

# PROGRESS

## BUILDING BRIDGES

### TO A SUSTAINABLE FUTURE

ACHIEVING HIGHER FUEL EFFICIENCY and reducing CO<sub>2</sub> greenhouse gases are imperatives of our times. That's why Audi is actively engaged in developing the solutions that will shape our driving future, while also taking measurable steps toward achieving these imperatives with Audi models today. Even as far-reaching propulsion systems are being explored, an important distinction at Audi is the use of advanced technologies and strategies that can be implemented today at reasonable cost...with no breakthroughs required. Turn the page to learn more.



Audi  
Truth in Engineering



# ADVANCED STRATEGIES

## TOMORROW'S GOALS ACHIEVED AT AUDI TODAY



THE GOAL IS CLEAR. Drivers want higher fuel efficiency without compromise. Lower environmental impact is fundamental, yet the joy of driving must not be sacrificed along the way. That's a tall order. It's also one that speaks to Audi, where efficiency and performance are inextricably linked.

### ADVANCED POWERTRAINS

The heart of any vehicle is the engine that powers it. Engines of today bear more scrutiny, and require greater engineering, than at any point in the 100-plus year history of the motor vehicle. In Audi models, engine design addresses the diverse needs of higher fuel efficiency, lower emissions, satisfying levels of power, and the many

### LIGHTWEIGHTING IS IMPORTANT FOR MEETING FUEL ECONOMY AND PERFORMANCE GOALS.

characteristics expected of a performance and luxury brand.

Audi is the first automaker in the U.S. to equip all of its gasoline engines with FSI direct injection technology, beginning with 2010 models. The technology – which injects fuel directly into the combustion chambers rather than introducing it through an intake manifold – has proven itself in racing over the past decade. It first came to U.S. Audi production models in 2004. Audi's FSI spark-ignition gasoline engines benefit from increased torque and power along with reduced exhaust emissions, plus up to a 15 percent increase in fuel economy.

Advanced diesel engines have long been an important element in Audi's vehicle lineup. In fact, Audi was the first German auto manufacturer to combine turbocharging with diesel engine technology

20 years ago. Today, a new generation of TDI® Audi models is coming to U.S. highways, beginning with the 2010 A3 TDI and Q7 TDI. These vehicles are powered by engines distinguished by their high torque and spirited driving characteristics, quiet and refined operation, and 50-state clean diesel emissions certification.

Audi's clean diesel models offer up to 50 percent better highway fuel economy and a corresponding decrease in CO<sub>2</sub> greenhouse gases versus comparable gasoline engines. Plus, Audi clean diesel models can run on biodiesel blends up to B5. The A3 TDI achieves an EPA estimated 42 mpg in highway driving, the kind of impressive fuel economy often associated with hybrids...without the complexity of two different drive systems. According to U.S. EPA estimates, if just a third

of the vehicles on American highways ran on clean diesel, the country would use an astonishing 1.5 million fewer barrels of oil every day.

### TOTAL ENERGY MANAGEMENT

Audi strategies that focus on improving a vehicle's total energy management and drivability already are appearing in various markets around the world and making a difference throughout the model line. These efficiency measures range from optimized aerodynamics and high-efficiency transmissions and air conditioning to technologies like the Audi valvelift system, which elegantly provides variable valve lift for greater efficiency and lower emissions.

An energy recovery system on many Audi models converts kinetic energy into electrical power during deceleration. This energy is temporarily

stored in the battery, and during acceleration is directed back into the vehicle's electrical system to relieve the alternator. The result is less parasitic load on the engine and improved fuel economy. A new start-stop system shuts down the engine on some Audi models when stopped to save gas and emissions, and then restarts the engine seamlessly when a driver operates the clutch. Working in tandem with the Audi Driver Information System, a new on-board computer with efficiency program continuously analyzes energy consumption and presents a driver with recommendations for efficient driving.

As inventor of the self-supporting aluminum Audi Space Frame (ASF®) technology, it should be no surprise that Audi places a strong emphasis on lightweighting and extensive use of aluminum. Today, lightweighting is one of Audi's most important core competencies. It already shows in key models with use of advanced ASF technology and an array of lightweight materials like aluminum, magnesium, and honeycombed or carbon fiber-reinforced plastics.

Lightweight design benefits driving dynamics, passive safety, and of course fuel efficiency since a lighter weight vehicle requires less energy to move down the road. Lightweighting is an important strategy for meeting higher fuel economy targets in Audi models of all types, and it's especially crucial for offsetting battery weight in coming electric drive vehicles.

The synergies of efficiency, energy management, lightweighting, and performance were underscored earlier

this year when Audi won the second heat of the RCN Green Challenge held at the Nürburgring race track in Germany. Here, a pair of Audi TT quattro® TFSI models with 2.0-liter engines posted first and fourth place finishes, with the front-running TT Coupe achieving 30.55 mpg at speed and beating the competition's benchmark city fuel consumption standard by 28 percent.



# ACCELERATING ENVIRONMENTAL PERFORMANCE

Audi's dynamic environmental policy focuses on continuously lessening the impact of its products and manufacturing facilities on the natural world. Far from a vague set of principles, this includes some very important milestones like reducing the CO<sub>2</sub> emissions of the Audi vehicle fleet some 20 percent by the year 2012.

On the manufacturing side, conservation and efficiency improvements alone have enabled Audi to keep energy requirements essentially constant since 2003, even as auto production has increased by about 10 percent. To operate more sustainably, Audi's Ingolstadt manufacturing plant in Germany is working with the Stadtwerke municipal utility to utilize an additional 120,000 megawatt-hours of unused waste heat for its operations, effectively doubling the plant's use of waste heat and reducing annual CO<sub>2</sub> emissions by 26,000 metric tons.

## DRIVING THE FUTURE

The array of technologies and fuels that may drive the future could



Audi is investing in future technologies in other ways. One example is hiring an additional 100 young engineers to focus on electric mobility through the ePerformance development project, a program supported by the German Federal Ministry of Education and Research. Specific areas of focus include electronics, battery technology, and power electronics.

A high-profile example of Audi's vision is provided by the lithium-

## AUDI IS REDUCING THE CO<sub>2</sub> EMISSIONS OF ITS VEHICLE FLEET SOME 20 PERCENT BY 2012.

ion battery powered e-tron, a high-performance sports car concept featuring all-wheel electric drive, great driving dynamics, and of course zero-emission motoring. The e-tron's 313-horsepower electric drivetrain provides scintillating performance, while its systemic lightweight construction of aluminum and carbon fiber-reinforced composites ensures rigidity and light weight. While this concept may be forward-looking, like many Audi explorations it also shares a view of things to come since much of the advanced construction technology will soon be used in similar form for Audi production vehicles.

be as diverse as the world markets in which Audi models are sold today. Audi continues to explore a complete portfolio of fuels ranging from standards like gasoline and clean diesel to alternatives including biodiesel, bioethanol, natural gas, hydrogen, and electricity. Because of its inherent efficiency, electric drive is being investigated in various ways – on its own in the form of battery electric drive and in hybrid configurations with other fuels and technologies. Audi is committed to hybrid vehicle development and will introduce its first production hybrid model in 2011.

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