

*This press pack accompanied the UK launch of the first generation Lexus GS 450h in May 2006. Some changes were made to the model range during its time on sale, which can be tracked using the Timeline feature available on the Lexus GS 450h archive web page. Additional assets and information relating to the GS 450h may be obtained from the Lexus press office if required.*

## **THE NEW LEXUS GS 450h**

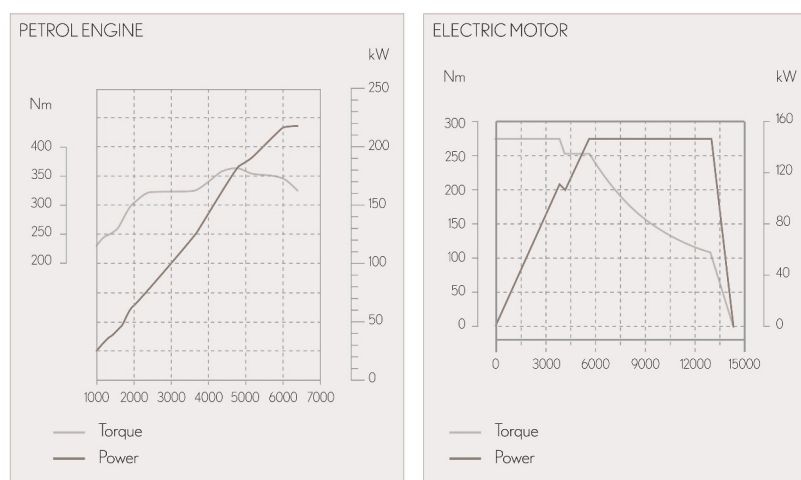
### **KEY POINTS**

- The world's first rear-wheel drive full hybrid power sports saloon
- Lexus Hybrid System developed to combine a 3.5-litre V6 petrol with a high-output electric motor
- First production engine in the world to feature D-4S twin-injector system
- Performance matches conventional V8 petrol competitors, but with significantly lower fuel consumption (35.8mpg combined cycle) and CO<sub>2</sub> emissions (186g/km)
- Lowest combined nitrogen oxides and hydrocarbons emissions of any internal combustion engine
- Low emissions secure class-leading benefit-in-kind rating for company car tax
- Maximum engine output 292bhp (296 DIN hp), maximum electric motor output 197bhp (200 DIN hp), combined system maximum output 341bhp (345 DIN hp)
- Engine produces 368Nm of torque and electric motor 275Nm
- Nought to 62mph acceleration in 5.9 seconds, maximum speed 155mph
- E-CVT transmission with sequential braking mode
- Vehicle Dynamics Integrated Management (VDIM) co-ordinates braking, stability and traction control systems with Adaptive Variable Suspension (AVS) and Variable Gear Ratio Steering (VGRS) to maintain vehicle stability up to the performance limit
- 50:50 weight distribution between front and rear axles, taking driver into account
- Advanced suspension system with Adaptive Variable Suspension (AVS) with non-linear H<sup>∞</sup> control logic
- 10 airbags standard on all models, including front knee airbags; additional rear side airbags standard on SE and SE-L models
- Adaptive Front-lighting System (AFS) standard on all models
- Pre-Crash Safety (PCS) system with Adaptive Cruise Control (ACC) standard on SE-L grade
- Lexus Multimedia and Navigation System (SE and SE-L models) combining Mark Levinson surround sound system for CD and audio/video DVD, new-generation satellite navigation and the Lexus Parking Assist Monitor
- Electro Multi Vision (EMV) touch screen with Bluetooth phone connectivity
- Smart keyless entry system with programmable electronic key
- Unique-in-class fully electric dual-zone air conditioning system
- GS 450h distinguished by features including 18-inch alloy wheels, boot spoiler and dedicated badging
- On sale in the UK from 19 May 2006
- Three equipment grades, GS 450h, SE and SE-L
- On-the-road prices from £38,015 (GS 450h)
- Currently exempt from London Congestion Charge

## LEXUS HYBRID DRIVE

Lexus Hybrid Drive is the new name adopted to identify Lexus's hybrid power technology. In essence it represents a paradox: delivering high performance with fuel efficiency and emissions levels beyond the capabilities of comparable, conventionally powered vehicles.

The GS 450h has a completely new, front engine, rear-wheel drive, series/parallel hybrid powertrain. It uses a 3.5-litre V6 petrol engine with a new D-4S (Direct-injection 4-stroke Superior-version) twin injector system with Dual VVT-i (Variable Valve Timing – intelligent), developing 292bhp (296 DIN hp) and 368 Nm of torque, mated to a compact, high-output, permanent magnet electric motor that generates 197bhp (200 DIN hp) and 275Nm of torque right from standstill.



