce little or no CO_2 emissions.

The call for reducing greenhouse gas emissions is not just a political movement, nor is it a trend or temporary movement. For future generations action must be taken by this generation.

As an industry that contributes heavily to airborne and other pollutants, we cannot ignore the scientific evidence that proves that devastation brought on by climate change – increasing temperatures, changing weather patterns, flooding and drought is directly related to the build-up of greenhouse gas emissions.

In addition to fuel and vehicle testing, many postal companies have been part of the development of sound environmental programmes that incorporate environmental sustainability and sensitivity together with social responsibility.

This paper will present an overview of what some of IPC's member are doing with regards to alternative fuel vehicles. Further, it will highlight the different technologies that are being currently tested in other industries for power generation while reducing CO_2 emissions.

Alternative Fuels

By definition, alternative or non-conventional fuels are materials or substances that can be used as a replacement for conventional fossil fuels such as diesel and petrol. Alternative fuels include electricity and hydrogen and agrofuels (biofuels) such as biodiesel and bioethanol.

This report will focus on the most current vehicles such as electric, hydrogen and compressed natural gas (CNG) because IPC members are testing and implementing these alternative fuel vehicles to add to their fleet.

Alternative Fuels
Electric

The first electric vehicle, a tricycle powered by lead batteries, made its debut in 1881. Since then, postal operators were quick to use electric vehicles for postal delivery; in 1899 the United States Postal Service started using an electric vehicle in New York. Other postal operators such as Groupe La Poste and Deutsche Post soon followed suit. However, it was Groupe La Poste that had the first electric vehicle fleet in 1904.

According to the United States Department of Energy office of Energy Efficiency and Renewable Energy, "Electric motors convert 75 percent of the chemical energy from the batteries to power the wheels—internal combustion engines (ICEs) only convert twenty percent of the energy stored in gasoline."

Although the power plant that produces the electricity to power and recharge the electric vehicle may produce pollutants, the vehicles themselves produce no tailpipe pollutants. Therefore, these are the most effective in urban areas.

The driving range of most battery-powered electric vehicles is only 150 miles (241km) before refuelling is necessary. At this time, fully recharging or "refuelling" electric vehicle can take four to eight hours.

"Plug in" vehicles that are charged using public electricity networks and have a minimum range of 20 kilometres between charges will inevitably use lithium batteries rather than lead batteries in order to store sufficient energy for this performance requirement. However, participants at the 2008 International Advanced Mobility Forum which included representatives from the Massachusetts Institute of Technology, the International Energy Agency, Paul Schaerer Institute and various members of the automotive industry; agreed that lithium batteries do not meet the current market demand. This may be due to the fact that the high cost of lithium batteries and the recharging system can produce excessive heat which is hard to control.

According to the US-based Electric Drive Transportation Association "what plug-in electric vehicles all have in common is the ability to use electricity from the grid to displace the petroleum used for transportation."

Finally, the batteries used in vehicles have an impact on the environment. U.S. based Environmental Defence Fund - an environmental advocacy organisation – conducted a study on the environmental impact of batteries used in alternative fuel vehicles. The results of the study indicate that lead batteries are the most harmful to the environment followed by nickel. Lithium batteries are the least harmful; however, their effect on the environment depends on the materials of which they are combined.

Case Study: Groupe La Poste

In France, the fleet strategy for Groupe La Poste integrates requirements of urban legislation for the reduction of pollutants and is based on using electric vehicles. The postal operator has already tested many electric vehicles such as cars, quads, three wheels and bikes.

Groupe La Poste plans to have 10,000 electric cars, 12,000 electric bikes, 3,000 electric quads and 4,000 electric three-wheelers as part of it vehicle fleet by 2012.

Global Electric Motorcars, LLC, (GEM) a DaimlerChrysler company, and MATRA Manufacturing and Services have partnered to market all GEM's light electric vehicles in France.

GEM has been manufacturing Neighbourhood Electric Vehicles (NEVs) for the past ten years. To date, the company has distributed over 35,000 electric vehicles worldwide.

Hydrogen

Hydrogen is an energy carrier that can be used to power nearly every end-use energy need. The fuel cell, an energy conversion device that can efficiently convert and use the power of hydrogen is the key element to making it happen.

