



Zafira 1.6 CNG monovalent^{plus}

The Natural Gas Alternative



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OSV – Opel Special Vehicles – is a subsidiary of Adam Opel AG. It concentrates on producing special vehicles and fitting special equipment on new Opel vehicles.

Together with the engineers at Adam Opel AG's International Technical Development Center (ITDC), OSV has developed a natural gas concept for the Zafira 1.6 CNG which, in the sum of its advantages and characteristics, has a unique market profile.

The "monovalent^{plus}" concept of the Zafira 1.6 CNG represents:

- Significant operating cost benefits
- Undercutting the most stringent exhaust standards by up to 80 %
- Unrestricted use of passenger compartment and luggage area
- Full functionality of the Flex7® system
- Nearly same engine performance as the gasoline-operated version of the Zafira 1.6 16V
- Range of over 350 km in natural gas operation
- Reserve gasoline tank with approx. 150 km additional range
- In spite of its ability to run on gasoline, the Zafira 1.6 CNG is classed as a monovalent natural gas vehicle, and is correspondingly encouraged and subsidised
- High operating security with natural gas
- Full Opel warranty on all vehicle components

Because of these characteristics, the Zafira 1.6 CNG has a unique market position. It is for this reason that it has generated strong advance interest from commercial customers, as well as from environmentally conscious private customers keen to cut their transport costs.

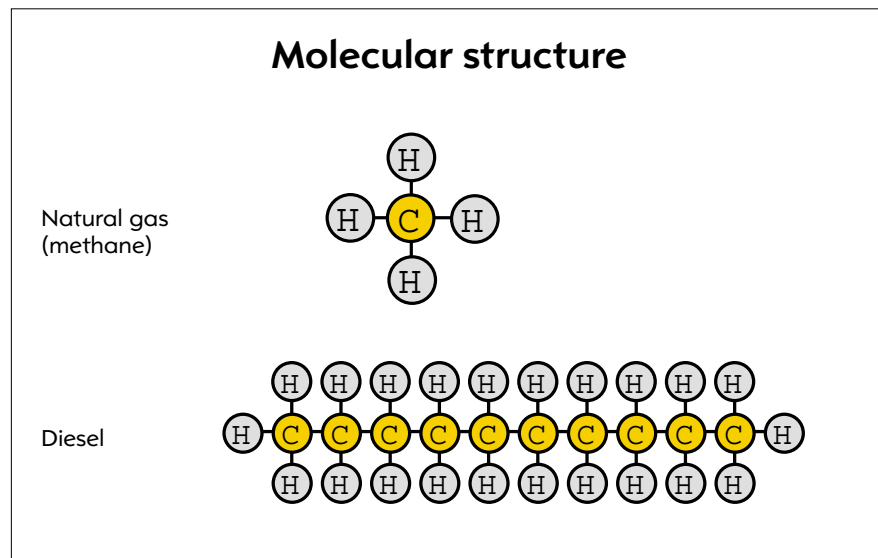
The following pages contain information not just about a new vehicle with unique benefits, but also about a new business sector that offers you unique opportunities.

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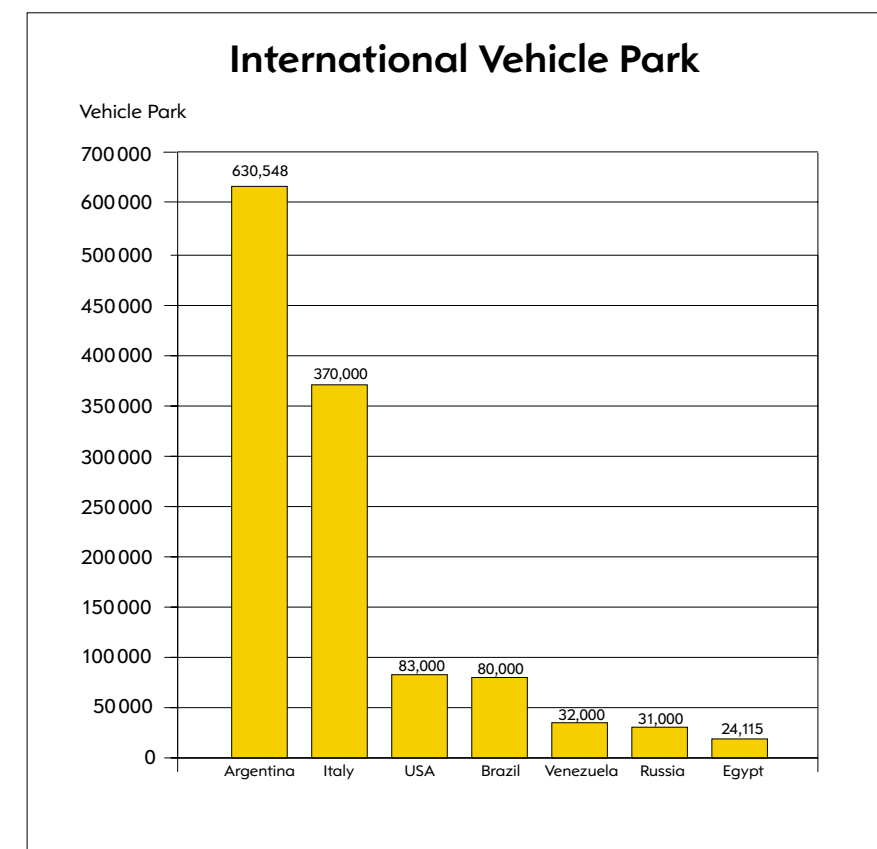
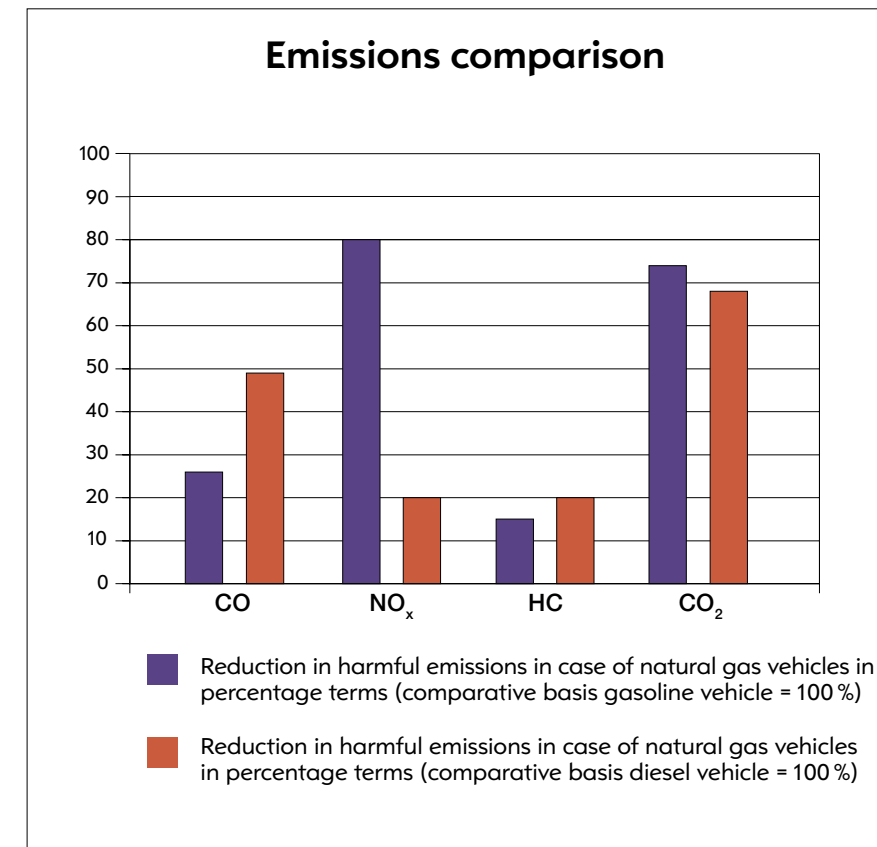
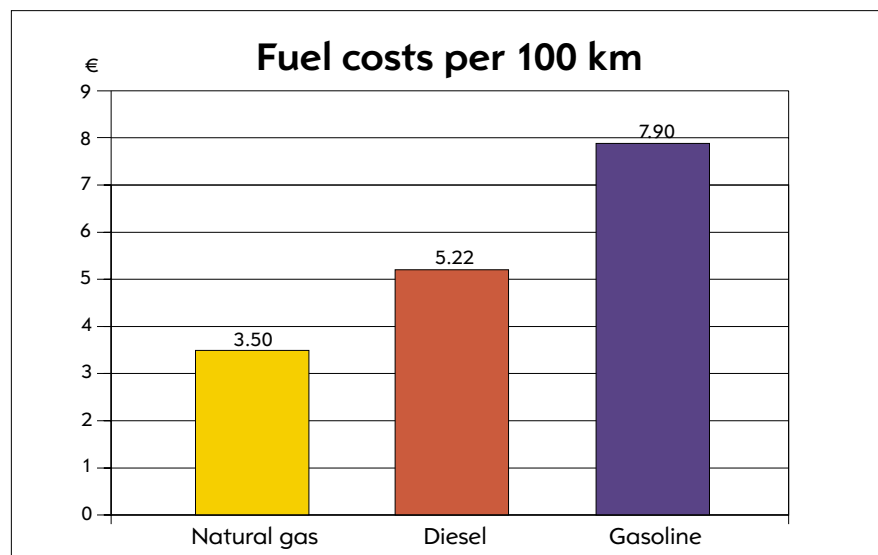
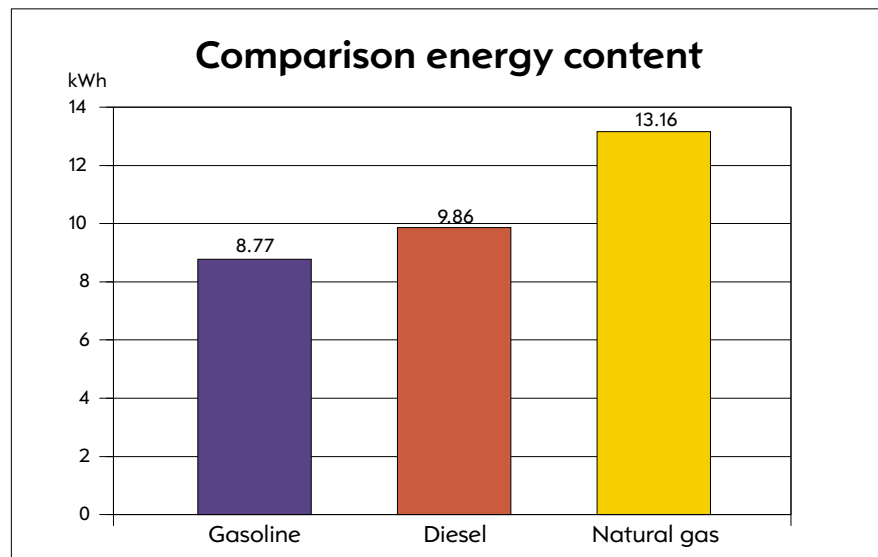
**Natural gas as energy source:
The most successful formulas tend to be very simple.**



