



Communications Motorsport

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Audi R18 e-tron quattro: heading for Le Mans with all-wheel drive

- **Latest electrified generation of the successful all-wheel drive**
- **Audi sets benchmarks in terms of assembly space, weight and performance**
- **Four more weeks to go before the start of the Le Mans 24 Hours**

Ingolstadt, May 17, 2012 – In a month from now a prestigious success will be at stake for Audi. On June 16/17, a hybrid vehicle could be winning the Le Mans 24 Hours for the first time.

Electrified drive and quattro all-wheel drive – what looks like two different worlds at first glance has been merged into a technological synthesis by Audi. “Soon after the TDI phase had begun we started to think about the hybridization of a Le Mans sports prototype, when it was foreseeable that the regulations would open up this option,” explains Head of Audi Motorsport Dr. Wolfgang Ullrich. “After exploring the concepts we quickly saw the opportunity of bringing a new technological specification of all-wheel drive back into motorsport. Unfortunately, it had been banned from circuit racing since 1998.”

From 1981 to 1997, Audi won four titles in the World Rally Championship, clinched three victories at Pikes Peak, a championship win in the TRANS-AM, two DTM titles and eleven national Super Touring Car Championships plus a Touring Car World Cup with quattro models. For the first time since the 1998 ban an all-wheel drive model is now allowed to compete in the FIA’s circuit racing program.

Yet what sounds like a simply return has been one of the biggest tasks ever tackled by Audi Sport to date. Packaging an additional front-wheel drive and a hybrid system into a sports car is particularly difficult due to the space conditions. With a width of two meters and a length of 4.65 meters the car has large outer dimensions. But underneath the outer shell there is a monocoque construction which in motorsport has been quite classically optimized for totally different aspects than the integration of a drive axle and incorporation of a hybrid system.



Consequently, the achievements of the engineering team that has made the hybrid front-wheel drive reality are particularly impressive: for example, because the entire drive unit is installed inside the carbon fiber structure for optimal protection. Or because the monocoque has been stretched in forward length compared with the predecessor model. This shortens the crash structure in front of it which still has to successfully pass all crash tests, though. Or because of the extreme proximity to the driver, which requires special protection measures. Or because of the weight, as every gram counts in motorsports. Or because of the performance capabilities. Never before has such a small and light-weight system recovered so much energy.

With support from system partners, Audi has achieved a particularly compact MGU (motor generator unit) on the front axle. During energy recuperation, which is fully electronically controlled, drive shafts transmit the power to the inside of the MGU where the kinetic energy is converted into electric power during braking periods. The principle is similar to that of the commonly known dyno – albeit with extremely high energy flows. Converters integrated into the housing transform this energy from alternating into direct current which in turn drives a rotating mass storage device located alongside the driver. The energy is stored by the current accelerating this carbon fiber flywheel which runs in a high-vacuum to as much as 45,000 revolutions per minute. After cornering, this energy is available again to power the electric motors of the MGU unit which in turn drive the front wheels. Up to 150 kW of short-term power (204 HP) can be supplied to the front axle.

“The fact that in Audi’s Technical Development division ideas of driving the internal combustion engine and an axle via the electric motor have been in existence gave us strong motivation to steer the concept for the R18 e-tron quattro in this direction,” says Dr. Ullrich. “We’re convinced that by splitting the electric drive and the combustion drive between two axles we’re achieving a positive weight distribution in the vehicle while making use of at least some of the advantages of a quattro drive system. After presenting our concept to the ACO and the FIA for the first time we received a relatively quick response. They saw that in the case of our hybrid solution in combination with all-wheel drive the quattro factor certainly carries some weight. The FIA wanted to keep this within the limits of a reduced scope because its chief aim is hybridization, not the return of all-wheel drive. Therefore, a clause in the regulations was agreed that limits the advantage of a standard quattro drive when accelerating out of tight corners. The electrified axle may only be additionally used for acceleration above a speed of 120 km/h”

At the same time, the number of braking zones is specified by the FIA for each track. The prescribed 58-liter fuel tank capacity of the hybrid vehicle is two liters less than



that of the conventional car. Last but not least, the amount of energy that may be recuperated between two braking zones is limited to 500 kJ. “The FIA defines these intervention options for itself in order to create a balance between the hybrid vehicles and the conventional models. The effects vary from track to track and are difficult for us to judge at this point in time,” says Dr. Ullrich.

Dr. Ullrich’s conviction that this has been the right step outweighs these imponderables, though. There is even a bit of nostalgia involved. “I’m really happy that we managed to bring quattro back into motorsport. It was the system I started my first hours in the Super Touring Car project at Audi Sport with,” explains the head of motorsport. “Audi proved back then that all-wheel drive offers an advantage on any track in any weather even with low engine output, just like our customers can experience it on the road every day as well. It’s nice that we’re bringing a form of quattro back into motorsport even though, to put it in jest, we’re only allowed to compete with ‘part-time’ quattro at the moment.”

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The Audi Group delivered 1,302,659 cars of the Audi brand to customers in 2011. In 2011 the Company posted revenue of €44.1 billion and an operating profit of €5.3 billion. Audi produces vehicles in Ingolstadt and Neckarsulm (Germany), Győr (Hungary), Changchun (China) and Brussels (Belgium). The Audi Q7 is built in Bratislava (Slovakia). In July 2010, CKD production of the Audi Q5 was added to the existing Audi A4 and A6 manufacturing operations in Aurangabad (India). At the Brussels plant, production of the Audi A1 has been running since May 2010, while production of the new A1 Sportback began in 2012. The Audi Q3 has been built in Martorell (Spain) since June 2011. The Company is active in more than 100 markets worldwide. AUDI AG’s wholly owned subsidiaries include AUDI HUNGARIA MOTOR Kft., Automobili Lamborghini S.p.A. in Sant’Agata Bolognese (Italy), AUDI BRUSSELS S.A./N.V. in Brussels (Belgium) and quattro GmbH in Neckarsulm. Subject to a positive decision by the responsible competition authorities, the Italian sports motorcycle manufacturer Ducati Motor Holding S.p.A. will also belong to the Audi Group. Audi currently employs around 64,000 people worldwide, including around 48,000 in Germany. Between 2012 and 2016 the brand with the four rings is planning to invest a total of €13 billion – mainly in new products and the extension of production capacities – in order to sustain the Company’s technological lead embodied in its “Vorsprung durch Technik” slogan. Audi is currently expanding its site in Győr (Hungary) and will start production in Foshan (China) in late 2013 and in Mexico in 2016.

Audi has long been fulfilling its social responsibility on many levels – with the aim of making the future worth living for generations to come. The basis for Audi’s lasting success is therefore formed by environmental protection, the conservation of resources, international competitiveness and a forward-looking human resources policy. One example of AUDI AG’s commitment to environmental issues is the Audi Environmental Foundation. Within the context of “Vorsprung durch Technik,” which extends far beyond its products, the Company is directing its activities toward a major goal – comprehensive CO₂-neutral mobility.