Fuel cells directly convert the chemical energy in hydrogen to electricity and heat. Inside a fuel cell, hydrogen electrochemically combines with oxygen from the air to create electricity, with pure water and potentially useful heat as the only by-products.

Hydrogen and fuel cells are reaching a critical threshold - moving from research, development and demonstration to sales in various markets. The use of hydrogen and fuel cells as power solutions in material handling, back-up power, residential cogeneration and micro-power applications are key benchmarks for commercialization.

Hydrogen fuel cell powered vehicles produce no smog creating emissions, and no greenhouse gas emissions, and can be more than twice as efficient as internal combustion engines. Further, the perceived danger of exploding hydrogen tanks has been reduced through improved tank designs that reduce pressure and corrosion.

In the United States, the Department of Energy (DOE) is facilitating the creation and adoption of model building codes and equipment standards for hydrogen systems in commercial, residential, and transportation applications; and provide technical resources to harmonize the development of international standards.

Hydrogen polymer electrolyte membrane (also called proton exchange membrane or "PEM") fuel cells are leading candidates for use in fuel cell vehicles. Although it will be a while before fuel cell vehicles reach every dealer showroom, PEM fuel cells are commercially available today for some niche applications. One of these near-term markets is material handling equipment (forklifts, pallet trucks, etc.).

According to the U.S. Department of Energy, Energy Information Administration - in normal driving, the gasoline engine in a conventional car is less than twenty percent efficient in converting the chemical energy in gasoline into power that moves the vehicle. Hydrogen fuel cell vehicles, which use electric motors, are much more energy efficient and use up to sixty percent of the fuel's energy. This corresponds to more than a fifty percent reduction in fuel consumption, compared to a conventional vehicle with a gasoline internal combustion engine.

One kilogram of hydrogen contains approximately the same energy as one gallon (4.55ltr) of gasoline. To achieve a 300-mile (483 km) range in the full spectrum of light-duty vehicles, approximately 5 - 13 kilograms (kg) of hydrogen must be stored on-board. (This range depends primarily on vehicle weight and fuel economy).

Within a logistics setting, for material handling equipment, PEM fuels cells are seen as the way forward because of their distinct advantage over lead-acid batteries.

Lead-acid batteries are currently the established technology for materials handling equipment. Although perceived as a reliable technology, these batteries have, from a maintenance standpoint, offered a few challenges. Challenges include – limited range, time to recharge, need time to cool before reuse, and can be affected by voltage drops and power outages. For these reasons, the PEM fuel cells have a distinct technological and economic advantage. In the materials handling industry, the continuous running of forklift trucks can run two or three shits per day.

PEM fuel cells can be refueled rapidly thereby increasing efficiency of use and reducing the costs associated with downtime waiting for batteries to recharge. Further, in a warehouse environment, where space can be costly, PEM fuel cells have the advantage as unlike batteries; they do not require floor space for chargers, storage and changing areas

PEM fuel cells, like batteries, produce no harmful emissions at the point of use. However, unlike PEM fuel cells, which deliver a constant voltage-flow as long as the hydrogen fuel is supplied, the voltage supplied by batteries can drop after constant use.

Finally, although hydrogen fuel cells are currently being test amongst IPC members, it is a future solution for power generation.

Case Study – USPS

In 2004, the United States Postal Service began testing a General Motor's (GM) fuel cell vehicle for mail and packages in the state of Virginia and Washington D.C. area. As part of the contract with GM, the test continued on for an additional year.

The successful two-year test was conducted was conducted on GM's HydroGen3 a converted minivan which is based on the Zafira which is produced by GM's Opel division in Germany. The minivan's internal combustion engine; a hydrogen storage tank replaced the gasoline tank.

The test was considered successful as the vehicle had an extremely high reliability rate of 99 percent. It was out of commission for one half-day for servicing a minor component.

Both GM and USPS gain important insight into the future use of hydrogen fuel cell vehicles in the postal industry.

Compressed Natural Gas (CNG)

Compressed natural gas, or CNG, is natural gas under pressure which remains clear, odourless, and non-corrosive. Natural gas is a fossil fuel comprised of methane which is one of the cleanest burning alternative fuels.

Although CNG has been used in cars since the 1920s, use of it has been limited due to the need of converting engines, storage space and a limited re-fueling network. The most developed networks where CNG use is possible are South America, Germany, Egypt, and parts of South East Asia.