The term CNG (compressed natural gas) stands for natural gas which is kept at a pressure of 200 bar. Natural gas (CH_4) is one of the simplest chemical formulas. In contrast to diesel or gasoline, which are derived from mineral oil in highly energy-intensive processes, natural gas can be found naturally in more or less pure form – depending upon the particular location. Furthermore, it requires a far less complex process to transform natural gas into fuel. Known stocks of natural gas will last – based on current consumption levels – for at least 160 years. Natural gas production is environmentally friendly. The same is true when it comes to transporting gas through a network of underground pipelines. In Germany the total length of these pipelines is currently more than 365,000 kilometres.

In accordance with the German Calibration Act, compressed natural gas (CNG) must not be sold at filling stations in litres, but instead by weight. In order to draw effective comparisons with gasoline or diesel fuel, it is therefore necessary to determine the energy content: one kilogram of natural gas has an energy content of 13.16 kWh (kilowatt hours), one litre of diesel 9.86 kWh and one litre of gasoline 8.77 kWh. This means 1 kg CNG contains the energy of 1.33 l diesel or 1.5 l gasoline.

At an average price of € 0.66 per kilogram CNG, in the case of an automobile with 71 kW (97 hp), this results in fuel costs of € 3.50 per 100 kilometres. The corresponding vehicle with a gasoline engine needs € 7.90 to cover the same distance, with a diesel engine € 5.22 (on the basis of fuel prices of € 1.00 and € 0.80 per litre respectively).



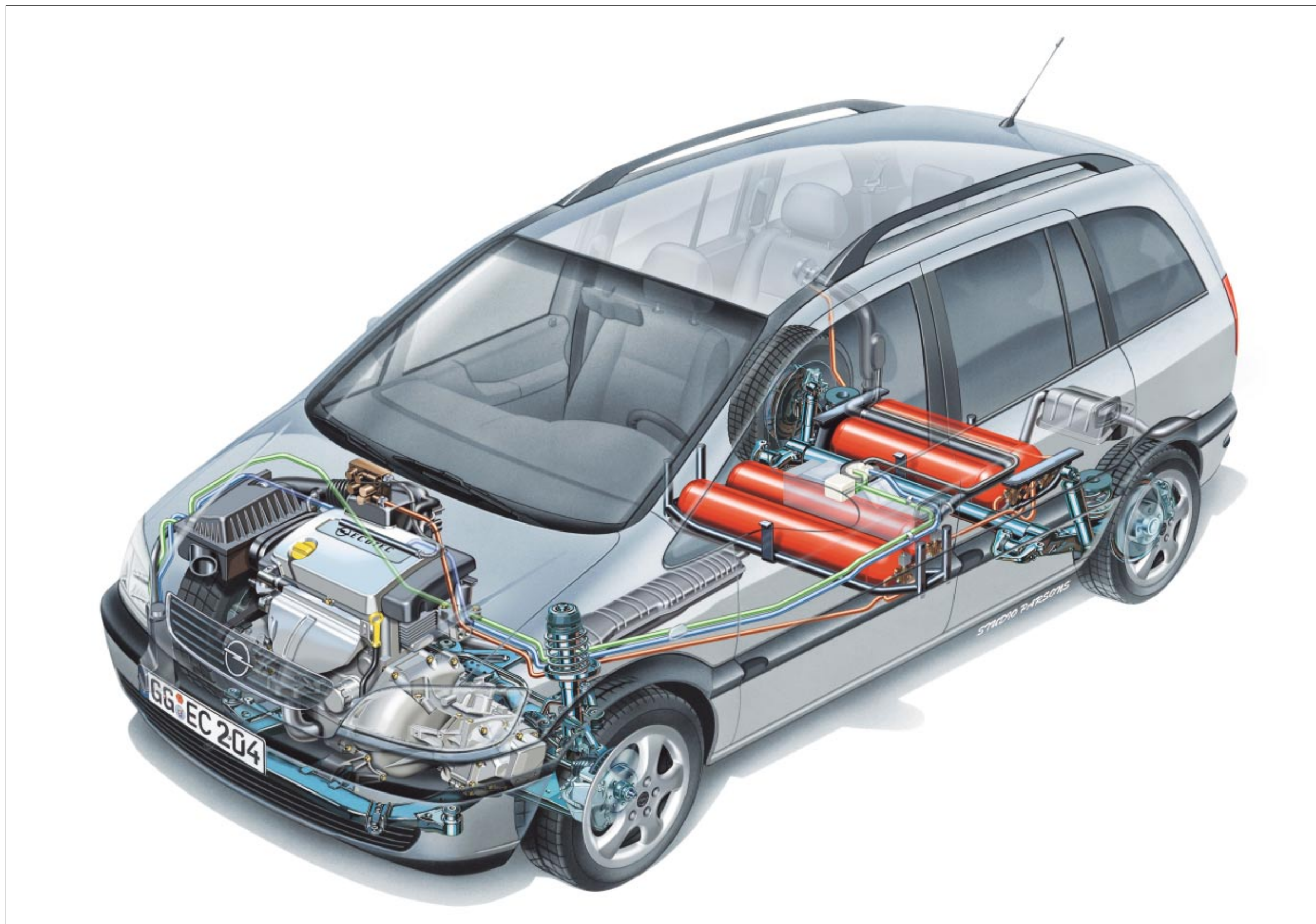
Natural gas – as the formula clearly demonstrates – has a much lower carbon (C) content than diesel or gasoline. For this reason, combustion of natural gas generates significantly lower quantities of carbon monoxide (CO) and carbon dioxide (CO₂) than in the case of diesel or gasoline. It also produces very substantially lower levels of nitric oxides (NO_x), which leads to a significant reduction in the formation of low-level ozone.

