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#### 4. Field test

The first Volvo 7700 Hybrid city buses are servicing the streets of Gothenburg. Data from the one year test will provide information for upcoming serial production.



#### 8. Hybrid buses for Luxemburg

The Luxemburg bus company Sales-Lentz is the first to order the new Volvo 7700 Hybrid.



#### 10. Improved fuel consumption

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The new alcolock system from Volvo Buses has especially adapted features for city buses, like the possibility to start the engine before taking the breath test.



#### 16. Biogas is the future

The city of Berne has dedicated itself to biogas buses. Right now, 45 Volvo biogas buses are running the streets of the Swiss capital.

## Our hybrid buses keep their promises

During the spring we took a major step closer to next year's start of series production of our hybrid buses as our first field test buses began to carry passengers.

The reactions to date are highly positive. The drivers are satisfied with the performance, passengers appreciate how quietly and emission-free the buses depart the bus stops solely using the electric motor and fuel consumption is proving to be just as low as we have always asserted.

In our hybrid project, we have prioritized high operating reliability, maximum fuel reduction, combined with smooth drivability and comfort in city and intercity traffic. To be able to offer a competitive payback time for our customers, we have developed a common hybrid solution for the entire Volvo Group, with standard components as a base, which ensures high quality and economics of scale. Our hybrid buses feature solely Volvo components, which increases simplicity and security for our customers on the aftermarket.

We are living in times in which we must continue to invest heavily in reducing vehicular traffic's negative impact on the environment, while at the same time that the economic conditions for this are being impeded as a result of the financial crisis and recession. It is more important than ever that we vehicle manufacturers can offer our customers products and services that to the greatest extent possible contribute to improving the customers' productivity.

With our hybrid buses, fuel-efficient Euro V drivelines and our biogas buses, I contend that Volvo Buses has one of the market's strongest offerings with regard to environmentally sound products with favorable productivity.



Håkan Karlsson  
President & CEO  
Volvo Bus Corporation



# A debut for Volvo 7700 Hybrid

Almost without a sound, and without any exhaust fumes, the blue city bus starts off from the bus stop, slowly reaching cruising speed. Seamlessly, the diesel engine kicks in and powers the bus until the next bus stop. By now, the bus passengers of Gothenburg are used to the diesel engine going silent again, and the noiseless electric motor taking over.

The Volvo 7700 Hybrid is in operation – and it is a quiet debut that is making some noise.

Text Håkan Hellström  
Photo Johanna Asplund



The field test of the Volvo 7700 Hybrid city bus is currently running in the Swedish town of Gothenburg for one year. At the same time, the Volvo B5L Hybrid Double Decker is undergoing field-testing in central London.

This is the time when the result of every hour of research and development are being put to the test, by real streets, real drivers and real passengers.

"Of course, Volvo Buses have carried out thorough testing before the field tests began, but this year will provide us with essential information about the hybrid bus that could only be collected in 'real' situations," says Edward Jobson, environmental manager of Volvo Buses. "What we discover during the test period will be used in the continuous development, and production, of the hybrid bus."

In Gothenburg, the hybrid bus serves on several different bus lines, so that its performance is tested in a diverse range of road conditions and traffic situations.

Serial production of the Volvo 7700 Hybrid will start in the beginning of 2010.

#### Technical leap

"Three years ago, we basically started from scratch to develop hybrid technology that would meet very tough standards, including lower fuel consumption, lower emissions and less noise. Volvo Buses has realized a hybrid solution that not only fulfils our own goals but also meets both customer and regulatory demands. I'm very pleased that we are just one step away from serial production of the Volvo

7700 Hybrid," says Håkan Karlsson, President and CEO of Volvo Buses.

"The hybrid bus is a technical leap that we have been waiting for," says Lena Malm, chairwoman of the bus operator Göteborgs Spårvägar. "It suits our vision of more environmentally friendly transports, and it matches our tram and other bus services very well."

The Volvo 7700 Hybrid is easily incorporated into fleets that are already using diesel buses.