According to the International Gas Union (IGU) – a not-for-profit organisation based in Switzerland - In 1997, there were over seven million vehicles worldwide using natural gas. This resulted in the reduction of 15 million tonnes of CO2 emissions.

Further, the IGU states that "increased use of natural gas will have environmental benefits as reduced greenhouse gas emissions, reduced harmful vehicle emissions that cause local air pollution, and reduced noise. This has clearly already been demonstrated in a number of major cities around the world, including New Delhi in India where all public vehicles have been converted into CNG. It will also act as a pathway to use hydrogen as a transport fuel."

Compared with vehicles fueled by conventional diesel and gasoline, gaseous fuel vehicles can produce significantly lower amounts of harmful emissions such as nitrogen oxides, particulate matter, and toxic and carcinogenic pollutants.

In fact, the Natural Gas Technology Forum recognises the importance of vehicles powered by hydrogen fuel cells and believes that natural gas technology can facilitate the transition into hydrogen fuel cell technology.

This is because natural gas has the highest hydrogen-to-carbon ratio of any hydrocarbon, and is an efficient source of hydrogen. According to the Natural Gas Technology Forum "it is the number one source of commercial hydrogen used in the United States."

Due to the CNG infrastructure that support CNG fuel filling stations all over the country, Italy has the largest number of compressed natural gas vehicles (CNGV) in Europe. This network or filling stations and other support services is expected to grow due to the rising cost of petrol. In fact, Poste Italiane has a rather large CNGV fleet with approximately 1,400 in their fleet. Poste Italiane's decision to use CNG was not because they wanted to reduce CO2 emissions, rather the post wanted to reduce NOx and PM10.

In the Netherland's, TNT is interested in CNG vehicles due to their green credentials and the low price of the fuel. TNT also see the CNG as a transitional fuel which can be replaced by biogas which will tackle the remaining CO2 emissions. The CNG infrastructure in the Netherlands is developing at a rapid pace – currently there are eleven CNG filling stations. However, the number is expected to increase to 57 within a year's time.

Finally, the IGU, in a recent presentation, stated that the four challenges faced by the natural gas industry include – domestic demand versus export markets, national policies on investment, national policies on acreage, and environmental concerns.

