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Audi at Michelin Challenge Bibendum 2011

The equipment and data specified in this document refer to the model range offered in Germany. Subject to change without notice; errors excepted.

Summary

A new concept for future mobility

“Clean, safe, connected”: that is the slogan of the 11th Michelin Challenge Bibendum, to be held in Berlin from May 18 to 22. Audi satisfies these requirements concerning the mobility of the future via its “Audi balanced mobility” project, its modern assistance systems and its “Audi connect” initiative. The brand with the four rings will participate in Michelin Challenge Bibendum’s rally races and test drives by way of five different vehicles with alternative drivetrains.

Michelin Challenge Bibendum, one of the world’s largest forums for sustainable mobility, will be held at Tempelhof (Berlin’s one-time airport) from May 18 to 22. The field comprises some 120 vehicles with alternative and resource-efficient drive concepts, including five pioneering technology studies and production models by Audi.

A highlight of this large-scale event will be the rally races on Wednesday, May 18. Performance tests and handling tests will take place beforehand at the ADAC Road Safety Center in Linthe (southwest of Berlin) on Tuesday, May 17. The rally itself will span 125 kilometers (*78 miles*) and end near Potsdam. Audi will enter the A3 Sportback e-tron in this competition.

The InterCity Rally, a different event on May 18, will cover 300 meandering kilometers (*186 miles*) in the German state of Brandenburg. This is a long-distance competition for passenger vehicles and also includes safety tests. Four Audi vehicles will participate: the A3 TCNG powered by natural gas, the Q5 HFC with a fuel-cell power system, the Q5 hybrid quattro and the Audi A8, which features the new 3.0 TDI generating 150 kW (204 hp).

This highly efficient luxury sedan will take part in a third competition: the Eco Driving Challenge, which the ADAC will stage on Sunday, May 22 to wrap up the event. Entrants will seek to complete the course spanning 300 kilometers (*186 miles*) as quickly as possible – while consuming as little fuel as possible.

The rally vehicles will also participate on the Tempelhof grounds in the Ride & Drive event, an opportunity to test drive for specialists, journalists and even some members of the general public. At its very own trade-show stand, Audi will publicize its comprehensive strategy for future mobility.

The company's overall goal in this context is referred to as Audi balanced mobility: mobility in accord with the environment and society. A core aspect of this mission is the Audi e-gas project. The brand is establishing a portfolio of sustainable sources of energy – starting with wind power. This portfolio will be rounded out by electricity, hydrogen and methane. Tomorrow's electric, fuel-cell and methane vehicles will thus be made mobile and clean. The dual electricity/gas principle can aid the energy-supply industry in solving the problem of how to store electricity generated via renewable energy.

Under the slogan Audi connect, the brand is connecting its vehicles with the outside world: with nearby infrastructure, the driver and the Internet. This networking is based on the speedy exchange of data via UMTS or, in the future, LTE. It offers countless opportunities for making driving even more convenient and comfortable while structuring traffic flows which are more efficient as well as safer and smoother.

The brand with the four rings is ahead of the competition in this field. A Bluetooth online car phone, which integrates a UMTS module and a WLAN hotspot, is available for several Audi models. And Audi's online traffic information system already provides up-to-the-minute traffic data more quickly and more precisely than conventional information via radio. Additional pioneering online services will soon follow.

The integrative approach to the future pursued by Audi goes far beyond the scope of automotive engineering. The company created the Audi Urban Future Initiative this year to develop new modes of individual mobility for the major cities of this world. Under this umbrella, Audi convenes its own experts as well as architects, city planners and scientists to exchange ideas – a novel and remarkable type of networking.

Safety, the third catchword at Michelin Challenge Bibendum, is also a top priority at Audi. The brand’s cutting-edge driver assistance systems help make driving more assured and practical. These systems simplify many tasks for the driver, warn him of potentially dangerous situations and, if necessary, intervene to lend a virtual helping hand. Audi is working at top speed to advance safety innovations, as well.

Advancements regarding driver assistance systems and the building blocks which constitute Audi connect are blazing a trail toward comprehensively networked automobiles.

Full version

Clean, safe and connected – Audi at Michelin Challenge Bibendum in Berlin

Under this year's slogan of "clean, safe, connected," the 11th Michelin Challenge Bibendum will be held in Berlin from May 18 to 22. Audi satisfies the slogan's requirements concerning mobility of the future via its "Audi balanced mobility" project, its modern assistance systems and its "Audi connect" initiative. Five of Audi's technological standard-bearers and series-production vehicles with alternative and highly efficient drives will take part in the rally races.