With a combined power output of 341bhp (345 DIN hp), the GS 450h is not only the world's most powerful production hybrid car, but also the first to achieve the 100 DIN hp per litre benchmark.

In addition to the petrol engine and electric motor, the Lexus Hybrid Drive system also features a generator, a high-performance 288V nickel-metal hydride battery, a Power Split Device and a new, compact Power Control Unit that is no larger than an auxiliary 12V battery (and 63 per cent smaller than the one used in the RX 400h).

The hybrid transmission incorporates a two-stage motor speed reduction gear, a feature exclusive to the GS 450h. The mechanism is similar to a very compact automatic gearbox and generates maximum low-gear torque for significantly better acceleration, and extended high-gear performance for quiet, high-speed cruising with improved fuel efficiency.

The electric motor, generator, Power Split Device and two-stage motor reduction gear are all housed in a single, lightweight, compact longitudinal transmission casing that is just one centimetre longer than the six-speed manual transmission in the Lexus IS.

Another world-first is the GS 450h's Electronically-controlled Continuously Variable Transmission – E-CVT – with sequential shift mode. Each of the six sequential 'steps' gives sharper engine braking force, in the manner of a conventional automatic gearbox in sequential mode. This improves vehicle control and the sports driving experience.

The GS 450h can accelerate from nought to 62mph in 5.9 seconds and from 50 to 75mph in 4.7 seconds, maintaining linear acceleration all the way on to a top speed of 155mph, with none of the typical 'jumps' between gears experienced in a conventional drivetrain.

At the same time, the GS 450h is substantially more frugal than comparable V8 models, returning 35.8mpg in combined cycle driving, fuel consumption that is on a par with D-segment petrol cars. Carbon dioxide emissions are 186g/km, which matches the performance of four-cylinder economy diesels in the premium segment, and combined emissions of nitrogen oxides (NOx) and hydrocarbons (HC) are lower than for any other vehicle powered by a combustion engine at 0.01g/km.

## **DRIVING DYNAMICS**

The new, third generation Lexus GS uses a platform with exceptional torsional stiffness. In the GS 450h this provides an excellent base for the installation of the Lexus Hybrid Drive system, with 50:50 front-to-rear weight distribution. It also has a better moment of inertia compared to the GS 430 model, as the 3.5-litre V6 is 17 per cent lighter than the 4.3-litre V8. These aspects contribute to the car's more dynamic, agile handling.

Positioning the hybrid system's battery directly above the rear axle aids rear-wheel grip and traction, qualities that are further enhanced by the use of a limited-slip differential.

The Electric Power Steering (EPS) incorporates Variable Gear Ratio Steering (VGRS), which alters the steering gear ratio according to vehicle speed. This gives minimal steering effort at low speeds, with improved feel and feedback as speed increases. The VGRS system is linked to the Adaptive Variable Suspension (AVS) and Lexus's Vehicle Dynamics Integrated Management (VDIM) system, helping maintain stability and increasing driver enjoyment up the limit of the car's performance capabilities.

The sophisticated front double wishbone and rear multilink suspension design includes an Adaptive Variable Suspension (AVS) system, with a choice of Sport and Comfort settings. Sport mode increases the difference between inner and outer shock absorber damping through corners to help reduce body roll. At the same time, the Variable Gear Ratio Steering (VGRS) reduces the steering gear ratio and the Electric Power Steering increases steering assist torque to compensate for the increase in steering effort. Ride also benefits from non-linear  $H_{\infty}$  control of all four shocks in response to changes in road surface quality.

## **SAFETY**

SE-L versions of the GS 450h feature Lexus's Pre-Crash Safety (PCS) system, which primes the front seatbelts and emergency braking when an unavoidable frontal collision is detected. This works in tandem with Adaptive Cruise Control (ACC), which automatically matches the speed of the GS 450h to that of the vehicle ahead, maintaining a safe distance.

The GS 450h is also equipped with the latest generation of Lexus's Vehicle Integrated Dynamics Management (VDIM), which co-ordinates the ABS, Electronic Brakeforce Distribution (EBD), Traction Control (TRC) and Vehicle Stability Control (VSC) with the Active Variable Suspension (AVS), Electronic Power Steering (EPS) and Variable Gear Ratio Steering (VGRS) to improve vehicle stability and handling, up to its performance limits.

The passive safety package includes a class-leading complement of front, knee, side and curtain airbags, augmented on SE and SE-L versions by additional side airbags for the outer rear seats. Four lateral collision sensors enable impact severity to be assessed before the side airbags are triggered.