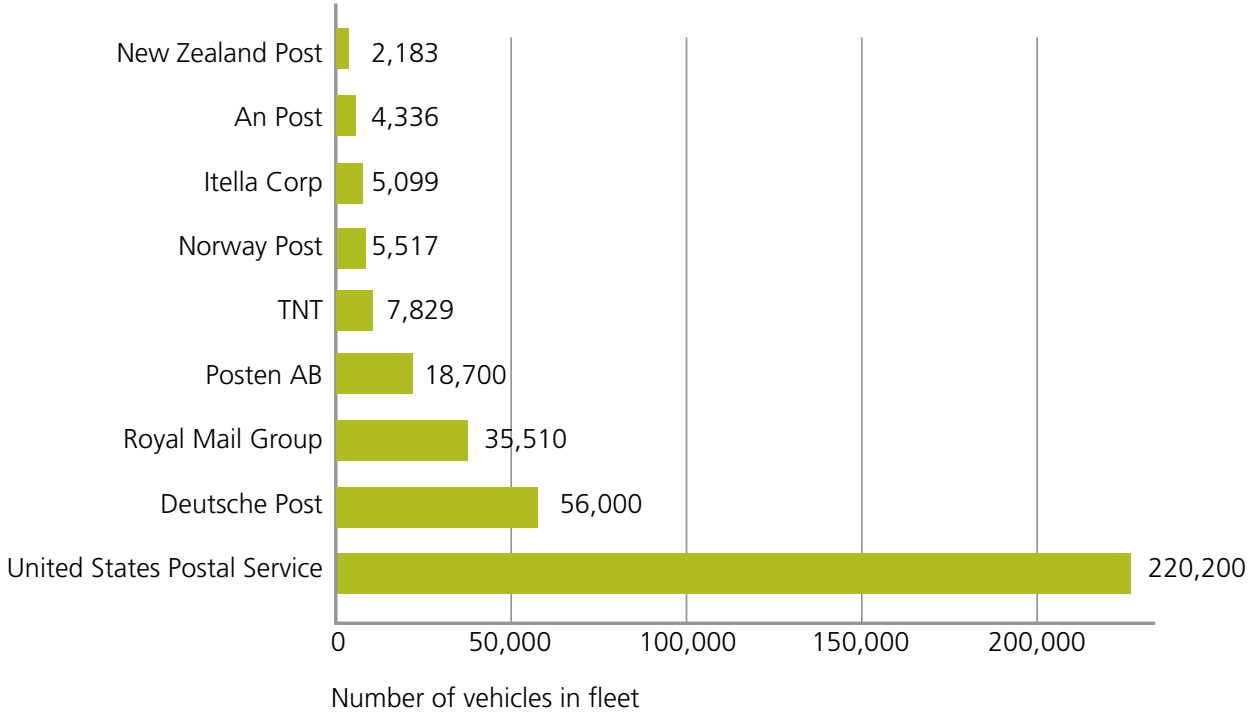
Case study – CTT Correios de Portugal

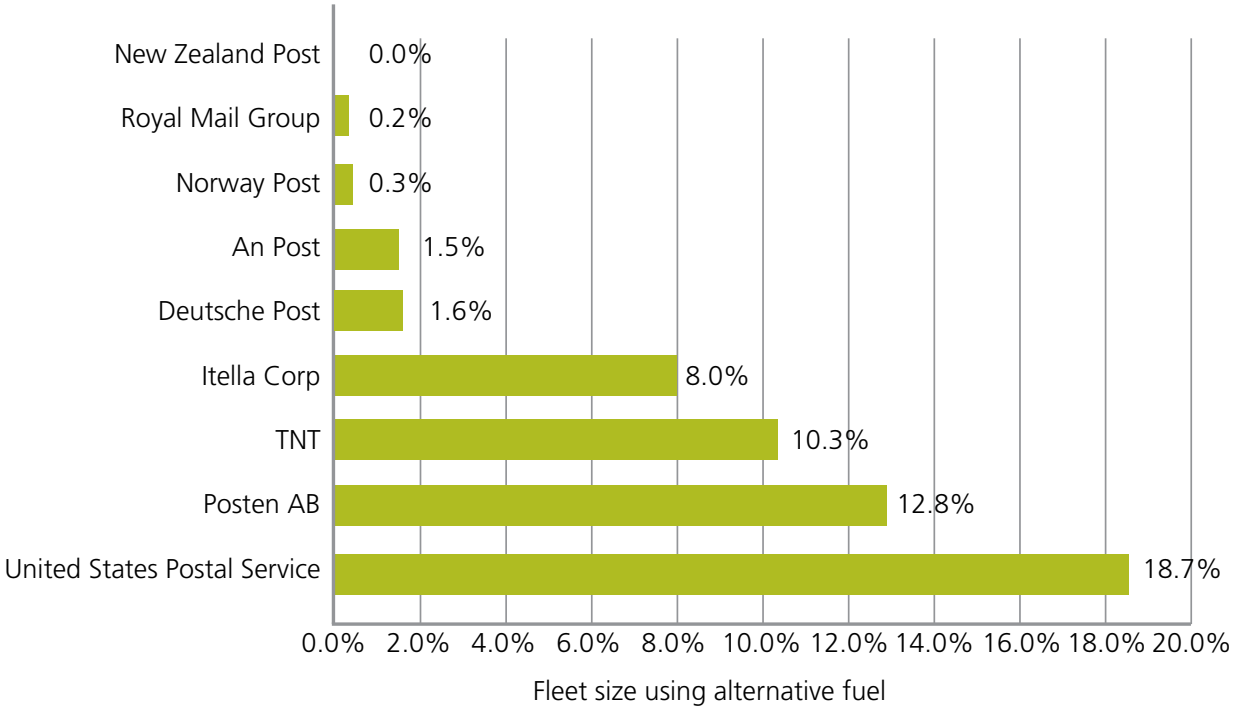
In 2004, CTT started testing CNG vans within their delivery network. Between 2004 and 2005 ten vehicles were tested. The results of the test proved that the vans were a commercially viable option for the post. However, logistically, refuelling the vehicles proved to be a problem as there is no network natural gas vehicles. In fact, at the time of this writing, there was only one public CNG fuelling station in Portugal.

IPC Research – Members' Opinions on Alternative Vehicles in the Postal Industry

In February 2008, IPC conducted a pilot survey amongst its members regarding their vehicle fleets and use of alternative fuels. Of twelve surveys sent out, nine posts responded.