The Audi A8 3.0 TDI with 150 kW (204 hp)

Audi will soon add a new engine version to its A8 family: the 3.0 TDI with 150 kW (204 hp). This sophisticated and powerful new 3.0-liter TDI powers this luxury sedan while raising the efficiency bar.

The V6 diesel is a high-tech engine. It weighs far less than 200 kilograms (*441 lb*) and extensive measures minimize internal friction. Innovative thermal management – a feature of many Audi engines – is particularly complex in the 3.0 TDI. The crankcase and the cylinder heads have separate coolant circuits; coolant is not circulated within the block while the engine is warming up.

A common rail system with lightning-fast piezo injectors provides injection pressure up to 2,000 bar; the turbocharger and both camshafts' control times have been optimized for maximum efficiency. A start-stop system deactivates the engine as soon as the vehicle comes to a stop, and an energy recovery system stores energy during deceleration.

The new and efficient TDI in the A8 model line generates 150 kW (204 hp). Its maximum torque becomes available just above the idling point: 400 Nm (*295.02 lb-ft*) remain constant between 1,250 and 3,500 rpm. The 3.0 TDI propels the A8 from 0 to 100 km/h (*0 to 62.14 mph*) in 7.9 seconds en route to a top speed of 235 km/h (*146.02 mph*).

It consumes an average of only 6.0 liters of fuel per 100 km (*39.20 US mpg*), equivalent to 158 grams of CO_2 per km (*254.28 g/mile*).

This high efficiency is made possible not by the engine alone, but also the A8's low weight – yet another chapter in the success story of Audi's "ultra" lightweight-design strategy. This luxury sedan with its ASF body (Audi Space Frame) made of aluminum weighs a mere 1,795 kilograms (*3,957 lb*) with a new 3.0 TDI – by far the lowest weight in its segment.

The Audi Q5 hybrid quattro

With series production to begin in late 2011, the Q5 hybrid quattro is designed as a parallel hybrid – an impressively efficient concept. Its electric motor generates up to 40 kW (54 hp) of output and 210 Nm (*154.89 lb-ft*) of torque; the motor is directly behind the combustion engine, a 2.0 TFSI with 155 kW (211 hp). Both drive units can be disengaged by means of a clutch. The engine and the motor transfer their power to a heavily modified eight-speed tiptronic that does not need a torque converter. The disc-shaped electric motor occupies the space previously occupied by the torque converter.

The Audi Q5 hybrid quattro produces a combined total of 180 kW (245 hp) and 480 Nm (*354.03 lb-ft*) of torque, enough for sporty performance. This model sprints in just 7.1 seconds to 100 km/h (*62.14 mph*) and tops out at 222 km/h (*137.94 mph*). On average, it consumes 6.9 liters of fuel per 100 km (*34.09 US mpg*) and emits 159 grams of CO_2 per kilometer (*255.89 g/mile*). In electric mode, this sporty hybrid SUV is a zero-emission vehicle for the first three kilometers (*1.86 miles*) at 60 km/h (*37.28 mph*), and reaches a top speed of 100 km/h (*62.14 mph*).

The electric motor supports the TFSI when accelerating strongly, and acts briefly as a generator to recover energy during braking. The Audi Q5 hybrid quattro can also be powered by the combustion engine alone in addition to hybrid mode operation. At low engine speeds, this temporarily places a greater load on the TFSI than is necessary for driving – the load point moves into a higher range and the efficiency ratio improves. The excess torque benefits the electric motor, which now recharges the battery.

The driver of the Q5 hybrid quattro can choose between three driving modes. Special displays provide status information about the hybrid system. The air-conditioning compressor and the power steering switch to electric mode. The brake servo also uses an electric vacuum pump

The high proportion of electric driving achieved by the Audi Q5 hybrid quattro can be attributed primarily to the sophisticated battery cooling system. The lithium-ion battery, which stores 1.3 kWh of usable energy and weighs only 38 kilograms (*83.78 lb*), is located beneath the luggage compartment floor. Under most circumstances, two cooling circuits maintain the battery within a temperature range which enables it to fully tap its potential. The first cooling circuit uses temperature-controlled air from the vehicle's interior. Designed for higher temperatures, the other cooling circuit is coupled with the air conditioner and has its own integrated evaporator.