In addition, the front and outer rear seats are equipped with seatbelts with pretensioners and force limiters.

The GS was rated best in class with a Euro NCAP 5-star rating for passenger crash protection.

## **DESIGN AND REFINEMENT**

The GS 450h can be identified as the high performance flagship of the GS range by its discreet bootlid spoiler, 'Hybrid' badging to the rear of the sills and bespoke 18-inch alloy wheels.

Inside the cabin, the GS 450h benefits from the same attention to detail applied to the other models in the GS range, with the design and operation of controls and features with optimum ease and refinement.

## **CONVENIENCE AND ENTERTAINMENT**

The GS 450h is equipped with a comprehensive range of technologically advanced equipment, designed both to simplify and enhance life on board. These include Smart Key access, sequenced interior lighting as driver or passengers enter or leave the vehicle, push-button engine start-up and steering-sensitive parking sensors.

It also features the only fully electric climate control air conditioning system in its segment, reducing the impact on fuel economy and performance compared to conventional systems.

In the cabin, the instrument panel remains clearly visible in all light conditions, thanks to the new Electronic Chromatic Device (ECD). This uses a light sensor in the high-mounted stop light to gauge the ambient light level and adjust the brightness of the Optitron instrument dials accordingly.

SE and SE-L models are fitted as standard with the new Lexus Multimedia and Navigation package. This includes a 14-speaker Mark Levinson Premium Surround System with six-disc DVD autochanger, Bluetooth connectivity and the Lexus Parking Assist Monitor.

The latest generation Lexus Navigation System delivers faster route calculation and clearer graphics, using enhanced display technology via a seven-inch Electro Multi Vision (EMV) touch-screen. Voice commands can be used to control navigation, audio, air conditioning and hands-free telephone functions.

## **INNOVATIONS**

Reflecting Lexus's pursuit of perfection, the GS 450h marks a number of world and European firsts in powertrain technology, safety and equipment.

### **D-4S (Direct-injection 4-stroke Superior version)**

The 3.5-litre V6 is the world's first production petrol engine to feature two injectors per cylinder, combining the benefits of direct injection and port injection and achieving better performance and fuel efficiency and lower exhaust emissions.

### **E-CVT with Sequential Shift Brake Mode**

The GS 450h is equipped with the first hybrid transmission to offer a sequential operation mode, giving performance like that of sequential selection in a conventional automatic gearbox.

### **Electric Climate Control**

The Lexus GS 450h is the first car in its segment to be equipped with a fully electric climate control system, with an electric compressor and water pump. This reduces the burden on the car's performance and fuel economy.

### **Electronic Chromatic Device (shared with GS 300/430)**

A light sensor in the high-mounted stop light monitors local light conditions and automatically adjusts the intensity of the Optitron display to ensure the instrumentation can be clearly seen under all conditions.

### **Knee Airbags (shared with GS 300/430)**

Driver and front passenger knee airbags are fitted as standard, part of a class-leading airbag package.

### **Lexus Hybrid Drive**

The GS 450h is the first car in its class to be powered by a hybrid system.

### **Parking Assist Sensors – Steering Guided (shared with GS 300/430)**

The front parking sensors adapt their scanning direction in line with the vehicle's steering angle, giving better detection of obstacles. The system also gives the driver visual guidance on steering into parking places.

### **Parking Assist Monitor (shared with GS 300/430)**

A rear colour camera feeds a real time view of the area behind the vehicle to the dashboard display screen to make reversing easier and safer. The driver can also follow superimposed guidelines indicating the vehicle's path for simpler and more accurate parking manoeuvres.

### **Surround Sound System with DVD Player**

The Mark Levinson hi-fi is the first in-car audio system in its class to feature Dolby digital 5.1 and DTS 5.1 surround sound capability. It can also play movie and audio DVDs via a six-disc DVD autochanger.

### **Two-stage Motor Speed Reduction Gear**

Using a two-stage motor speed reduction gear – a mechanism that is similar to a very compact automatic gearbox – it is possible to choose between two different gear ratios, which maximises low-speed torque for significantly improved acceleration, and extended high gear performance for quiet, high speed cruising with better fuel efficiency.

### **Vehicle Dynamics Integrated Management (shared with GS 430)**

Vehicle Dynamics Integrated Management (VDIM) is the world's most sophisticated stability control system. As well as increasing safety through co-ordinated activation of the Adaptive Variable Suspension and Variable Gear Ratio Steering, it can predict dynamic instability and intervene to avoid or minimise the risk of a loss of vehicle control.