The formation of sulphur dioxide, soot and other particle emissions is almost wholly prevented. This can be impressively demonstrated by examining the exhaust pipe of a vehicle which operates on compressed natural gas; even after having clocked up a large mileage, there are still no visible deposits. This can be verified with ease at any time.

The number of natural gas vehicles around the world has risen strongly in recent years. At the current time, over 1.5 million vehicles are registered. The largest proportion of these are to be found in Argentina and in Italy, where efficient distribution networks are already in place. Natural gas is also steadily gaining in popularity in the USA, Brazil and Germany. Germany currently has approx. 12,000 vehicles operating on natural gas – a figure which will increase rapidly as new models become available and the infrastructure for natural gas improves.

- Supplies of natural gas are guaranteed for decades.
- Significant price advantage through preferential tax treatment up to the end of 2009.
- Drastic reduction in emissions, significantly below all existing and planned emission standards.
- High growth potential.

The constructive preconditions:
Why the Zafira is the ideal natural gas vehicle.



Variability and the optimum use of interior space are essential strengths of the Opel brand. These are again demonstrated in the Zafira 1.6 CNG.



The Zafira's ultra compact rear axle consists of just three components: 2 hollow-cast axle brackets, which are connected to the hydro-formed axle shaft, and which at the same time take on the function of the stabiliser. Thanks to this space-saving construction, sufficient room exists beneath the vehicle's floorpan to locate two large capacity CNG tanks in front of and behind the axle – plus a reserve tank for gasoline.



This means that, by virtue of its structural configuration, the Zafira not merely has an advantage over vehicles with rear-wheel drive (where the tanks need to be located either in the luggage area or in the passenger compartment), but also relative to the majority of vehicles with front-wheel drive, such as e. g. from VW or Ford. This is because the latter's rear axle construction takes up significantly more space.

• Ultra-compact rear axle construction is ideal for locating the gas tanks below the floorpan.

**High performance and high torque with natural gas:
What makes economic and ecological sense
should also be fun.**

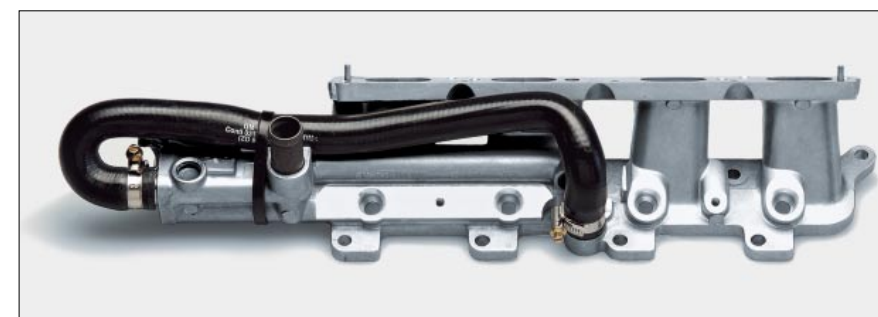
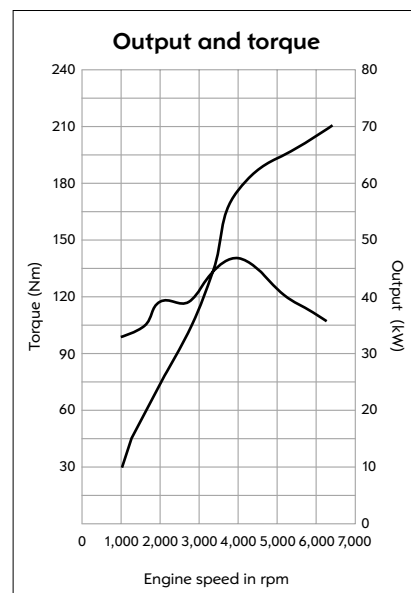


At first glance, you will not notice any difference under the bonnet of the Zafira 1.6 CNG vis-à-vis the gasoline-operated version. The driving performance is also identical. The engine of the Zafira 1.6 CNG is optimised for use with natural gas, and has precisely the same performance parameters of 71 kW/97 hp and a maximum torque of 140 Nm as the gasoline-operated version. Because the engines of bivalent vehicles are optimised for gasoline operation, their performance tends to drop by approx. 20 per cent when they are switched over to natural gas operation.

In the case of the monovalent^{plus} concept of the Zafira 1.6 CNG, by contrast, Opel has aimed to achieve maximum efficiency during natural gas operation. Because natural gas has an octane value of up to 130, it is significantly less liable to cause engine knocking than gasoline. This means efficiency can be raised correspondingly by increasing the compression ratio. As a result, in conjunction with a special injection system and engine management, nearly the same performance parameters can be achieved as in the case of the gasoline engine. Maintenance- and service intervals of the Zafira 1.6 CNG correspond largely to the gasoline-operated version. Exception: Replacement of spark plugs after 30,000 km (instead of 60,000 km) due to higher requirements.

The comparison between the output and the torque curves of the Zafira 1.6 CNG shows only small differences to the gasoline-operated 1.6 16V ECOTEC[®] engine. When it comes to driving performance, however, the increased weight causes slight deviations.

Zafira 1.6 CNG	
The key data.	
Cubic capacity (ccm):	1,598
Output (kW/hp): at rpm:	71/97 6,200
Maximum torque (Nm): at rpm:	140 4,200
Maximum speed (km/h):	170
Acceleration 0–100 km/h in s:	15.5
Fuel consumption (kg/m ³ /100 km) according to 1999/100/EG	
Urban:	6.7/10.3
Motorway:	4.4/6.7
Total:	5.3/8.0



One for the price of two: the Zafira 1.6 CNG has – unlike other natural gas vehicles – a dual injection bank, each with 4 injection nozzles for natural gas and gasoline. The injection is given sequential intervals even in natural gas operation – an important precondition for maximum efficiency and particularly clean exhaust performance.