Another highlight of the Q5 hybrid quattro is the power electronics module, which converts the direct current of the battery into three-phase current for the electric motor. Compact and lightweight, it is located in the engine compartment. All told, this hybrid technology weighs in at less than 130 kilograms (*286.60 lb*). In fact, the Audi Q5 hybrid quattro's curb weight is below 2,000 kilograms (*4,409.25 lb*) – making it one of the market's lightest hybrid SUVs.

The Audi A1 e-tron

The Audi A1 e-tron is an electric car with a range extender – it is powered purely by electric motor. Audi created this four-seater specifically for transport in the world's rapidly growing megacities.

The electric motor, installed transversely at the front, supplies a continuous output of 45 kW (61 hp) and a peak output of 75 kW (102 hp), transmitted to the front wheels via a single-stage transmission. The peak torque of 240 Nm (*177.01 lb-ft*) is available right from the off. The A1 e-tron sprints from 0 to 100 km/h (*62.14 mph*) in 10.2 seconds and on to a top speed of more than 130 km/h (*80.78 mph*).

It draws its energy from a package of lithium-ion batteries arranged in a T pattern beneath the center tunnel and rear bench seat. The liquid-cooled battery supplies 12 kWh of energy. A charging process takes barely three hours with a 230V supply, and less than one hour with high-voltage current. While on the move, the driver determines the level of recuperation using five-stage shift paddles mounted on the steering wheel. The Audi A1 e-tron covers over 50 km (*31 miles*) on one battery charge.

For longer distances of up to 250 km (*155.34 miles*), there is a range extender on board: a small rotary-piston engine with a displacement of 254 cm^3 is mounted beneath the luggage compartment. Running at a constant 5,000 rpm, it recharges the battery via an alternator that generates up to 15 kW (20 hp) of electrical power.

The great strengths of the rotary-piston engine are its vibration-free, virtually noiseless operation, compact dimensions and extremely low weight. The entire assembly weighs just 65 kilograms (*143 lb*), including the alternator, the special power electronics, the intake, exhaust and cooling system, the acoustic encapsulation and the subframe. As per the draft standard for determining the consumption of range-extender vehicles, the Audi A1 e-tron consumes just 1.9 liters per 100 km (*123.80 US mpg*) – a CO_2 equivalent of 45 g per km (*72.42 g/mile*). Its tank can hold 12 liters of fuel (*3.17 US gallons*).

The amount of space available for passengers and cargo in the A1 e-tron is the same as in the production models. Details such as the roof made from carbon fiber composite material demonstrate Audi's expertise in lightweight construction.

The Audi A3 Sportback e-tron

The Audi A3 Sportback e-tron is an all-around vehicle for future mobility. A powerful electric motor and a lithium-ion battery impart to this compact car – which weighs less than 1.6 metric tons – agile performance and impressive cruising range. This technical study has already provided a preview of potential series-production solutions.

The permanent magnet synchronous motor in the A3 Sportback e-tron supplies a continuous output of 60 kW (82 hp) and a peak output of 100 kW (136 hp). Maximum torque is a potent 270 Nm (*199.14 lb-ft*), with the power delivered to the front wheels via a single-speed transmission.

Energy storage is provided by the lithium-ion battery, which is located in multiple blocks under the luggage compartment floor, under the rear seat and in the center tunnel. It stores 26.5 kWh of usable energy at 380 volts and weighs 300 kilograms (*661.39 lb*). Water flows around the 30 modules which constitute this battery; the waste heat is utilized to heat the vehicle's interior. At low temperatures, the system is aided by an electric PTC heating element; an air conditioner is activated in hot weather.

The power electronics module in the engine compartment converts the battery's direct current (DC) to alternating current; a DC converter couples the 12-volt electrical system with the high-voltage system. The Audi A3 Sportback e-tron can be recharged in about nine hours with a 230-volt household socket; 400-volt three-phase current reduces that to some four hours.

On a single battery charge, this compact car can cover around 140 km (*86.99 miles*). It powers the car from zero to 100 km/h (*62.14 mph*) in 11.2 seconds and on up to a top speed of 145 km/h (*90.10 mph*). The driver of an A3 Sportback e-tron can decide how sporty or economical driving should be by switching among three modes of operation – dynamic, auto and efficiency – as well as four settings which adjust the degree of energy recovery during braking and coasting phases.