#### Easy to drive

Ahead of the field test, twelve drivers from Göteborgs Spårvägar went through a short training programme.

"Any driver who is used to driving Volvo buses will not have any problem driving the hybrid bus," says Jaime Faundes. "There really is not much difference."

"You just have to think a little when it comes to braking, but after a while it comes naturally," says Richard Säterborn.

As the brakes are applied on the hybrid bus, the retardation energy is transmitted to charge the batteries – up to a certain point. After that point, the energy no longer charges the batteries, being transformed into energy losses like heat and friction.

"You soon learn to apply the brakes more softly," says Richard.

"The other thing you have to get accustomed to is that it is entirely silent at the bus stop when the diesel engine switches itself off. That's an amazing sensation. I sit more proudly when driving this bus because I know I'm helping the environment."

## WHAT DO THE PASSENGERS THINK ABOUT THE HYBRID BUS?

"In all, the hybrid bus doesn't seem much different than any regular bus when you ride it, but I think that the hybrid technology is very interesting. If you look at some specific details, the smooth start reminds me of the old trolleybuses that used to run in Gothenburg. I think the transition between the electric motor and the diesel engine is phenomenally smooth. The bus also has a good layout, I imagine it's very easy to clean."

Sven Löv, Gothenburg



"As a former worker at Volvo, I'm happy that the company keeps presenting new products. I'm retired now, so I travel often by bus. It's a very efficient way to travel and a more environmentally friendly solution is a positive thing. Hybrid technology is a great concept. The start off from the bus stop with the electric motor is very smooth."

Ingvar Sjöholm, Gothenburg



"Since we don't have a car of our own, we use public transport a lot. There's not much difference between the hybrid and the diesel buses. The only thing that's really noticeable is when the diesel engine switches off and only the electric motor is running, as the hybrid bus is much quieter than the diesel bus."

Jeanette and Kenth Mathiasson, Gothenburg

# The Volvo hybrid buses can reduce fuel consumption by up to 30 per cent

Last year, Volvo Buses launched its hybrid city buses, the Volvo 7700 Hybrid and Volvo B5L Hybrid Double Decker. The buses reduce fuel consumption and greenhouse gas emissions by up to 30 per cent compared to conventional diesel buses.

Text Håkan Hellström  
Photo Volvo Buses

A hybrid bus utilizes two power sources: the Volvo hybrid features a smaller than normal diesel engine and an electric motor, both of which are operated in their most efficient ranges. For example, when the vehicle starts from bus stops, it is the electric motor that accelerates the bus to a speed of 15-20 km/h. When the bus is underway, the parallel hybrid system combines diesel and electric power to maintain speed. At higher speeds, the bus uses diesel power alone. Regenerative braking energy charges the battery via the generator. Several of the Volvo hybrid auxiliary systems are powered by independent electric motors, including air conditioning, air compressor and power



steering pump. These measures all contribute to high fuel-savings on routes with frequent braking and accelerations, like city bus traffic.

Fuel consumption improvement is realised both in city stop-and-go traffic but also when the route goes to the suburbs. A hybrid bus can also give lower operating costs due to reduced stress and maintenance on components such as brake linings.

All these savings help provide a shorter payback time for the Volvo

7700 Hybrid, where the break-even point is estimated at around 5-7 years, depending on current and future oil costs.

## Lowering exhaust emissions

A hybrid powered city bus produces lower exhaust emissions and operates more quietly than the diesel equivalent. The Volvo hybrid buses can reduce CO<sub>2</sub> emissions by up to 30 percent, while the Euro V engine with SCR (selective catalytic reduction) in the hybrid configuration reduces nitrogen oxide and particulate emissions by up to 40-50 percent.

At idling speed when the bus is powered by the electric motor the bus produces no exhaust gases at all. In a bus garage, this results in a big improvement in working conditions.

The parallel hybrid system means that the lithium-ion battery of the Volvo hybrid can be smaller than in other hybrid concepts, thereby reducing the weight. The smaller 4 cylinder, 5 litre, engine also helps with weight distribution. The Volvo 7700 Hybrid has room for up to 7 more passengers than the conventional Volvo 7700.