The Zafira 1.6 CNG has special pistons designed for natural gas operation. The raised areas on the piston heads increase the compression ratio to 12,5:1. This makes it possible to exploit fully the higher octane content of natural gas, and consequently to boost operating efficiency. In addition to the pistons, the valves, valve guides and valve seals of the Zafira 1.6 CNG have also been configured specially for natural gas operation.



The pressure control unit, which is mounted in the engine compartment, ensures that the injection nozzles in natural gas operation are supplied with a constant pressure of 8 bar. This is also where the switchover from natural gas to gasoline operation takes place. In order to guard against the risk of icing, the unit is integrated in the engine's coolant system.



The catalyst of the Zafira 1.6 CNG is located close to the engine, which means it is particularly quick to start operating. Because natural gas burns at a lower temperature than gasoline, it is not necessary to enrich the fuel mixture under full load. This is normally done to protect the catalysts of gasoline engines from heat damage.

- Engine of Zafira 1.6 CNG optimised for natural gas.
- Performance comparable to 1.6 16V ECOTEC[®]-engine.

Two answers to the question of range:
**The only monovalent natural gas vehicle
 that can also use gasoline.**



In Germany natural gas vehicles are divided into two categories: monovalent vehicles are configured exclusively for operation with natural gas. They are subsidised by gas utility companies to the tune of some thousand € – e. g. in the form of free natural gas vouchers or direct financial support (see page 17). However, these vehicles are dependent upon the availability of natural gas filling stations. Bivalent natural gas vehicles, by contrast, are technically configured to operate mainly on gasoline. With their duplicate tanks, they have substantial range, and can be switched from gas to gasoline operation at any time. One disadvantage of these vehicles is the extra space taken up by the gas tanks (luggage compartment or vehicle interior). In addition, bivalent vehicles tend to lose power and produce higher levels of emissions when running on natural gas.

The monovalent^{plus} concept of the Zafira 1.6 CNG brings together the advantages of both systems: 4 capacious gas tanks ensure a range of approx. 350 km in natural gas operation. An additional reserve gasoline tank is installed between the gas tanks. With a capacity of 14 litres, the Zafira 1.6 CNG is still classed as a monovalent vehicle, and enjoys the corresponding subsidies and support. If need be, however, the reserve gasoline tank ensures an additional range of approx. 150 km – enough to bridge all gaps in the supply network.

The entire tank system is mounted in a stable steel tube structure, and is protected against dirt and contamination by underfloor cladding.



Just the right size: the reserve gasoline tank of the Zafira 1.6 CNG. It is made of stainless steel, and is located safely in front of the rear axle.

As the engine of the Zafira 1.6 CNG is optimised for natural gas operation, both the output and the torque are reduced in gasoline operation. In terms of smoothness and driveability, however, there are no drawbacks whatsoever.



A switch located on the central console of the Zafira 1.6 CNG is used to change from natural gas to gasoline operation. This also shows the respective operating mode.

At the same time, the corresponding pressure or gasoline gauge display is also activated. This means that the fuel gauge of the Zafira 1.6 CNG always shows the corresponding reserve of the respective operating mode that has been selected.

Opposed to bivalent vehicles of other brands the Zafira 1.6 CNG can also be started in natural gas mode.



- Monovalent^{plus} combines the benefits of monovalent and bivalent systems.
- Range in natural gas operation approx. 350 km.
- Reserve range in gasoline operation approx. 150 km.
- Fuel switchover at the push of a button.
- Precise display of the respective fuel reserve.

The subject of safety:
Why natural gas in the Zafira 1.6 CNG is a particularly safe fuel.



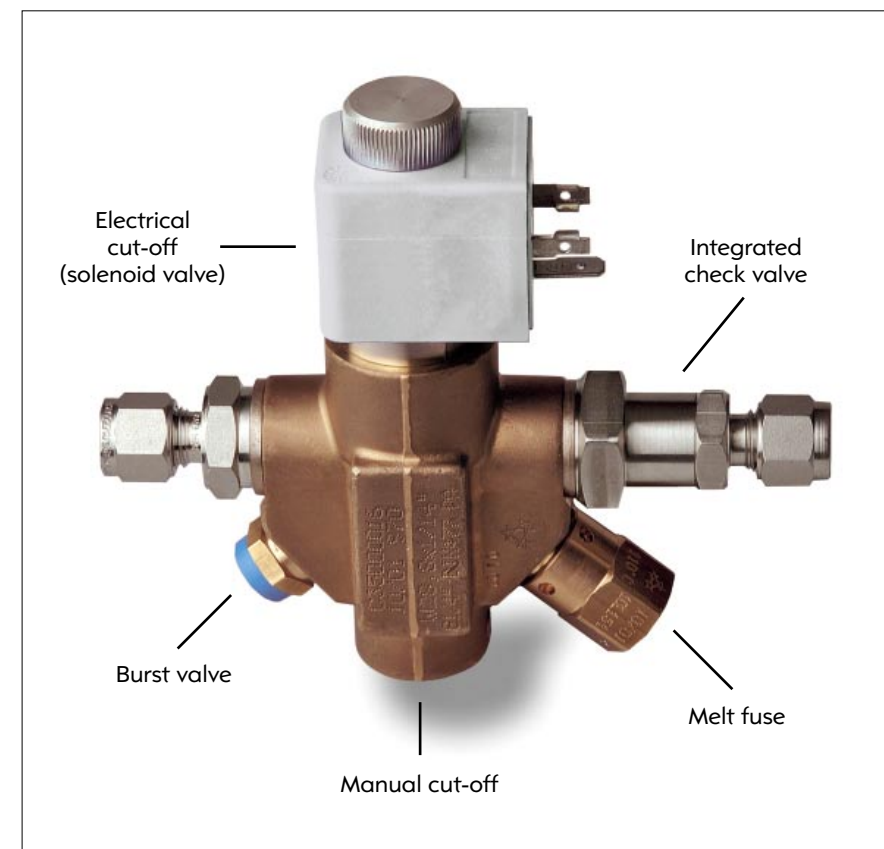
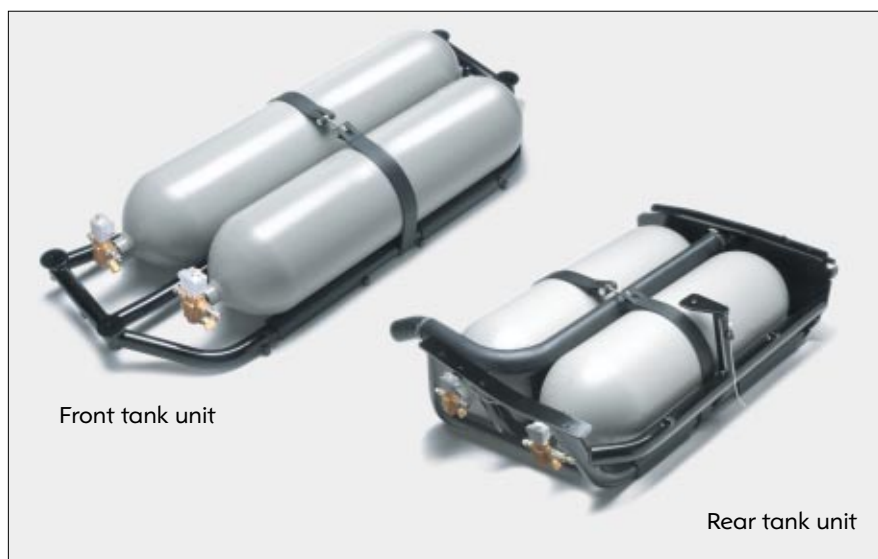
Natural gas is – in contrast to popular misconception – an extremely safe fuel. Because natural gas is lighter than air, it evaporates immediately. This makes it safer than liquid fuel. In addition, the ignition temperature for natural gas is 650° Celsius, which is far higher than gasoline or diesel. Refilling vehicles with natural gas is a very simple and straightforward procedure. An advanced system with standardised pumps and fuel inlets ensures that no operating errors can occur. The tanking procedure itself takes about as long as that for liquid fuel.