## PRODUCT CONCEPT AND MARKET INFORMATION

- The world's first rear-wheel drive full-hybrid power car
- Class-leading UK company car tax performance
- On-the-road prices from £38,015 (GS 450h)
- Three equipment grades, GS 450h, SE and SE-L
- On sale in the UK from 19 May

The new Lexus GS 450h will become the second production model to benefit from the technical sophistication and high-performance attributes of Lexus Hybrid Drive engineering, following the launch last year of the RX 400h.

It is the world's first full hybrid power vehicle to feature a classic front-engine, rear-wheel drive configuration for sports driving dynamics and it breaks the mould in the luxury market by delivering a level of performance that falls between conventional premium segment V8s and their high-performance counterparts, with fuel efficiency comparable to petrol D-segment machines.

The GS 450h redefines the high-performance luxury saloon, integrating the world's most technologically advanced powertrain in a car that perfectly expresses the elegant simplicity of Lexus's contemporary L-finesse design philosophy. It fully embraces the fundamental Lexus values of uncompromised luxury, safety, refinement, quality and ride comfort.

The designation '450' does not indicate engine capacity, but recognises power output comparable to a conventional, Lexus-standard 4.5-litre V8 petrol engine. The 'h' suffix indicates the car uses the Lexus Hybrid Drive system.

In Europe, the GS was Lexus's second best-selling range in 2005, accounting for 21 per cent of all brand sales. The year-end total of 6,145 units represented a seven-fold increase in the previous year, while this year

the figure is expected to rise above 6,800 units – a 12 per cent increase – with the new 450h claiming 29 per cent of that total.

In the UK, the launch of the new GS in April 2005 revitalised the range, with year-end sales figures up by almost 700 per cent to 1,820 units. For the remainder of 2006 Lexus expects to sell 700 GS 450h models, accounting for 40 per cent of all GS sales. In 2007 the annual total is expected to rise to 750 units.

## **PRICING AND INSURANCE**

The new GS 450h goes on sale in the UK on 19 May with on-the-road prices from £38,015 for the entry-level model. Details of pricing and insurance groups are given in the table below.

<b>MODEL</b>	<b>OTR PRICE</b>	<b>INSURANCE GROUP</b>
GS 450h	£38,015	17E
GS 450h SE	£43,920	17E
GS 450h SE-L	£46,765	18E

## **CLASS-LEADING COMPANY CAR TAX RATING**

Traditionally there is a high price to be paid by any motorist who seeks performance, prestige and luxury from his or her company car, not just in terms of the purchase cost, but also in the year-on-year tax burden. The new Lexus GS 450h enters the premium executive segment with tax rates that will save drivers thousands of pounds each year compared to the bills incurred by competitor models.

The key factors which make the financial argument for the GS 450h so strong are the low carbon dioxide emissions from the hybrid powertrain and the exceptional value its list price represents.

Emitting 186g/km of carbon dioxide, the GS 450h SE incurs a benefit-in-kind rate for company car tax of 21 per cent. With a list price of £43,920, that produces an annual tax bill of £3,672.

Owners of the BMW 550i SE, Audi A6 4.2 quattro and Mercedes-Benz E500 pay the penalty for their vehicles' higher emissions and higher list price: consequently tax bills are between £2,469 and £2,641 a year more than for the Lexus. And there is little comfort for owners of premium diesel models either: the Audi A6 3.0 TDi quattro attracts a top-line 35 per cent rating and the BMW 535d SE 32 per cent.



LEXUS GS 450h COMPETITOR COMPANY CAR TAX COMPARISONS

MODEL	LEXUS GS 450h SE	AUDI A6 4.2 quattro	AUDI A6 3.0 TDI	BMW 550i SE	BMW 535d SE	MERCEDES - BENZ E500
Engine	3.5 V6 hybrid	4.2 V8 petrol	3.0 V6 diesel	5.0 V8 petrol	3.0 in-line 6 diesel	5.0 V8 petrol
Max. power (bhp)	341	335	225	367	272	272
Max. torque (Nm)	368*	420	450	490	560	306
Transmission	E-CVT	6-speed automatic	6-speed automatic	6-speed automatic	6-speed automatic	7-speed automatic
Acceleration 0-62mph (sec)	5.9	6.1	7.3	5.6	6.5	6.0
Fuel consumption						
Urban	30.7	16.9	23.5	17.8	25.9	16.3
Extra urban	39.2	31.3	43.5	36.2	44.8	33.7
Combined	35.8	23.9	33.2	26.2	35.3	25.5
CO <sub>2</sub> emissions (g/km)	186	283	229	260	211	258
<b>BIK tax rate (2006/7)</b>	<b>21%</b>	<b>35%</b>	<b>35%</b>	<b>35%</b>	<b>32%</b>	<b>35%</b>
Insurance group	17E	18A	16E	20A	18A	19D
List price	£43,920	£44,165	£31,410	£44,065	£37,765	£45,295
<b>Tax payable (2006/7)</b>	<b>£3,672</b>	<b>£6,155</b>	<b>£4,369</b>	<b>£6,141</b>	<b>£4,808</b>	<b>£6,313</b>