Diesel hybrids are easily incorporated into fleets that are already using diesel buses. Maintenance is as straightforward on the hybrid as on any other diesel bus, allowing for some additional training for maintenance personnel.

## Specifications Volvo 7700 Hybrid

**Length:** 12.0 m

**Height:** 3.4 m

**Width:** 2.55 m

**Wheelbase:** 5.95 m

**Gross vehicle weight:** 18,000 kg

**Suspension:** Air suspension, electronic control with kneeling

**Brakes:** EBS electronically controlled disc brakes

**Maximum number of passengers:** 95

**Hybrid system:** Parallel hybrid Volvo I-SAM

**Diesel engine:** Volvo D5, 5 litre 4 cylinder to Euro V with EEV emissions level

**Power output/Torque:** 210 hp, 800 Nm

**Electric motor:** Power output/Torque: 160 hp, 800 Nm

**Transmission:** I-Shift automatic gearshifting system





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# Volvo hybrid buses for Luxembourg



With a long-standing interest in sustainability, the Luxembourg bus company Sales-Lentz was the first private bus company to order the new Volvo 7700 Hybrid. The first one will be delivered later this year.

Text Koen Mortelmans  
Photo Sales-Lentz

In the early years after World War II, Jos Lentz, grandfather of the current directors Marc and Jos Sales, transported people to sport events during the weekends, with a truck where he had installed some benches. This modest start resulted in what now is the largest private bus company in Luxembourg, with more than 480 employees and a fleet of 330 comfortable vehicles. Sales-Lentz runs city and rural lines in the Grand Duchy and surroundings, long distance tourism and business tours, a long distance shuttle line to an airport near

Frankfurt and is also a tour operator with 21 travel agencies.

### Key issue of sustainability

Sustainability is a key issue at Sales-Lentz. Most of the roofs of the company's buildings are almost completely covered with solar panels for the production of electricity. Whenever possible, parts are collected and recycled. Sales-Lentz also is accurately measuring the engine performance and fine-tuning gearbox settings, to obtain the lowest energy consumption possible. It is also sending its drivers

on courses in eco-driving and in work safety. A new operating site, to be built in the north of the country in the near future, will also collect rainwater and recover and purify wastewater.

"The ecological aspect is only one factor," explains Jos Sales. "The economical aspect is also important. And a lower fuel consumption results in lower costs. But more generally, we want to profile ourselves not just as a supplier or a customer, but also as a responsible partner. In our philosophy, we don't buy new buses when we see a good price opportunity, but we try to

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Photo: Koen Mortelmans

Jos and Mark Sales of Sales-Lentz, the first customers of the Volvo 7700 Hybrid.

build long term, flexible partnerships. We are constantly measuring the performance of our buses. The numbers we obtain are important for our future choices. We don't take these decisions based on the results of a few months, but on long-term numbers. Of course the price still is important, but it's not the only important factor."

**Much lower fuel consumption**

"Our goal is to use hybrid buses for regular city services in and around the city of Luxemburg. We think this is the most appropriate way of using a

hybrid bus, as a city line has a lot of stop and go," says Marc Sales.

"The price of a hybrid bus is much higher than a classic type, but its fuel consumption is much lower, because the electric and the diesel engines are each are used or combined at the proper moments and the braking energy charges the battery. Economically this will be neutral, unless fuel prices rise spectacularly. But we consider it as our duty to do the right ecological things," he says.

"The Luxemburg authorities have asked bus operators to make such efforts; we are the first private company to do it. We made a choice for Volvo, because this producer could guarantee us better fuel reduction numbers than other bidders. Recently, we saw a fuel reduction of about 3 l/100 km with the classic Volvo 7700. For the Volvo 7700 Hybrid buses we expect a much larger saving."

**Evaluate in different environments**

At first, the hybrid bus will not only be seen in the capital city of Luxemburg.

"We'll try her out on different lines. So we can measure and evaluate its performance in services with few or many stops, in flat and hilly environments. At the same time, we can generate some publicity with our new approach across the whole country," declare the two business partners.