The Zafira 1.6 CNG is fitted with an universal filling joint, which is also compatible to other countries filling systems (e. g. Italy) without additional adapter.

In the case of the Zafira 1.6 CNG, a whole range of measures are in place to ensure that in the event of a collision, the risk of fire is reduced to a minimum:

- The 4 gas tanks in which the natural gas is stored at a pressure of 200 bar are made of special steel and are designed to withstand pressures of up to 450 bar. Prior to installation, each container is individually tested under a pressure of 300 bar.
- The pressurised containers comply with stringent safety standards, and are capable of withstanding even the toughest mechanical and technical stresses.

For additional protection in the event of an accident, the tanks are also mounted in safety cages made of 38 mm thick steel tubing. The material used here is a high-strength special steel that is usually deployed to make roll-cages for rally and racing vehicles.



Each of the 4 pressurised containers is fitted with a valve with the following safety features:

- The electrically controlled solenoid valve releases the flow of gas only when the ignition is switched on, that is to say, when the engine is running. In the case of an accident, or if the engine stalls, all 4 solenoid valves will be closed.
- An integrated mechanical check valve automatically switches the flow of gas off in the event of a loss of pressure in the gas feed, caused e. g. by a leaking connection.
- In the event of a vehicle fire – caused e. g. by fuel leaking from the other vehicle involved in the accident – an integrated melt fuse ensures a controlled release of natural gas if the temperature exceeds 110° Celsius.
- If pressure raises over a defined limit, an additional burst valve also ensures controlled release of gas.
- Each gas bottle can also be closed off using a manual cut-off valve.



The gas feed system itself consists of stainless steel hoses with special threaded connections, and is capable of withstanding all the pressures and loads which could be encountered in an accident.



Unlike vehicles which operate on liquid fuels (butane/propane), natural gas vehicles are not subject to any access restrictions whatsoever.

Because natural gas is lighter than air, no explosive mixture can form at ground level – in contrast to butane or propane. For this reason, contrary to the widely held view, natural gas vehicles are also officially approved for use in locations such as underground car parks.

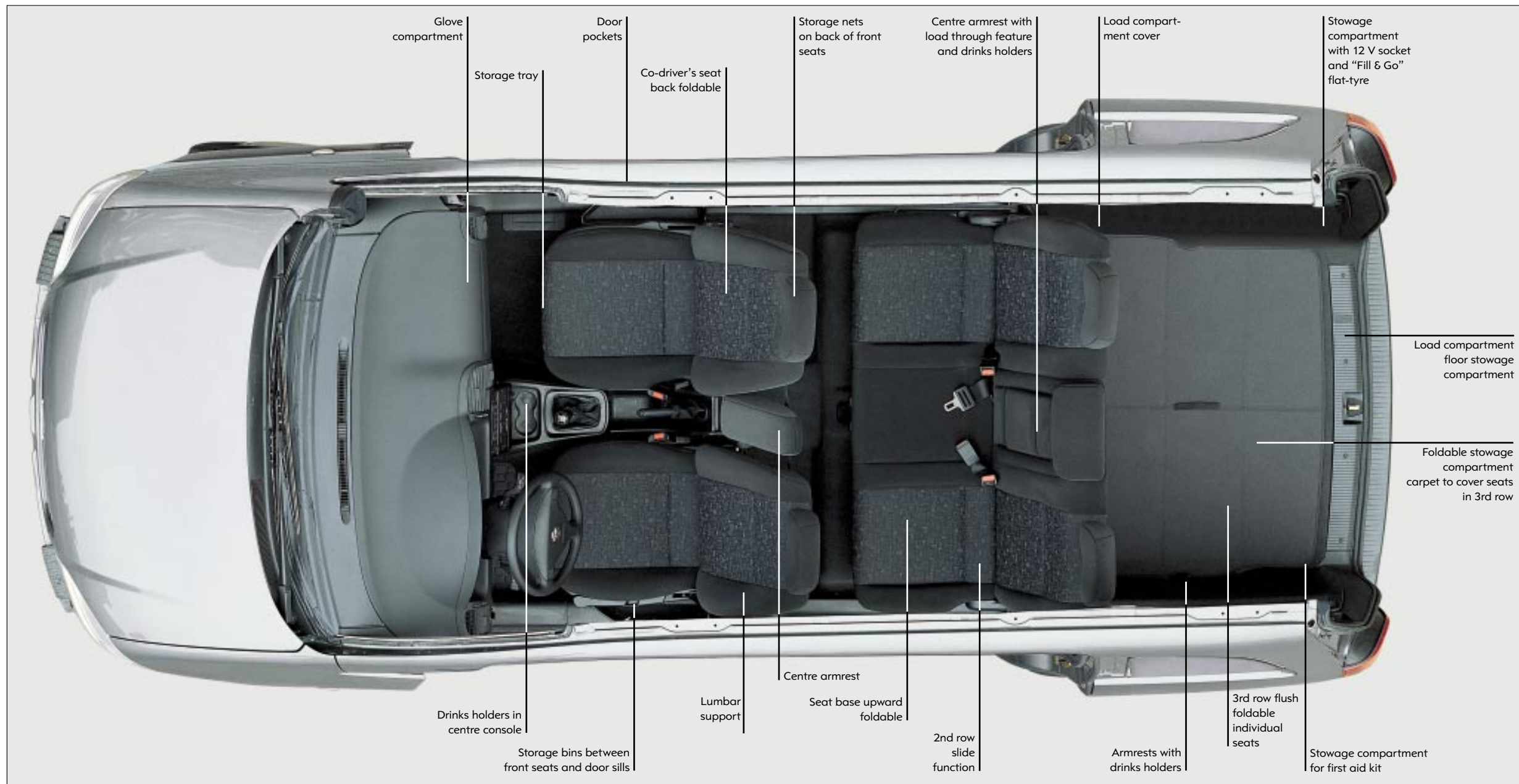
In the opinion of experts, natural gas is the safest fuel for internal combustion engines. The latest accident statistics from the USA, where over 83,000 natural gas vehicles are registered, show that there were no leaks whatsoever in vehicle gas containers during the period under review.

Even in the case of a documented accident which took place at a speed of 180 km/h, the gas tank remained undamaged in its anchoring.

Because of the high standard of safety, natural gas vehicles are subject to the same official checks and controls by the German TÜV or other vehicle safety organisations as conventional vehicles. It is only necessary for the gas tanks to be given separate checks after a period of 10 years. The cost of this check is likely to lie in the region of € 260.–.