\*Petrol engine only – electric motor generates 275Nm

Figures correct as at April 2006

**SUPERIOR SPECIFICATIONS**

True to Lexus’s reputation for providing class-leading specifications, the new GS 450h outperforms its market rivals in terms of standard equipment, delivering exceptional value for money.

Taking the GS 450h SE as an example, purchasers of key rival models would have to pay up to an extra £9,400 in order to match the Lexus specification. Even then, a number of key items would not be available to them, for example the six-disc DVD autochanger, the Vehicle Dynamics Integrated Management system and front knee airbags.

The BMW 550i SE has an on-the-road price marginally higher than the GS 450h SE, but the value gap rapidly expands when the cost of features such as touch-screen satellite navigation (£1,825), Bluetooth connectivity (£465) and High Intensity Discharge headlamps (£720) are taken into account.

For the owner of the Audi A6 4.2 quattro SE Tiptronic, the picture is bleaker still, having to find extra funds for everything from electric steering wheel adjustment to a six-disc CD autochanger. Full details of the

comparative specifications and pricing are given in the table below.

LEXUS GS 450h SE COMPETITOR SPECIFICATION COMPARISONS

MODEL	LEXUS GS 450h SE	JAGUAR S-Type 4.2 V8 SE	MERCEDES-BENZ E500 Elegance	BMW 550i SE	AUDI A6 4.2 quattro SE Tiptronic
OTR price	£43,920	£38,540	£45,295	£44,065	£44,165
E-CVT/automatic transmission	✓	✓	✓	£1,450	✓
Adaptive Front-lighting system	✓	✗	£890	£305	£325
Electro Multi Vision touch-screen display	✓	✓	Not touch-screen	Not touch-screen	Not touch-screen
Premium Hi-fi system	✓	£640	£510	✗	£325
DVD touch-screen satellite navigation with ETA	✓	£2,235	£1,990	£1,825	£1,750
Bluetooth connectivity	✓	✓	✗	£465	£400
Rear parking monitor	✓	✗	✗	✗	£575
6-disc DVD autochanger	✓	✗	✗	✗	✗
18-in alloy wheels	✓	£1,000	✗	£1,045	£1,000
Electric steering wheel adjustment	✓	✓	✓	✓	£300
High Intensity Discharge headlamps	✓	£700	✓	£720	✓
Smart Key keyless entry	✓	✗	✓	✓	£800
Tyre pressure warning system	✓	✗	£245	✓	£400
Wood trim inserts	✓	✓	✓	✓	✓
Electric rear sunshade	✓	£300	£375	£215	£225
Power front seat adjustment	✓	✓	✓	£820	✓
Heated front seats	✓	£330	£820	✓	✓
Ventilated front seats	✓	✗	✓	✓	✗
Memory function for driver's seat, door mirrors and steering wheel	✓	✓	£1,045	£605	£750
Leather upholstery	✓	✓	✓	✓	✓
Steering-guided parking sensors	✓	£560	£605	✗	✗
Front knee airbags	✓	✗	✗	✗	✗

Rear side airbags	✓	✗	£320	£230	£250
Rain-sensing wipers	✓	✓	✓	✓	✓
Rear lip spoiler	✓	✗	✗	✗	✗
Whiplash Injury Lessening front seats	✓	✗	✗	✓	✗
Cruise control	✓	✓	✓	✓	✓
Variable Gear Ratio Steering	✓	✓	✗	£850	✗
Electronically Controlled Braking	✓	✗	✗	✗	✓
Adaptive Variable Suspension	✓	✗	£1,265	✗	£1,500
Vehicle Dynamics Integrated Management	✓	✗	✗	✗	✗
Leather steering wheel and gearshift trim	✓	✓	✓	✓	£475
<b>Specification adjusted price</b>	<b>£43,920</b>	<b>£44,305</b>	<b>£53,360</b>	<b>£52,640</b>	<b>£53,140</b>
Absolute specification adjustment vs GS 450h SE	-	£385	£9,440	£8,720	£9,320
<b>Price position vs GS 450h SE</b>	-	<b>0.9%</b>	<b>21.5%</b>	<b>19.9%</b>	<b>21.2%</b>

Data correct at March 2006

## COLOURS AND OPTIONS

The new Lexus GS 450h is offered with a choice of nine colours, matching the range available for the GS 300 and GS 430, plus a new shade, Nordic Blue, exclusive to the model. The cars are so well equipped that the only key options are mica or metallic paint finishes; leather upholstery (GS 450h); electric sunroof (GS 450h SE); and a Wood Pack steering wheel and gear knob trim (GS 450h SE-L).