This technology study, with a Glacier White paint finish, sports an understated appearance, with its set of wheels and the interior both borrowed from production models. Its special features include seat covers made of an Alcantara/leather blend – which feels warmer than pure leather in cold weather – and a heated windshield. The latter keeps the glass free of condensation and ice while heating the interior much more efficiently than a conventional climate-control system.

The Audi e-tron Spyder

The dynamic e-tron Spyder, a technical study by Audi, is designed as a plug-in hybrid. Located in the front end, its lithium-ion battery with an energy content of 9.1 kWh can be recharged via electrical outlet; the electric drive unit operates in tandem with a powerful combustion engine. Both power units can operate independently or in unison.

Two electric motors with a combined output of 64 kW (87 hp) and 352 Nm (*259.62 lb-ft*) of torque propel the front wheels. Behind the open, two-seat passenger cell is a 3.0 TDI with twin turbochargers. It generates 221 kW (300 hp) and 650 Nm (*479.42 lb-ft*) of torque, which is distributed by the seven-speed S tronic to the rear wheels.

All four wheels of the e-tron Spyder can be accelerated and braked individually, creating extremely precise, dynamic handling. The electric motors on the front wheels can be activated separately and a mechanical sport differential on the rear axle distributes the power. This form of “torque vectoring” marks a new advanced stage of the quattro principle – the e-tron quattro. The short wheelbase and low weight, achieved above all thanks to the aluminum body using the Audi Space Frame (ASF) construction principle, further hone its sporty character; the axle load distribution is 50 : 50.

The Audi e-tron Spyder sprints from 0 to 100 km/h (*62.14 mph*) in 4.4 seconds and goes on to reach an electronically governed top speed of 250 km/h (*155.34 mph*). As per the draft standard for plug-in hybrids, it consumes an average of only 2.2 liters of fuel per 100 km (*106.92 US mpg*), equivalent to 59 grams of CO_2 per km (*94.95 g/mile*). The electric range is 50 km (*31.07 miles*) and the top speed in that mode is 60 km/h (*37.28 mph*). With its 50-liter (*13.21 US gallons*) fuel tank, the open-top two-seater has a range of more than 1,000 km (*621.37 miles*).

The Audi Q5 HFC

Audi is also examining the potential offered by fuel-cell power systems – technology on board the Audi Q5 HFC, a technical study. The letters “HFC” stand for “Hybrid Fuel Cell.”

The concept car relies on synergies and consequently utilizes many technical components from the future hybrid models. Two high-pressure cylinders store hydrogen at a pressure of 700 bar. The polymer electrolyte membrane (PEM) fuel cell outputs 98 kW (133 hp). The lithium-ion battery has an energy content of 1.3 kWh. The drive is provided by two electric motors close to the wheels; together the motors produce a combined peak output of 90 kW and up to 420 Nm (*309.78 lb-ft*) of torque.

The Audi A3 TCNG

The Audi A3 TCNG, which will enter series production in 2013, will run on e-gas – the same synthetic methane gas which the brand with the four rings will manufacture itself via wind energy as part of the e-gas project.

The 1.4 TFSI engine and the exhaust system’s catalytic converter were modified for e-gas driving. The high octane rating of approx. 130 RON for this fuel facilitates a high compression ratio, which ensures high efficiency. The two steel cylinders beneath the luggage compartment store the gas at a pressure of 200 bar, which suffices for over 400 km (*248.55 miles*) of driving. Thanks to its bivalent configuration, the A3 Sportback TCNG can run on conventional gasoline if it runs out of methane; its total range thus exceeds 1,200 km (*745.65 miles*).

Compared to premium unleaded, the combustion of e-gas leads to far lower exhaust-pipe CO_2 emissions. The life cycle assessment across the entire fuel chain is even more impressive: Every gram of carbon dioxide emitted by the Audi A3 TCNG had been incorporated from surrounding air during the production of e-gas.

The life cycle assessment is excellent even if one includes the CO_2 emitted during the construction of engineering facilities. A well-to-wheel analysis shows that a compact car which runs on e-gas emits the equivalent of just 27 grams of CO_2 per kilometer (*43.45 g/mile*) – not much more than an electric car which runs on green power.

Via the “balanced cycle method” – similar to the purchasing of green power – A3 TCNG owners will be able to fill up their tanks with fuel produced via wind energy. When a driver refuels with e-gas, the corresponding amount of renewable energy required to produce said e-gas is fed into the grid.