- Problem-free, safe tanking procedure.
- Pressurised tanks with high safety reserve in the event of an accident.
- Solid safety cage for additional protection.
- Numerous safety functions within the overall system.
- No deployment restrictions in day-to-day operation.
- Safest fuel for internal combustion engines.

The Flex7® seating system:
Because natural gas customers have practical minds,
the Zafira is the first choice.



The Zafira's revolutionary Flex7® seating system also remains fully deployable in the case of the Zafira 1.6 CNG: this enables the Zafira 1.6 CNG to be transformed in next to no time from a 7-seater to a 1-seater with a transport volume that makes the capacity even of large estates pale in comparison. The natural gas version of the Zafira also retains all the practical characteristics which have made it such a successful vehicle: impressive functionality throughout the vehicle's interior. High seat position with superb all-round vision. Easy manoeuvrability and safe handling. And not least: a substantial payload that remains unchanged relative to the gasoline engine version.

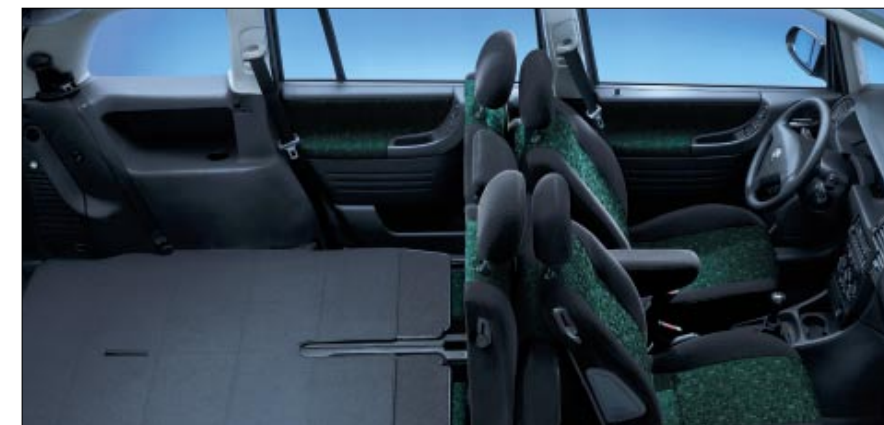


In the event of a flat tyre, the Zafira 1.6 CNG makes life easier for the driver than in the case of the versions with conventional engines: for instead of having a spare tyre beneath the floorpan, the Zafira is equipped with a tyre repair kit as series. This consists of a container with sealant, and a small, powerful electric compressor. These components are stored in the right-hand rear stowage compartment, which (from the Zafira Comfort upwards) is equipped with the necessary 12-volt socket. The compressor can also be operated by connecting it to the cigarette lighter socket. This solution enables the Zafira to be put back on the road in the shortest possible time, and eliminates the need for laborious wheel changes.



"No other manufacturer has produced such a practical and versatile vehicle as the Opel Zafira." This is the first sentence in the test report on the Zafira published in the motoring journal "mot" (issue 5/2001).

This view is also shared by the customers who in a short time have made the Zafira the market leader in the compact van segment.



- Flex7® seating system fully useable.
- Unrestricted functionality and space.
- Substantial payload.
- Comfortable solution in the event of a flat tyre.

Assessing the Zafira 1.6 CNG in terms of cost-effectiveness: High-mileage drivers drive half-price. Or for less.

Comparative cost-effectiveness vis-à-vis gasoline/diesel			
	Zafira 1.6 CNG	Zafira 1.6 16V ECOTEC®	Zafira 2.0 DTI 16V ECOTEC®
Drive concept	monovalent ^{plus}	Gasoline	Diesel
Price (€)	21,270.00	18,640.00	19,850.00
Output (hp)	97	100	100
Torque (Nm)	140	150	230
Maximum speed (km/h)	170	176	175
Kerb weight (kg)	1,570	1,385	1,400
Payload (kg)	545	565	565
No. of seats	7	7	7
Luggage compartment (l)	1,700	1,700	1,700
Total range (km)	500	734	878
Energy consumption (per 100 km)	5.3 kg/8.0 m ³	7.9 l	6.6 l
CO ₂ emissions (g/km)	144	190	178

Example of cost breakdown in the case of 20,000 km per year			
	Zafira 1.6 CNG	Zafira 1.6 16V ECOTEC®	Zafira 2.0 DTI 16V ECOTEC®
List price in €	21,270.00	18,640.00	19,850.00
Operating costs in €			
Costs per 100 km in €	3.50	7.90	5.22
Total fuel costs/year in €	699.60	1,580.00	1,044.12
Insurance/year in €	767.00	767.00	909.00
Road tax in €	108.00	108.00	276.00
Total costs/year in €	1,574.36	2,455.00	2,228.00
Difference relative to gasoline	-880.40		
Difference relative to diesel	-653.76		
Amortisation vis-à-vis diesel version in years	ca. 2.2		
Amortisation vis-à-vis gasoline version in years	ca. 3.0		

As the following table illustrates, the Zafira 1.6 16V ECOTEC® and the Zafira 2.0 DTI 16V ECOTEC® represent the ideal basis for an assessment of cost-effectiveness vis-à-vis the Zafira 1.6 CNG. This is because all 3 vehicles have almost the same operating output, and have similar road-handling performances. The comparison between the respective models is based on an additional price of € 2,630.– relative to the gasoline version, and € 1,420.– relative to the diesel direct injection engine. In practice, however, this additional price is reduced or is offset by the subsidies made available by local gas utility companies (see following page). Since the Zafira 1.6 CNG fulfils the D4 emission standards, the owner is entitled up to € 307.– in tax benefits; valid up to 31.12.2005.

Fuel accounts for the largest share of the operating costs. In this respect, the Zafira 1.6 CNG is over 50 % more cost-effective than the gasoline version – costing only € 3.50 per 100 km instead of € 7.90 per 100 km. The advantage vis-à-vis the diesel engine amounts to approx. 30 %.

If the higher insurance costs and the higher tax rate for diesel vehicles are taken into account, this results in an amortisation of about 2 years vis-à-vis the Zafira 2.0 DTI ECOTEC® and of 3 years vis-à-vis the Zafira 1.6 16V ECOTEC®. Once this period has expired, the significant cost benefits of natural gas are felt in full.

- Amortisation vis-à-vis diesel engine after about 2 years.
- Amortisation vis-à-vis gasoline engine after 3 years.
- Fuel cost advantage approx. 30 % (diesel) or over 50 % (gasoline).