Over the years, Sales-Lentz had taken over several existing Luxemburg coach companies, so its fleet was quite diverse.

"Only in 2004 did we become a Volvo customer. The first Volvo buses we bought were B7L open top-vehicles for tourist work in Luxemburg city. The number of days of inactivity for each bus is important in our statistics. Volvo performed very well in this respect. We also are very pleased with the after sales service. Furthermore, the Luxemburg representative of Volvo supports our partnership philosophy. This and the good results with the tour buses motivated us to see Volvo as a choice for lines service buses as well."

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# Euro IV improves fuel consumption for Hessische Landesbahn

A fleet of Volvo buses with the Euro IV engine has improved diesel fuel consumption for Hessische Landesbahn (HLB) considerably. The German bus company is hoping that Euro V engines will do even better in the long term.

Text Koen Mortelmans  
Photo HLB

HLB is wholly-owned by the federal state of Hessen. It takes care of public transport in Hessen and parts of Bavaria and Thüringen, in the central part of Germany. It is working with a few trams, nearly 100 trains and almost 200 buses. About 50 of them are Volvo 7700 and Volvo 8700 LE. In 2008, the HLB-buses covered about 9.2 million kilometers in total.

## Important issue

HLB spokeswoman Christina Schlöter and Thomas Baumgartl, staff member of the HLB Technical Division, explains the different aspects of reducing fuel consumption.

“Limiting fuel consumption is a very important issue for us, with the purpose of reducing costs in general, but also because of environmentally friendliness. When we are buying new

buses, we use a matrix, where every requirement gets a certain number of points. The prime cost is the main parameter. Over the years, the parameter values don't change much or often, but fuel consumption has increased in importance. We don't buy new buses one by one; the acquisitions are always for a number of buses of the same type, for a specific line or a specific bus service.”

The matrix also includes technical guidelines, running costs, date of delivery, compatibility with existing buses, after sales service and resale value as well.

“In general Volvo fulfils the requirements of the tenders. From the new models we expect fuel savings, lower costs and of course environmental friendliness. We are measuring performance, both with the on board diagnostics and by comparing the fuel

taken on at fuel stations with the number of driven kilometres.”

## Satisfactory results

“We organize public transport by bus from three different headquarters in Hessen and maintain city bus line services in small towns and in the countryside. With our buses we drive as well to Frankfurt-Höchst, a suburban part of Frankfurt am Main. Most of our bus routes are rural. Some lines start or end in an urbanized area, while most of the route is overland. The type of bus, especially the engine and gear box, varies according to the kind of line it is serving.”

The results for fuel consumption of the Volvo buses are satisfactory. HLB started using Volvo buses in 2006.

“The use of the Euro IV-engine resulted in an important decrease of fuel use. Until now, we have not seen



## Volvo Buses receives award in India

Volvo Buses has received the Automotive Technology of the Year award in India for the Volvo 9400 6x2 coach model, the first three-axle coach in India.

Considered the most prestigious of all the local automotive industry awards, the NET Car & Bike Awards have grown in significance and in recognition since inception in 2006.

Volvo Buses received the technology prize for the Volvo 9400 6x2, a new coach launched in October 2008. It is the first 3-axle coach to be introduced in India and it has taken the market for luxury, air-conditioned long-distance coaches in India another step forward.

Volvo Buses has received orders totalling 260 buses from customers in India: notably, the city of Bangalore will purchase 140 Volvo 8400 city buses.

The other orders, totalling 120 Volvo 9400 inter-city coaches, are from the State of Karnataka, where Bangalore is the capital, and from the State of Maharashtra, capital Mumbai. These are repeat orders from satisfied customers already operating Volvo coaches.



## Volvo buses introduced in USA and Canada

Volvo Buses is now taking a further stride into its global expansion through the launch of the Volvo 9700 in USA and Canada. For the first time in more than 20 years, buses with the Volvo brand are being sold there.