Audi balanced mobility

Audi wants to take the lead in the automotive industry regarding sustainable approaches to the use of natural resources. Under the motto of “Audi balanced mobility,” the company is gearing its efforts to pursue a major goal: completely CO_2-neutral mobility.

The Audi e-gas project, the initial phase of which is now underway, is a cornerstone of the master plan. Audi is the world’s first premium automotive manufacturer to set up a portfolio of sustainable sources of energy – starting with wind power. This portfolio will be rounded out by clean power, hydrogen and methane. These three sources will make mobile the electric, fuel-cell and methane vehicles of the near future. This new technology offers additional, significant potential: it can aid the energy-supply industry in solving the problem of how to store clean power.

Wind turbines constitute the first component of the Audi e-gas project. Audi is investing in four large power plants at an offshore wind park in the North Sea. Each new wind turbine generates 3.6 megawatts and can collectively produce some 50 GWh of electricity annually – enough to meet the demand of a medium-sized city. Just a portion of this green power would be enough to manufacture 1,000 units of the A1 e-tron and propel them 10,000 km (*6,200 miles*) a year – as per the maxim that electric vehicles from Audi ought to run primarily on sustainably generated electricity.

The project's second component is Audi's e-gas plant. The first plant of its kind in the world is scheduled to go into operation in Werlte, Germany in 2013. Ground will be broken in July 2011; Audi is investing several tens of millions of euros in the plant's construction. Construction of additional plants is expected in the medium term. Four project partners are on board with Audi: Stuttgart's SolarFuel GmbH; the Centre for Solar Energy and Hydrogen Research (*ZSW*), also based in Stuttgart; the Fraunhofer Institute for Wind Energy and Energy System Technology (*IWES*) in Kassel, Germany; and EWE Energie AG.

The e-gas plant will comprise two main components, the first of which is an electrolyzer. It will run on clean power – some of which will be electricity generated by Audi's nearby wind turbines. Aided by polymer electrolyte membranes, the electrolyzer splits water into its components: hydrogen and oxygen. In the future, hydrogen can power fuel-cell vehicles such as the Audi Q5 HFC. Hydrogen is not, however, used directly during the project's first phase; it is instead placed into a storage tank and then the methanation unit.

The methanation unit thermochemically combines the hydrogen with carbon dioxide to create methane – synthetic natural gas. The e-gas plant is connected to a waste-biogas plant, which supplies the required CO_2 that would otherwise be emitted into the atmosphere and pollute it. Rated at 6.3 MW, the plant in Werlte is expected to produce some 1,000 metric tons of methane annually while consuming 2,800 metric tons of CO_2. In January 2011, Audi set up a lab facility in Werlte with an output of 25 kW for testing purposes. It was possible straightaway to manufacture methane of the required quality.

The methane created from renewable sources and known at Audi as e-gas is fed into Germany's natural-gas network and therefore the network of CNG stations as well, where methane replaces fossil-based natural gas imported from abroad. In the future, this new fuel will power Audi's specially modified natural-gas vehicles such as the A3 TCNG, scheduled to hit the market in 2013.

The projected quantity of e-gas produced at the plant could propel 1,500 units of the A3 TCNG 15,000 km (*9,320 miles*) annually – with 150 metric tons of e-gas left over.

This surplus can be stored in the public gas network and then be used as needed by other consumers such as block-type thermal power stations, which can utilize the surplus gas to produce green power and heat on overcast days with little wind.

The Audi e-gas project has the potential to solve the most pressing problem confronting Germany's sustainable energy-supply industry. Although the future belongs to renewable sources of energy, production is subject to natural fluctuations. Existing means of storage, such as pumped-storage power plants, can handle only a tiny fraction of renewable power, and the expansion of capacities will result in increasingly larger surpluses.
Methanation using renewable energy solves this problem: the power grid is coupled with the underground gas network, which can store surplus power supplies for months. The gas network bears tremendous potential: 220 terawatt hours (TWh) in contrast to electricity-storage systems, with a capacity at present of just 0.04 TWh. Energy can be discharged from the gas network, converted back to electricity, and returned to the power grid at any time, as needed.

Audi connect

The whole world is networking, and Audi is playing an integral role. Under the slogan Audi connect, the brand with the four rings is pooling all the solutions which connect its vehicles with the Internet, the driver and nearby infrastructure. Audi started equipping its vehicles with online services in late 2009 and has kept ahead of global competitors ever since.