## SERVICE INTERVALS AND WARRANTY

The new GS hybrid system itself is maintenance free, as are the fuel filters, and the oil in the transmission does not require changing. The air filter is designed to last for 40,000 miles before changing, engine coolant replacement intervals are every 100,000 miles, and spark plugs are scheduled for changing at 60,000 miles. The GS 450h is also designed to run on mineral grade oil rather than the more expensive synthetic kind.

Service intervals are every two years/20,000 miles, with a health and safety inspection annually or every 10,000 miles, including an oil and filter check. This schedule optimises the component replacement cycle and

also ensures owners are able to enjoy the full benefit of Lexus's legendary customer care, acknowledged by five successive Gold Awards in the annual J.D. Power and Associates survey.

The GS 450h may have a more technically sophisticated and advanced powertrain than any other car on the market, but that does not put it at a greater risk of component failure. This is backed up by figures showing that repair incidences for the high voltage battery, inverter and transmission of hybrid power are minimal, affecting less than 0.5 per cent of vehicles sold since 2000. The GS 450h is covered by Lexus's three-year/60,000-mile manufacturer's warranty, a 12-year anti-corrosion warranty and for added peace of mind, the vehicle's high voltage battery and hybrid components are protected by a five-year/60,000-mile warranty.

## **LEXUS HYBRID DRIVE**

- First full hybrid vehicle to combine a front-mounted engine with rear-wheel drive
- 3.5-litre V6 petrol engine is assisted by high output electric motor and battery
- Maximum output 341bhp (345 DIN hp)
- World's first longitudinal hybrid transmission enhances acceleration performance
- Linear acceleration from nought to 62mph in 5.9 seconds, 50 to 75mph in 4.7 seconds
- Maximum speed 155mph
- Possible driving range of more than 500 miles on one tank of fuel
- Combined cycle fuel economy 35.8mpg
- Carbon dioxide emissions comparable to D-segment four-cylinder diesels at 186g/km
- Lowest combined nitrogen oxides (NOx) and hydrocarbon (HC) emissions of any combustion engine production vehicle at 0.01g/km

The GS 450h is Lexus's second production model to be powered by the Lexus Hybrid Drive system, following last year's launch of the RX 400h SUV, and it demonstrates the flexibility of the technology by being the first full hybrid car to adopt a front-engine, rear-wheel drive design, delivering classic sports driving dynamics.

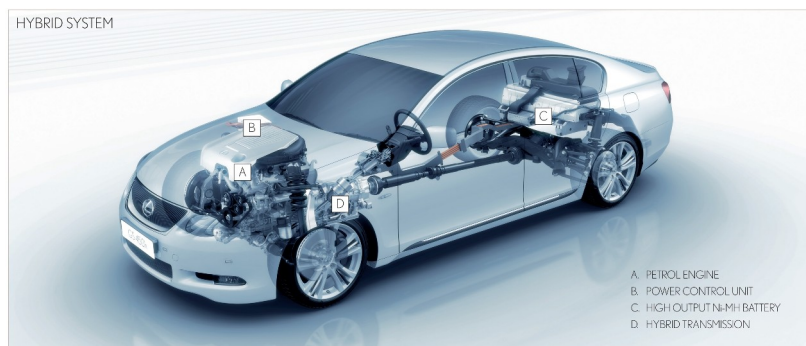
It also reinforces the importance of hybrid power as a core powertrain technology for Lexus. The Lexus Hybrid Drive system has precisely the type of driving characteristics that are the established hallmark of Lexus drivetrain engineering, being powerful, smooth and refined, yet delivering an engaging and rewarding driving experience. This comes without the penalties of high fuel consumption and exhaust emissions normally associated with such performance levels.

The designation '450' does not indicate engine capacity, but refers to power output comparable to a conventional, Lexus-standard 4.5-litre V8 petrol engine. The 'h' suffix indicates the car uses the Lexus Hybrid Drive system.