The Volvo brand is well-known in USA and Canada as a result of Volvo cars and trucks. However, Volvo buses have not been sold in this market for many years. Volvo Bus is present there through its Canadian subsidiaries, coaches under the Prevost brand and transit buses under the Nova Bus brand.

The Volvo 9700 for USA and Canada is manufactured in Volvo Buses' plant in Mexico. The engine is completely assembled in Volvo's plant in Hagerstown, Maryland, USA.

The Volvo 9700 will be sold through Prevost. Prevost will also handle the entire aftermarket through the company's extended network of certified service centres and spare parts inventories.



*"it is good to aim at new, higher targets to save both on fuel and on raw materials"*

Baumgartl and Schloter, HLB

that the Euro V is giving a further reduction, but our Volvo-representative assured us that the numbers will be better once the engines have done more kilometres."

The European authorities introduced the Euro IV and -V standards to minimise the emissions of particulate matter and nitrogen oxides. To meet this, Volvo adopted Selective Catalytic Reduction (SCR). This system also results in higher efficiency and a lower

use of fuel. The majority of Volvo-buses used by HLB already meet not only the Euro IV, but also the more recent Euro V standards, because Volvo was early to put Euro V engines in most of its buses.

### I-shift for rural lines

The use of the I-shift gearbox also gave good results.

"We use the Volvo 8700 LE with this gearbox on our rural routes. This

technology also results in a lower consumption of diesel. For our city lines, we are using buses with automatic gearshifts. In those areas, this is more comfortable for our passengers." Apart from the engines, the behaviour of the drivers also plays an important role in the use of energy in service.

"Through holding general workshops, we can train our drivers to consider economical attitudes in their driving style."

Christina Schloter and Thomas Baumgartl from Hessische Landesbahn states that the Euro-engines do reach the ecological targets.

"But it is good to aim at new, higher targets to save both on fuel and on raw materials."



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Alcolocks are automatic control systems that prevent driving with excess alcohol, by requiring a breath test by the driver. This solution is becoming more and more common among bus operators, and in the Swedish county of Östergötland all city buses have alcolocks.

Text Håkan Hellström  
Photo Anders Nilsson



## Alcolocks increase traffic safety and improve public image

Since the summer of 2006, all buses and trams run by the operator Veolia for ÖstgötaTrafiken have been equipped with alcolocks. ÖstgötaTrafiken is owned by the municipalities and county council of Östergötland and is responsible for public transport within the county.

“The main reason for the introduction of alcolocks was a specific incident, when one of our tram drivers failed a breath test after an unrelated accident,” says Mats Eriksson, bus safety manager at Veolia. “Alcolocks are now an important part of our safety policy.”

“The alcolock system makes sure that every driver performs a breath test before they can drive a vehicle. All drivers have their key to start the system, which secures the identity of every person. All events are logged.”

The alcolock devices are calibrated and the test results are screened twice a year.

“ÖstgötaTrafiken is naturally interested in the results, since they are important for evaluating our overall performance as an operator” says Mats Eriksson. “Hundreds of thousands of tests have been performed by our drivers since the introduction of the alcolocks. Only on one occasion has a driver failed a test while on the job.”

### Concerns have disappeared

Initially, drivers had concerns about integrity and taking the breath test in front of the passengers. But since then, the worries have long gone.

“They are now viewed as an entirely positive thing,” says Mats Eriksson. “It has become part of the daily routine.”

Fredrik Sällberg has been a bus driver for 18 years in Linköping, and has been driving Volvo buses for the last decade.

“Sure, there was some apprehension about integrity among the drivers in the

beginning, but not anymore. Personally, I have not had any problems. There were actually much more discussions when a new ticket system was introduced,” he says. “Starting a work shift by taking the breath test doesn’t take much longer than it did before.”

Every breath test should last for at least five seconds, so that the air in the lungs, and not just in the mouth, is analyzed. If a driver fails the test, one minute has to pass before he or she can perform the test again.

“The introduction of alcolocks have been a very positive experience, with positive feedback from both drivers and passengers,” says Mats Eriksson. “It has definitely improved our image with the public.”