For all telephone and online services by Audi, data transfer is handled by a UMTS module. It is integrated in the Bluetooth online car phone and transfers data at rates as high as 7.2 MB per second. The UMTS module also provides specially configured weather reports and the news as well as helps with travel planning. Audi passengers enjoy full access to the World Wide Web: a WLAN hotspot in the Bluetooth online car phone enables access for as many as eight mobile terminal devices, be they smartphones or laptops.

LTE (Long Term Evolution), the next-generation mobile communications standard, will transfer data much more quickly. Designed for transfer rates as high as 100 MB per second, it functions far faster than UMTS or DSL. Audi has already presented an A8 with this technology.

Some large models now feature a new service from Audi connect: Audi's online traffic information system keeps drivers abreast in real time of the traffic situation ahead in many European countries. This innovation relies on travel data generated by hundreds of thousands of on-the-road vehicles; data is then evaluated at a control center. If a driver enters their intended journey prior to departing, the system will depict the current traffic situation along the entire route. Depending on how much traffic is on a given stretch of road, it will be highlighted green, yellow, orange or red.

Such real-flow data represents a quantum leap over traditional TMC reports. Information not only is truly precise and up-to-the-minute, but also includes rural routes and especially cities. Audi's online traffic information system describes traffic jams in a handful of words and estimates how many minutes a delay will last. The insights it provides help to plan routes and offer alternatives. This service will first be available in Central Europe, France and Italy, with additional European countries to follow soon thereafter.

Audi and Google have been collaborating since 2005 – and their close cooperation has borne an array of attractive results. The elegant 3D map graphics displayed by the large navigation system in new models can interface with online images from Google Earth. Audi is currently the world's only automotive manufacturer to offer this service. The Google Street View function will soon become available in Germany. It allows the driver to preview their destination on the MMI screen from one of two perspectives: the driver's seat or a 360-degree view. This makes it far easier to get oriented.

Another new Audi connect service will facilitate the search for certain points of interest. This is an online, voice-controlled service known as Google POI Voice Search. The driver simply chooses a destination and specifies their interest – "Italian restaurant," for instance. This voice command is sent as a data packet to Google's search engines.

The on-board monitor will then display a diverse variety of results, many of which list a restaurant's telephone number and various pieces of additional information.

A further aspect of Audi connect concerns interfaces with the future e-tron models. Special smartphone apps will make it possible to remotely check the state of an e-tron's rechargeable battery or, in the summer, to efficiently air-condition the vehicle's interior while the battery is still recharging.

In the medium term, this function could evolve to include remote diagnostics: prior to a scheduled service appointment, the car will share with the dealership all key data regarding its condition. The spectrum of online communications offered by fully networked Audi vehicles will one day make the on-board storage of data all but superfluous; from music to navigational information, cars can retrieve all the data they need from servers.

Audi connect also stands for the new field of Car-to-X communication, a means for vehicles to network with other vehicles and the transportation infrastructure. Car-to-X technology bears tremendous potential for making traffic flow more safely and smoothly, thus conserving fuel.

Audi covered key fundamentals during the travolution project. In Ingolstadt, where Audi is headquartered, 25 traffic signals communicate with vehicles in a test fleet; these signals tell the vehicles when they will be changing and what the optimal speed is between each set of traffic signals. Such intelligently synchronized traffic lights can reduce CO_2 emissions at these intersections by 15 to 20 percent.

Audi is further bolstering its Car-to-X know-how in the scope of a large-scale test in the Frankfurt region: Germany's simTD project (Safe and Intelligent Mobility Test Bed Germany). The project partners, including five other German vehicle manufacturers, are hard at work on solutions for the future. For example, drivers will be warned of a traffic jam ahead, icy roads or a risk of collision at an upcoming intersection – or simply be notified about available parking spaces. Communication can be handled via LTE by a service provider or via automotive WLAN, a mobile communications standard which enables vehicles to spontaneously network with each other.

Along with future driver assistance systems, advancements regarding the building blocks which constitute Audi connect will establish the prospect of comprehensively networked automobiles. Such a futuristic Audi could significantly ease the burden on its driver: the vehicle could drive itself wherever conventional driving is not any fun – in stop-and-go traffic, for example.