Local promotion of natural gas vehicles in Germany (examples)			
Company	Address/Telephone	Contact/ Direct tel.	Support and promotion
SWB Energie und Wasser	D-53111 Bonn +49 (0) 2 28/7 11-0	Herr Lautenschläger -27 19	CNG to the value of € 1,534
badenova AG & Co. KG	D-79206 Breisach +49 (0) 76 67/2 97-1	Herr Beck -25 22	€ 1,790/vehicle
Südhessische Gas und Wasser AG	D-64293 Darmstadt +49 (0) 61 51/7 01-0	Ekkehard Schott -93 10	€ 1,000/vehicle with CNG advertising
RWE Gas AG	D-44137 Dortmund +49 (0) 2 31/18 21-0	Herr Wolf -9 94	2,000 kg CNG/vehicle with advertising
Stadtwerke Duisburg AG	D-47051 Duisburg +49 (0) 2 03/6 04-0	Ramon Proske -10 10	2,400 kg CNG for half price; CNG to the value of € 700
Stadtwerke Düsseldorf AG	D-40215 Düsseldorf +49 (0) 2 11/8 21-0	Claus Möller -23 66	1,500 kg CNG/ first year of operation
Stadtwerke Eberswalde GmbH	D-16225 Eberswalde +49 (0) 33 34/20 24-0	Ludwig Scheffler -3 10	400 kg CNG; max. € 2,500/vehicle
Stadtwerke Emden GmbH	D-26725 Emden +49 (0) 49 21/83-0	Stefan Siegmann -2 95	max. € 2,500/new vehicle; 60 % of modification costs
badenova AG & Co. KG	D-79108 Freiburg +49 (0) 761/2 79-1	Bernd Beck -25 22	€ 1,790/vehicle
Stadtwerke Hameln	D-31785 Hameln +49 (0) 51 51/7 88-0	Carsten Freise -3 65	1,500 kg CNG
Stadtwerke Hannover AG	D-30449 Hannover +49 (0) 5 11/4 30-0	Detlef Wöhler -19 39	1,500 kg CNG (in one year)
Stadtwerke Hildesheim	D-31137 Hildesheim +49 (0) 51 21/5 08-0	Herr Hartmann -3 48	2,000 kg CNG/vehicle; 3,000 kg CNG/taxis
Stadtwerke Homburg GmbH	D-66424 Homburg +49 (0) 68 41/6 94-0	Jürgen Schirra -170	€ 1,200/vehicle, support for commercial clients
egm Erdgas Mitteldeutschland GmbH	D-34131 Kassel +49 (0) 5 61/9 33-0	Lothar Brübach -21 42	Voucher to the value of 1,000 kg CNG
RGW Rechtsrheinische Gas- und Wasserversorgung AG	D-51109 Köln +49 (0) 2 21/9 69 49-0	Andreas Rödiger -3 35	€ 1,534/vehicle
badenova AG & Co. KG	D-77933 Lahr +49 (0) 78 21/97 44-0	Herr Freudenreich -1 23	€ 1,790/vehicle
Ferngas Nordbayern	D-90429 Nürnberg +49 (0) 9 11/27 77-0	Michael Streffing -2 13	1,200 kg CNG/vehicle
Stadtwerke Osnabrück AG	D-49074 Osnabrück +49 (0) 5 41/3 44-0	Sabine Jahnke -8 05	€ 1,500/vehicle
Stadtwerke Potsdam GmbH	D-14480 Potsdam +49 (0) 3 31/6 61-0	Reinhard Heinsdorff -13 61	CNG to the value of € 1,025/vehicle
HGW HanseGas GmbH	D-19055 Schwerin +49 (0) 3 85/57 50-0	Klaus Wichmann -2 08	CNG to the value of € 1,500
Neckarwerke Stuttgart AG	D-70167 Stuttgart +49 (0) 7 11/2 89-0	Nathalie Ender -474 78	€ 750/vehicle

Many local gas utility companies promote natural gas vehicles in various ways. This can take the form of substantial financial subsidies, or vouchers for free natural gas. In this respect, monovalent vehicles often receive higher subsidies than bivalent vehicles. For this reason, it is worth discussing the various options available with the gas utility company in your area.

A complete list of names and the direct telephone numbers of the responsible contacts is available on the Internet under www.erdgasfahrzeuge.de.

- Attractive promotional programs offered up by local gas utility companies.
- These can even entail reimbursement of the entire additional cost of the Zafira 1.6 CNG (€ 2,630.–).
- Special promotion of monovalent natural gas vehicles.

Natural gas infrastructure and natural gas filling stations: German network is growing faster than the Internet.



One of the most important factors currently limiting the further spread of natural gas vehicles – along with the shortage of attractive vehicles – is the fact that the filling station network is still being built up and expanded. In Germany there are currently about 265 natural gas filling stations.

However, the use of natural gas as a fuel will benefit from preferential tax treatment in Europe up to the end of 2009. This is encouraging both the major filling station operators as well as gas utilities to complete the network as rapidly as possible, meaning that there will soon be blanket coverage.

However, the monovalent^{plus} concept means the Zafira 1.6 CNG already has practically unlimited scope for operation in Germany.

In Italy the filling station infrastructure for natural gas is already significantly further developed than in Germany. This means that drivers whose vehicles use natural gas do not need to plan their journeys in advance.

In Switzerland and Sweden filling stations for biogas are also available in addition to those for natural gas. The composition of biogas corresponds to that of high-quality natural gas, and for this reason can be used in the 1.6 CNG at any time. Biogas is made from renewable raw materials. For this reason, it is CO₂-neutral, and is even more environmentally friendly than natural gas.

All Zafira 1.6 CNG customers are provided with an extensive "Natural Gas Pathfinder" containing both a general map of the respective locations as well as a detailed description of all natural gas filling stations in Germany.

The Internet provides more information about natural gas and an actual overview of the natural gas filling station network under www.erdgasfahrzeuge.de.

If the vehicle is equipped with OnStar, the driver will be directed to the nearest natural gas filling station after pushing the OnStar button in the car or by calling the phone numbers 46011 (D1-net) or 22593 (D2-net) from a mobile phone.



Plan of a slow-fill refuelling plant, Manufacturer Schwelm Anlagenbau GmbH

Here are the addresses of a number of manufacturers who will be pleased to make you offers with respect to setting up natural gas filling stations:

AMCO GmbH
Bildstock 5
D-88085 Langnargen
Tel.: 075 43/49 96 00
Fax: 075 43/49 96 11
E-mail: seaway-germany@t-online.de

Bauer Kompressoren
Drygalski-Allee 37
D-81477 München
Tel.: 089/78 04 90
Fax: 089/78 04 91 67
E-mail: info@bauer-kompressoren.de

Schwelm Anlagenbau GmbH
Loher Straße 1
D-58332 Schwelm
Tel.: 023 36/80 90
Fax: 023 36/80 92 22
E-mail: info@schwelm-gruppe.de
www.schwelm-gruppe.de

As natural gas is available almost everywhere in Germany through regular household connections, establishing private filling stations presents no problem for many companies and fleet operators – and the same applies to automobile dealerships.

A number of different systems are offered by various manufacturers. These can be tailored precisely to meet particular requirements – from small filling stations for workshops and service facilities, to self-service filling pumps.

Some of the systems have a modular structure, meaning that it can cost relatively little to set up a basic level of supply equipment.

In the case of higher requirements, these plants can then be expanded step by step to provide the necessary capacity.

A German bank, for instance Deutsche Ausgleichsbank, provides subsidies for those wishing to set up natural gas filling stations, using funds made available by the German Environment Ministry. Up to 100 % subsidies are available for such projects.