## **LEXUS HYBRID DRIVE SYSTEM COMPONENTS**

Like the RX 400h, the GS 450h is equipped with the Lexus Hybrid Drive system in a series/parallel configuration. As a result, the petrol engine can power the electric motor exclusively (series mode), or engine

and motor can power the wheels at the same time (parallel mode). Being a 'full' hybrid, the GS 450h can also operate in pure electric mode.



In addition to the petrol engine and electric motor, the Lexus Hybrid Drive system also features a generator, a high-performance nickel-metal hydride battery, a Power Split Device, a two-stage motor speed reduction gear and a compact Power Control Unit. Notably the GS 450h adopts a longitudinal hybrid transmission.

The electric motor, generator, Power Split Device and two-stage motor speed reduction gear are all housed in a single, compact hybrid transmission casing that is only one centimetre longer than the six-speed manual gearbox found in the Lexus IS.

As in the RX 400h, the tachometer in the driver's instrument display is replaced by a meter which gives a constant read-out of the hybrid powertrain's power output and the levels of energy being regenerated during braking or deceleration.

For added peace of mind, all hybrid-related components (not including the petrol engine and transmission) are covered by a five-year/60,000-mile pan-European warranty.

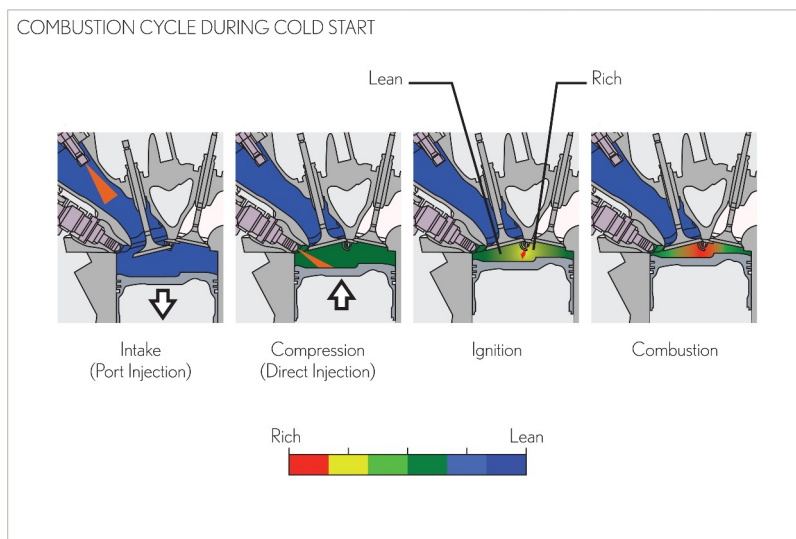
## **DUAL-INJECTOR V6 PETROL ENGINE**

The new GS 450h has a 3,456cc 60-degree V6 petrol engine which operates on the Otto cycle to favour performance.

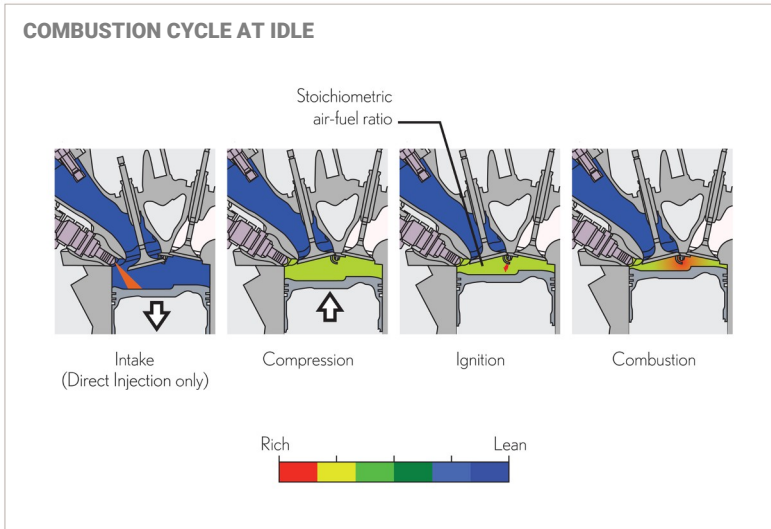
To save weight, the engine block, cylinder heads, head covers, oil pan, pistons and bearings for the connecting rods and the crankshaft are made of aluminium and the connecting rods themselves are forged in high tensile steel. Thanks to advanced casting techniques, the aluminium block and cast iron liners are produced as a single unit, which reduces the space between the cylinder bores to just 11.5mm. Integrating the engine within the Lexus Hybrid Drive System means there is no need for a starter motor, alternator or serpentine belt, with the V6 being started by the electric generator.