Driver assistance systems

In many of its models, Audi offers a broad portfolio of cutting-edge driver assistance and safety systems. They are closely integrated both with each other and with other systems, which elevates these models to a new level of intelligence.

The Audi pre sense safety system is available in a variety of versions. In many situations it is capable of taking the sting out of accidents and their consequences or even preventing them altogether by warning the driver and braking the vehicle with escalating intensity in an emergency. Meanwhile the system closes the windows and sunroof, tautens the belts, activates the hazard warning flashers and selects firmer shock absorber settings for the optional adaptive air suspension.

Audi pre sense front operates closely with adaptive cruise control and the stop & go function. The radar-based distance control system accelerates the car and slows it down within certain limitations. It uses the signals from two radar sensors, a video camera and the ultrasonic sensors, as well as incorporating navigation data and analyzing a multitude of additional information. The operating range of ACC stop & go, the response of which can be finely tuned by the driver, ranges from rolling along in urban traffic right up to top speed.

At speeds of 30 km/h (*18.64 mph*) and above, Audi side assist employs radar to monitor traffic behind the vehicle in order to help the driver change lanes. The speed limit display recognizes maximum permissible speeds and depicts them on the driver information system’s screen or the optional head-up display.

The night vision assistant uses a thermal imaging camera. Its black-and-white images are presented on the DIS display, highlighting pedestrians identified in front of the vehicle. If the night vision assistant detects a potentially dangerous situation, it will highlight the pedestrian in question red – which is also visible on the optional head-up display.

There are two additional systems available for the A7 Sportback, the new A6, the new A6 Avant and the Q3. Audi active lane assist helps the driver to stay in lane at speeds above 60 km/h (*37.28 mph*). A camera identifies the lane markings on the road surface; if the car starts to approach one of them, the system gently corrects the steering.

The parking system, also new, reduces the driver's workload when parallel parking or parking at right angles to the road. It identifies suitable spaces either parallel to or at right angles to the road. The system guides the car automatically into and out of parking spaces – in several maneuvers if necessary.

Audi's assistance and safety systems mesh very closely with MMI navigation plus. The route data from the latter is a useful resource for the control units of the headlights, automatic transmission and ACC stop & go. These systems can thus identify complicated situations and proactively aid the driver. The tiptronic, for instance, knows not to shift up unnecessarily just before a bend, the highway light is activated as soon as a car enters the ramp to a highway, and adaptive cruise control performs smarter still.

Audi uses resources efficiently

Audi takes very seriously its responsibility to sustainably use natural resources. In addition to the e-gas project, many additional environmental commitments address every aspect of the automotive value-added chain – and beyond.

Audi runs its own environmental foundation and has planted forests near its production facilities in order to jointly research with scientific partners the conversion of CO_2 in trees. Audi is furthermore an associated partner of the Desertec Industrial Initiative, an international consortium which wants to produce solar power in the deserts of northern Africa and the Middle East.

Audi closely considers each and every individual step taken within the company as part of the big picture. Even during the development of the vehicles, Audi engineers are keenly focused on the environment. This is true not only of the individual parts and their assembly, but also the efficiency of manufacturing processes, the supplying of energy to production facilities, water cycles in the plants and logistics workflows.

The photovoltaic systems which generate electricity atop many Audi production facilities conserve resources, as does the highly efficient trigeneration power plant (power-heat-refrigeration) at the Ingolstadt site. And the trains which transport vehicles to the North Sea shipping port in Emden, Germany run on green power.

Of the emissions caused by a motor vehicle during its life cycle, some 70 percent occur during its operation. Audi is therefore working to continuously increase fuel efficiency. Great potential remains regarding TDI and TFSI engines – both Audi innovations – as well as automatic transmissions and the modular efficiency platform.

The brand's lightweight technologies – "ultra" in shorthand – similarly play a pivotal role in Audi's good life cycle assessment. The fuel savings which lightweight materials create more than offset the additional energy required to produce them. In order to substantiate that and to document all environmental impacts, Audi compiles life cycle assessments for its vehicles.

In the long term, customers' expectations will increasingly diverge – which is why Audi is diversifying its portfolio more and more. Today's combustion engines will be joined by specially modified TCNG engines, and second-generation biofuels will reduce the CO_2 emissions of other engines, too. This year, Audi will begin selling hybrid vehicles such as the Q5 hybrid quattro. They will be followed soon thereafter by the e-tron models, which can cover longer distances in purely electric mode.