### DID YOU KNOW THAT THE CITY BUSES ARE EQUIPPED WITH ALCOLOCKS?

“Yes, there are stickers in the bus that tell us about the alcolocks, but I have actually never seen a driver taking a breath test. I haven’t really thought about it, but I guess overall it’s a good thing to have alcolocks.”

Andrea Birgersson



“I know that all public transport within ÖstgötaTrafiken have alcolocks, and I have also seen drivers taking the test when they start a new work shift. Alcolocks are practically a matter of course today, especially for bus services.”

Peter Eriksson



“I have both heard and read about the alcolocks, and it seems like a very reasonable thing to have. Driving a bus is a big responsibility, and you should not be able to risk other people’s lives, so it’s an important feature.”

Barbro Khan



# Highly adaptable alcolock system for city buses

The new alcolock system from Volvo Buses incorporates a number of unique features, especially adapted for city buses. One of the main features is the possibility to start the engine before taking the breath test; however driving the bus is still impossible as the brakes will block the bus.

“This will improve management as well as handling of alcolocks in city bus traffic, while maintaining a high level of security,” says Jan-Olov Åkersten, safety manager at Volvo Buses.

Text Håkan Hellström  
Photo Volvo Buses



In 2007, Volvo unveiled its alcolock solution for heavy vehicles. The unit prevents a driver from starting the engine when he is under the influence of alcohol, and can be factory-fitted or retrofitted.

“This was a ignition interlock device, which means that before the engine can be started, the driver first has to exhale into the device and the breath-alcohol concentration can be analyzed,” says Jan-Olov Åkersten. “This is a perfect solution for truck or coach operators, but if you have a big fleet of city buses, it’s a different thing. This is why Volvo Buses developed a alcolock system of our own.”

## Saving time

City bus line schedules often mean that drivers begin or finish their working day at a bus stop, instead of at the bus depot. To keep the schedule, it is necessary to make the driver exchange as quick as possible.

“With the previous alcolock system, the driver who were finishing his or her shift, had to shut down the engine for 15 minutes to reset the alcolock system,” says Jan-Olov Åkersten. “The new driver then logged on, took the breath test and, after a negative result, was able to start the engine. With the new Volvo alcolock solution, there is no need to turn off the engine, as the brakes instead blocks the bus, saving valuable time.”

Now, the first driver resets the system with a button, but keeps the engine running. When the bus comes to a complete stop, the brakes is

activated. The second driver does the breath test and is then able to continue the journey.

“Another big advantage concerns operators with large bus fleets,” says Jan-Olov Åkersten. “Preparing and warming up a bus fleet in the depot in the morning can be a one man job. So, to first having to heat up the alcolock and perform 30 breath tests to be able to start 30 buses will take a considerable time. But now, there is no need for the breath test until the driver comes for the bus.”

## Dashboard display

The Volvo Bus alcolock solution contains a handheld unit and the use of the exciting dashboard display, both able to display the test information.

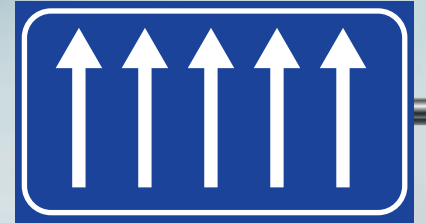
“The dashboard display was chosen for ergonomical reasons, it is placed where all the other bus information is and the driver can see the test result immediately without having to remove the handheld unit from the mouth.”

The handheld unit is not linked to the vehicle and can be collected from the buses and taken to a Volvo Bus service centre for calibration, which means that calibration is easily done even with a large bus fleet.

“The new alcolock system is available for buses with the BEA 2 electrical system, including most bus models manufactured in the latest 4 years,” says Jan-Olov Åkersten. “The system is highly adaptable to specific customer requirements, with several optional features.”