The graphs below summarises the data from our members. Members were asked about the total size of the vehicle fleets and the percentage of alternative fuel used to support that fleet.





Other results indicated that overall, members are satisfied with their organisations commitment to reducing CO_2. However, members did indicate that, overall, they were not satisfied with the turnaround time from vehicle testing to implementation, nor were they satisfied with the commitment of manufacturers to produce low CO_2 emitting vehicles.

The results of this survey have given us insight into what IPC members need and are committed to regarding environmental sustainability within their vehicle fleets and reduction of CO_2.

Conclusion

IPC members have an estimated 850,000 vehicles in their fleets. However, it is estimated that only 2-5 percent of the annual volume of fuel consumption among IPC members is alternative fuel.

In order to increase the number of vehicles using alternative fuels, and thereby reduce CO2 emissions many of our members have commissioned pilots to find the best sources for making their vehicle fleets environmentally sensitive and economically sound. In fact, some IPC members have been testing alternative vehicles and fuels since the 1970s.

While electric vehicles are being used by some IPC members, alternative fuels such as hydrogen are also being tested for delivery to rural areas that are not easily assessable by electric vehicles due to distance and recharging issues.

IPC members have indicated that they are satisfied with their own organisation's commitment to reducing carbon emissions and desire to be part of an industry-wide initiative to communicate their vehicle requirements to suppliers and manufacturers of low carbon emitting vehicles.

IPC has, with its members, taken the first step in order to mitigate the industry's impact on the environment – the IPC Environmental Measurement and Monitoring System (EMMS).

EMMS provides the postal industry with a transparent, scientific, sector specific carbon measurement system. The system evaluates performance through the application of a scoring system that grades performance in ten carbon proficiency areas and in key numeric carbon efficiency indicators.

The data collected by the system will help IPC and its members to develop and postal industry standard and best practise.

Annex I – Alternative Fuels Vehicle Testing: current situation within the postal industry

IPC Member	Alternative Vehicles	Comments
An Post	1 electric car	Introducing a trial for 25 vehicles that use pure plant oil.
CTT Correios	4 electric van, 10 CNG	The post started testing alternative vehicles in 2001 and is investigating electric motor-cycles.
De Post/ La Poste	A few thousand electric bikes	The post is working on an Eco-driving scheme and would like to work with other postal operators to develop this plan.
Groupe La Poste	8 E-cars (lithium-ion), 10 E-quads, E-three wheels, E-bike, 50 electric scooters	In order to implement its electric fleet strategy, Groupe La Poste has already ordered 300 E-quads (which will be increased to 3000 by 2012), 500 E-cars (which will be increased to 10,000 by 2012), and 2,200 E-bike (which will increased to 12,000 by 2012).
		The post is currently testing 50 electric scooters.
		Groupe La Poste has partnered with SNCF to create subsidiary FretGV to use the TGV on long distance inland transportation in France.
Itella Corp.	72 electric vehicles	There is a move by Itella to purchase more diesel vehicles (the VW caddy 1.9 TDi). The company did test first generation biofuels after testing was completed, there were no plans to purchase any biofuel vehicles.
	10 electric scooters	
	400 electric bikes	
Japan Post		The post is considering hybrid vehicles for the future.
Poste Italiane	1,400 CNG vehicles, 1 3.5 tonne hybrid vehicle	Further expansion of the CNG fleet is planned. In 2009, the post is planning on testing more electric vehicles.
Royal Mail	4 electric, 1 hybrid, 2 SMITHS (small electric vehicles)	
TNT	8 trucks, 1 van	TNT is interested in CNG due to its green credentials an low cost. The post is currently test a DAF hybrid truck.
USPS	38 electric step vans, 44,000 CNG, ethanol, hybrid electric, and propane (combined total). 1,000 using biodiesel	Started using electric vehicles in 1975. The post is currently testing hybrid electric, propane, natural gas and hydrogen fuel cell vehicles.

ABOUT THIS PUBLICATION

IPC Strategic Perspectives **is an indepth look at issues relevant to the postal industry. It will be published monthly.**

IPC Strategic Perspectives **is sent out exclusively to IPC member posts. If you would like to contribute an article or photograph to this publication please contact us via email at publications@ipc.be or send your submissions to:**

IPC
Head of Communication
Avenue du Bourget, 44
1130, Brussels
Belgium