



WORLD LP GAS ASSOCIATION

GAIN

Global Autogas Industry Network

The potential of Autogas Hybrid Electric Vehicles

Hybrid electric vehicles are the latest commercial innovations in the search for cleaner, more efficient transportation. By combining an electric motor and internal combustion engine, hybrids offer the extended range and performance that consumers expect from a conventional vehicle, with a significant portion of the environmental benefits of an electric vehicle. Substituting autogas for petrol is a viable option with significant potential to better achieve clean air.

Hybrid electric vehicles

Today's hybrid electric vehicles (HEV) typically combine the internal combustion engine (ICE) of a conventional vehicle with the battery and electric motor of an electric vehicle. The combination offers low emissions similar to electric vehicles and the power, extended range, and convenient fuelling capability of conventional petrol and diesel vehicles.

There are many ways to combine the engine, motor/generator and battery. The two basic hybrid configurations are series or parallel. In a series hybrid, the ICE drives the generator and the generator can either charge the batteries or power an electric motor that drives the wheels. In a parallel hybrid, both the ICE and the electric motor connect to the transmission and can supply power to the wheels, switching back and forth as driving conditions vary. Hybrids also use regenerative braking - capturing kinetic energy lost during braking and returning it to the battery. In short, the HEV delivers significantly greater fuel economy and lower emissions largely because the ICE is used less often, consuming less fuel. Also, the engine in an HEV operates at a constant speed thus producing lower emissions while extending fuel economy. As a result, the first hybrids on the market will cut emissions of global-warming pollutants by up to a half. Hybrids can also reduce pollutant emissions by up to 90% compared to the cleanest conventionally fuelled vehicles on the road today. In terms of fuel efficiency current hybrids have also been able to improve mileage by up to 2 times that of a conventional vehicle.

Potential for autogas hybrids

Substituting a cleaner fuel to power the ICE has the potential to deliver radically greater emission reductions and further reduce dependency on conventional fuels. Currently however, petrol and diesel-powered ICEs are the most widely developed hybrid fuel systems for today's mass consumer markets. The disadvantage of such a hybrid vehicle is that it retains many of the drawbacks of conventional petrol or diesel vehicles i.e. pollution and noise.

Autogas benefit for the hybrid electric system

Autogas represents a viable but as yet underdeveloped fuel option to power the ICE component in hybrid vehicles.

- Hybrid-electric vehicles are only as clean as the source of fuel for the ICE. Autogas has already demonstrated superior emissions performance over petrol and diesel. According to authoritative scientific testing, autogas yields 50% less carbon monoxide, 40% less hydrocarbons, 35% less nitrogen oxides (NO_x) and 50% less ozone forming potential compared to petrol. Likewise, autogas can produce on average 20% less CO₂ compared to petrol when total emissions from well to wheel are taken into consideration. When tailpipe emission levels alone are tested, autogas produces up to 15% fewer CO₂ emissions. Similar results would be achieved in autogas-hybrid-electric vehicles, yielding ultra-clean emissions per mile.

- Based on its ongoing status as an environmentally-friendly transportation fuel, autogas often benefits from fuel excise tax exemptions that can make the final pump price far lower than that of petrol. In the hybrid format, the ICE consumes roughly up to one-half the fuel to travel the same distance as a conventional vehicle - which equates to major fuel cost savings for motorists operating an HEV on less expensive autogas.
- Autogas has a higher octane rating than petrol, so autogas engines tend to run more smoothly and efficiently, thus reducing wear and tear and prolonging the life of the engine.
- Standard autogas vehicles, while clean, deliver a limited driving range compared to conventional petrol vehicles. However, in the hybrid format less fuel is needed. Therefore, the autogas hybrid would have a significantly extended range for the same onboard fuel storage capacity - reducing concerns over range limitations.
- Compared with some other alternative fuel options for powering the ICE, autogas has a high energy density, therefore offering fewer compromises in fuel storage and fuel system weight.
- Autogas hybrid-electric vehicles can be an attractive option to many mass transit districts and vehicle fleets that already have invested in autogas fuelling infrastructure.

State of technology

Toyota introduced the first HEV Prius in Japan in 1997. Two years later, Honda sold the first HEV in the U.S. Since then, a number of other automobile companies have announced plans to introduce HEV models. The Toyota Prius has proved to be extremely popular, with worldwide sales reaching 100,000 by end 2002. In the U.S. it is projected that hybrid vehicles could achieve rapid penetration - about 10% of the light duty vehicle stock by 2017; and 24% by 2030 if current technical targets are met. In Europe, HEVs are estimated to achieve 3 % of the market by 2010 and as much as 10% by 2015.

In the context of greater consumer demand and increasing emission standards, automobile manufacturers are beginning to recognise the benefit of using autogas in hybrid vehicle systems. Recently Ford Motor Company developed a prototype autogas hybrid electric bus for airport shuttle and mass transit at airports. A generator driven by a Ford 4.2-litre LP Gas engine charges a pack of 28 lead-acid batteries with electricity to power the bus. The hybrid system captures energy normally wasted during idle, virtually eliminates particulate emissions, uses regenerative braking to capture energy during braking to charge the batteries and allows operation with the ICE off (zero emission mode) in the most environmentally sensitive areas.

In Eindhoven, The Netherlands, twelve LP Gas Hybrid buses are currently in operation. Known as “ Phileas ” these buses use an LP Gas ICE in a series arrangement together with a fly-wheel that ensures the LP Gas engine always operates at maximum efficiency while consuming 30% less fuel than an LP Gas fuelled bus of the same size.

Autogas hybrids are gaining momentum in the developing world including China, where the Guangzhou Suijing Bus Co., Ltd. has recently developed an autogas-powered hybrid electric vehicle with an exhaust index on par with European standards and with a price to performance ratio that is allowing it to do well in the Hong Kong and Japanese markets.

About GAIN

GAIN is a network of LP Gas industry leaders from around the world. Their mission is to communicate the value of autogas as a clean, safe and immediately available alternative automotive fuel. Please visit our website at www.worldlpgas.com/gain, or contact :

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