## Volvo Bus alcolock system

- Possibility to start the bus engine, but not drive the bus before the breath test
- Reset button for the breath test (optional alternative reset function, for example key)
- Information available both in the display on the dashboard and on the handheld unit
- Restart possible within 15 minutes without performing a new breath test
- Alcohol level limit of 0,2 ‰
- Optional workshop mode; during service possible to drive the bus within depot/workshop area with hazard flashers at maximum speed 15 km/h without breath test
- Calibration only once per year



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# Ecologically friendly energy is the future for Berne's public transport

The diesel buses of Berne will soon be a thing of the past. The future is dedicated to biogas buses, in an effort to reduce emissions of CO<sub>2</sub>, particles and noise. Right now, 45 Volvo biogas buses are running the streets of the Swiss capital.

Text Håkan Hellström  
Photo Volvo Buses

Bernmobil, Berne's public transport company, runs trams, trolleybuses as well as gas and diesel buses. The company has made a strong commitment to biogas.

In 2006, 32 articulated Volvo 7700A CNG were delivered to Bernmobil, followed by 13 two-axle Volvo 7700 CNG. In 2009/2010,

Bernmobil will buy another 20 biogas buses. The future goal is that all of the company's 100 buses will be run on biogas, as the rest of the diesel bus fleet becomes obsolete.

"The main reason for our commitment is the environmental benefits of biogas," says Annegret Hewlett, press officer at Bernmobil. "Biogas buses are

carbon neutral and have low emission levels. We have the full support of the city as well as of the canton of Berne, which are equally committed to an environmentally sustainable development."

"Biogas also has a positive image, that reflects on Bernmobil. The environmental profile for our company is strong in general. All of the electricity used by Bernmobil is for example produced by hydropower," she says.

## Biogas from sewage plant

In 2005, the first plans were made to use biogas as a fuel for the city buses of Berne, when the 32 oldest diesel buses were to be replaced. A partnership between Bernmobil, ARA Bern and Energie Wasser Bern was initiated. The sewage treatment plant, ARA Bern, had for years used the energy to heat and power the plant itself as well as a housing estate nearby.

"The sewage plant was producing more heat than could be used, so part of it was lost," says Annegret Hewlett. "Today, we are using all of the biogas that the sewage plant is producing, and we will need more biogas in the future when we get more gas buses."

In the plant, wastewater sludge goes into bioreactors, producing a biogas with average methane content of 65



## Biogas – for a sustainable society

The demand for renewable and sustainable energy sources is ever growing. Volvo Buses is meeting this challenge with biogas-powered engines and the Volvo 7700.

Biogas is a simple and long-term solution to reducing green house gas emissions.

Volvo Buses' gas-powered G9A engine runs on both natural gas and biogas. In particular, biogas has properties that significantly cut emissions and green house gases. The emission levels are

below both Euro V and EEV. It is an engine intended to meet the growing demand for gas-fueled buses in city traffic, thanks to its highly efficient combustion technology.



Edward Jobson,  
environmental  
manager of Volvo  
Buses

"There are really no downside to biogas buses," says Edward Jobson, environmental manager of Volvo Buses. "Biogas is CO<sub>2</sub> neutral, produced from waste and significantly reduces emissions of particulate matter and nitrogen oxide, which is a big health benefit."

## Locally produced fuel

"One other big benefit is that biogas can be locally produced," says Edward Jobson.





per cent. Through a special process, the biogas is upgraded to the same methane content (96 per cent) as natural gas, and fed into the city's natural gas network via a pipeline. Through the network, Energie Wasser Bern provides the gas infrastructure for Bernmobil and is also responsible for operating the fuelling stations.

#### **Fuelling over night**

Bernmobil has 62 biogas fuelling stations in their bus depot, which fill the gas tanks over night, however two separate fuelling stations are fast-fill stations, taking 5-8 minutes to fill a tank. A number of gas fuelling stations are also available at a different location in the city.

At the depot, Bernmobil's service technicians perform service on diesel, gas and trolley buses alike.

"It makes it more interesting for the technicians not to be limited to just one type," says Annefred Hewlett. "In the beginning, the gas buses had a lot of small technical problems, but today the buses are running well."

It is an energy source that does not require pipelines or specialized tankers for transport. In many parts of the world biogas is already used to produce heat and energy. Biogas can be upgraded and compressed to high quality fuel for vehicles. Due to the excellent emission performance it is well suited for public transport and fleet vehicles, such as city buses.