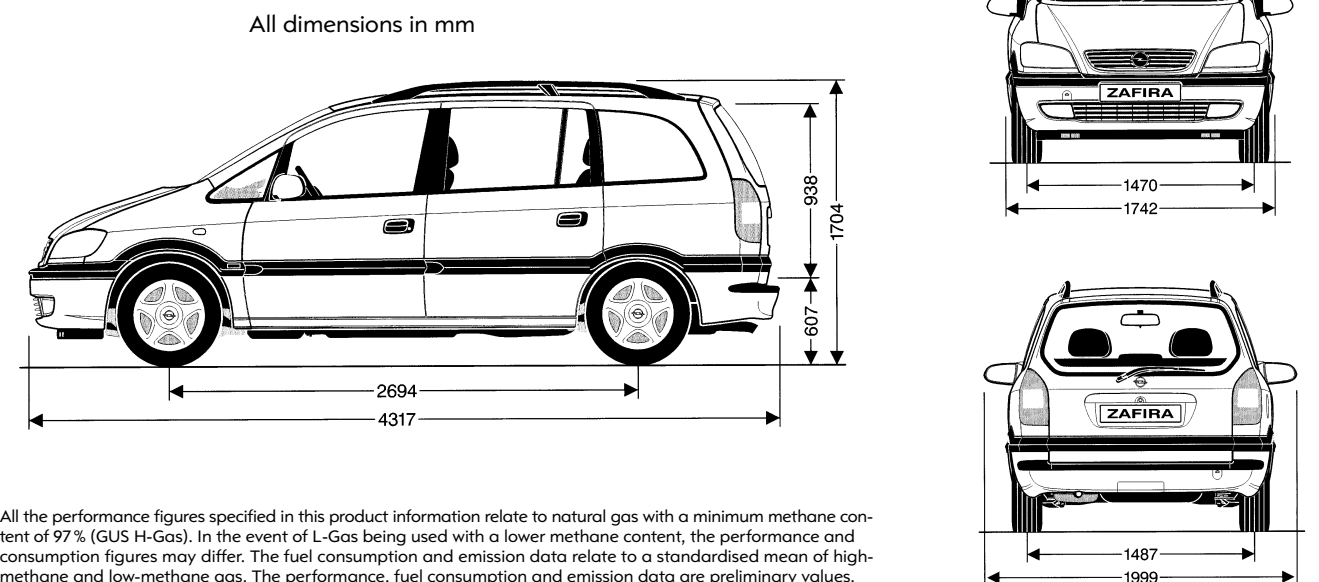
- Filling station network in Germany is being continuously expanded.
- In-house filling stations can be installed at any time.
- Investment volumes geared to requirements.
- Subsidies available from the German Environment Ministry.

Technical data Zafira 1.6 CNG.

Engine		1.6 CNG
Number of cylinders		4
Bore	in mm	79.0
Stroke	in mm	81.5
Cubic capacity	in ccm	1,598
Max. output	in kW (hp)	71 (97)
	at rpm	6,200
Max. torque	in Nm	140
	at rpm	4,200
Compression ratio		12.5 : 1
Electrical equipment		
Battery voltage	(V)	12
Battery capacity	(Ah)	44*
Rotary current alternator	(A)	70
Fuel consumption		
	in kg/m ³ /100 km according to 1999/100/EG	
	Urban	6.7/10.3
	Motorway	4.4/6.7
	Total	5.3/8.0
CO ₂ emission	in g/km	144
Top speed	in km/h	170
Acceleration	from 0 to 100 km/h in s	15.5
Max. climbing ability	in %	49.0
Towing capacity	with 12% test incline in kg	
	braked w/o AC	1,150
	unbraked	600
Tyre size		195/65/R 15
Wheel size		6J x 15
Vehicle dimensions		
Length	in mm	4,317
Width incl. exterior mirrors	in mm	1,999
Height at kerb weight incl. roof railing	in mm	1,704
Wheelbase	in mm	2,694
Track width at front	in mm	1,470
Track width at rear	in mm	1,487
Turning circle	in m	11.2

* in combination with air-conditioning 55 Ah.

Luggage compartment dimensions in mm		
Length on floor with folded rear seats, max.		1,562
Length on floor to rear seat backrest 2nd/3rd row of seats		1,085/378
Height of load sill		607
Loading area height, max.		1,031
Height of opening		938
Width between wheel arches		1,017
Width of opening at belt line		1,147
Luggage compartment/luggage compartment capacity		
	in l according to ECIE measuring method	
Luggage compartment (5-seater) up to		575
With folded rear seats (2-seater) up to roof height		1,700
Weights and axle loads in kg basic model with series engine		
Kerb weight		1,570
Permissible gross total weight w. AC		2,115
Payload		545
Fuel tank filling capacity		
Natural gas	in kg/l	19/110
Gasoline	in l	14



All the performance figures specified in this product information relate to natural gas with a minimum methane content of 97% (GUS H-Gas). In the event of L-Gas being used with a lower methane content, the performance and consumption figures may differ. The fuel consumption and emission data relate to a standardised mean of high-methane and low-methane gas. The performance, fuel consumption and emission data are preliminary values.

Zafira 1.6 CNG and the competition.



Fiat Multipla



Volvo V 70



VW Variant

The Fiat Multipla is available as a natural gas vehicle, in two different models: the Fiat Multipla Blupower is designed as a monovalent vehicle, and has an engine optimised for natural gas operation. In the German market, however, this version remains practically insignificant. The Fiat Multipla Bipower is the bivalent version. The engine in this case is designed for gasoline operation, and has limited performance and efficiency when used with natural gas. Both versions offer a high total range. In terms of vehicle type, the Multipla – as vehicle registration figures show – is something of an outsider. It attracts a significantly smaller number of customers than the Zafira. The Fiat Multipla Bipower corresponds to the D4 emission limits since January 2002.

Since May 2001, Volvo offers bi-fuel versions of the S 80 and the V70. Both vehicles have a tank capacity of 30 l for gasoline and 114 l for natural gas. This results in a total range of approx. 650 km. The engine in both operating modes provides the same performance, although in the case of natural gas operation the torque is significantly lower (192 Nm instead of 220 Nm). In terms of price, both the Volvo S 80 as well as the Volvo V 70 are positioned significantly higher than the Zafira 1.6 CNG. This means that it is only in exceptional cases that they can be viewed as direct competitors.

VW presented a bi-fuel version of the Golf Variant in autumn 2001. The exact date of market introduction is not yet defined. The gas tanks with a volume of 86 liters are mounted under the cargo floor, which had therefore to be raised by approximately 8 cm. Cargo space and ease of access are so significantly reduced. With an additional price of € 3,850.– relative to the gasoline version, the bi-fuel version of the VW Golf Variant is rather expensive, amortisation takes considerably longer than with the Zafira 1.6 CNG.

	Opel Zafira 1.6 CNG monovalent ^{plus}	Fiat Multipla Bipower	Volvo V 70 Bi-Fuel	VW Golf Variant 2.0 BiFuel
Engines	1.6 CNG	1.6	2.5	2.0
Cubic capacity in cm ³	1,598	1,587	2,435	1,984
kW (hp)	71 (97)	68 (92)	103 (140)	75 (102)
at rpm	6,200	5,750	5,800	n. a.
Torque in Nm	140	130	192	151
at rpm	4,200	4,000	4,500	3,500
Maximum speed in km/h	170	157	205	190
Acceleration 0–100 km/h in s	15.5	16.0	11.0	n. a.
Fuel consumption in kg/100 km according to 1999/100/EG				
Urban	6.7	7.5	n. a.	8.2
Motorway	4.4	4.9	n. a.	4.3
Total	5.3	5.8	7.4	5.7
CO ₂ emissions in g/km	144	159	164	157
Gasoline tank capacity in l	14	38	30	55
Natural gas tank capacity in l	110	164	114	86
Range gasoline in km	150	450	350	690
Range natural gas in km	350	450	300	260
External dimensions (mm)				
Length	4,317	3,994	4,710	4,397
Height	1,704	1,721	1,499	1,485
Width	1,742	1,871	1,804	1,735
Wheelbase	2,694	2,666	2,765	2,515
Loading capacity				
Luggage compartment	575–1,700	540–1,300	450–1,641	396–1,415