"However, there has been a shortage of biogas in many countries for a few years, so a lot can be done to raise

biogas production volumes," he says.

#### **Improving the performance**

The G9 is an in-line six-cylinder gas engine with a displacement of 9.4 litres, fitted with a turbocharger and Intercooler, and based on Volvo's modern D9B diesel engine that has been modified for gas power. The engine is available in the Volvo 7700 citybus, both in the two-axle 12 meter version and the articulated 18 meter version.

The engine's low noise level means

it is particularly suitable for buses operating in sensitive urban environments.

"To improve the performance of our gas engine, we have introduced a number of new solutions, including changing components such as the accelerator pedal position sensor and updating engine control software" says Edward Jobson.

# Energy and environmental costs introduced into procurement criteria

**The new Clean and Energy Efficient Vehicles Directive will change the criteria for procurement of vehicles by public authorities. The directive introduces sustainable economics, such as lifetime costs for energy consumption and emissions into the criteria.**

Text Håkan Hellström  
Photo Volvo Buses

It means that not only the purchase price of trucks and buses should be considered in procurements, but also their lifetime energy and environmental impact.

The Directive on the promotion of clean and energy efficient road transport vehicles aims to stimulate the market for environmentally friendly vehicles. The directive requires that energy and environmental impacts linked to the operation of vehicles over their whole lifetime are taken into account in all purchases of road transport vehicles in the EU. The directive covers not only public procurers but also road transport vehicles purchased by contracting authorities and contracting entities irrespective whether they are public or private, if they provide services for public service. It also covers the purchase of road transport vehicles used for performing public passenger transports under a public service contract.

## Three options

"The directive is planned to come into effect from April 2010," says Edward

Jobson, environmental manager at Volvo Buses. "There are three different options for the procurer to meet the requirements of the directive and validate the environmental performance of the vehicles. First of all by setting technical specifications for energy and environmental performance, by listing limits for CO<sub>2</sub>, particulate matter, NO<sub>x</sub>, energy and other aspects."

The second and third options include energy and environmental impacts by internalisation of cost, either as award criteria or as internalisation of external cost per km. Any of these options can be selected for the procurement process.

## Monetary value attached

Internalisation of external cost means that a monetary value is attached to the criteria. The directive includes a methodology for calculating environmental costs. Cost levels are decided for the different emissions, however different levels can be chosen. For example, the value of NO<sub>x</sub> is 0.44 €cents/g and particulate matter is 8.7

€cents/g. However, the value of CO<sub>2</sub> is 3 or 4 €cents/kg. All or some emission costs can also optionally be doubled. The energy cost equals the diesel cost without taxes.

When calculating emissions and energy savings, different types of vehicles have different lifetime mileage. For example, the standard lifetime mileage for buses is 800 000 km.

## New way of thinking

Leif Magnusson is an environmental strategist for Västtrafik, a public transport company in Western Sweden.

"It's hard to tell what impact the new directive will have," he says. "But I think it presents a new way of thinking that is beneficial for public transport in general. But depending on what method you use, the result may vary for different bus types. Biogas buses have high-energy consumption, a fact that could eliminate them in future procurements. The benefit of biogas production is not included in the method of calculation. So, the drawback can be that the "wrong" alternative is promoted."


## Affecting relationships

"I think it will be necessary to introduce a simplified standard test cycle for fuel consumption and emissions, that can be generally approved by customers, manufacturers and tenders alike, to avoid confusion when comparing different test cycles," says Edward Jobson. He thinks the directive will affect the relationship with customers and tendering authorities, improving the dialogue between the three parties.

"The products we are selling today are highly competitive on the market and will be even more so when the directive is in force" he says.

"There are several examples of buses from Volvo that will do very well under the new directive, first and foremost the Volvo Hybrid bus," says Edward Jobson. "But also diesel buses like the Volvo 9700 coach, with the I-shift transmission system and Euro V engine with very good fuel economy."





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