The D-4S (Direct-injection 4-stroke petrol Superior version) is the latest evolution of Lexus's stoichiometric four-stroke direct-injection technology and the world's first automotive application of a two-injector per cylinder design. With one injector positioned in the combustion chamber and a second mounted in the intake port, it combines the strengths of both direct and port injection, raising engine efficiency, improving torque by seven per cent across the rev range and reducing fuel consumption and emissions.

The system's port injectors have 12 holes, enabling fuel to be injected at a maximum pressure of four bar. The in-cylinder injectors have twin rectangular slits measuring 0.52 by 0.13mm, producing a double fan injection pattern to produce the most homogenous fuel-air mixture possible. In-cylinder injection is performed at a maximum 13 bar, a reference value for petrol engines.

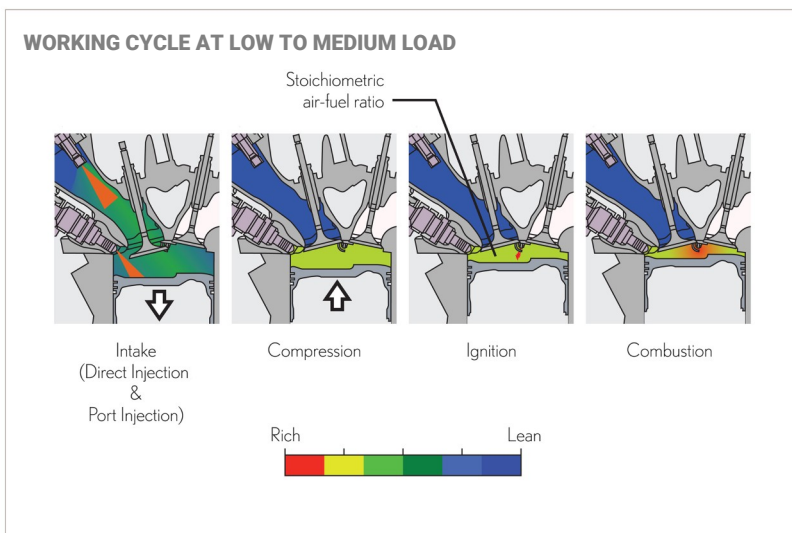


Under cold start conditions, D-4S employs port injection during intake and direct injection during compression. This produces an air/fuel mixture of 15-16:1. The richer mixture raises the combustion temperature and contributes to a quicker warm-up of the two thin-wall catalysts, while the hybrid system's electronic management maintains an engine speed that minimises emissions – something that is not possible in a conventional engine.



At idle, the engine runs on direct injection alone, due to its higher efficiency. When the engine is running under a low to medium load at lower speeds, both direct and port injection systems are used during the intake stroke. This creates a homogenous, 12-15:1 air/fuel ratio that stabilises combustion, improves fuel efficiency and reduces emissions.

When the engine is running under heavy loads, the direct injection system alone is employed. This achieves an intake cooling effect by injecting fuel directly into the combustion chamber, improving the efficiency of each charge. Once again, a 12-15:1 stoichiometric air/fuel ratio is effected during the intake stroke.



By reducing pre-ignition tendencies, D-4S also allows for a higher engine compression ratio of 11.8:1, improving engine efficiency.

Dual VVT-i (Variable Valve Timing – intelligent) provides the new V6 with continuously variable valve timing to both intake and exhaust camshafts, varying between 60 and 35 degrees respectively. This improves performance, fuel consumption and emissions. The system has been specifically adapted to suit the characteristics of the Lexus Hybrid Drive system, with intake timing retarded and the valves opening earlier and closing later than usual.

The V6 engine's exhaust system incorporates a twin-wall stainless steel manifold to reduce noise, improve heat resistance and accelerate catalyst warm-up. Pressure control valves in both main silencers close to reduce noise at lower speeds, opening as speed rises to reduce back pressure and enhance engine performance.

## **ELECTRIC MOTOR**

In order to satisfy the GS 450h's performance targets, a compact, high-output motor works as an electric supercharger, helping the engine achieve a flexible output delivery. The Lexus Hybrid Drive system uses a three-phase, permanent magnet AC synchronous type motor, operating on a 650V current processed by the Power Control Unit.

In order to accommodate the motor within the ultra-compact transmission casing the stator wiring has a small diameter and is wired using a double-star method, which results in a significant reduction in the unit's diameter. Nevertheless, the motor is the most powerful in any standard production passenger car – 20 per cent more powerful than that in the RX 400h – generating 197bhp (200 DIN hp) and 275Nm of torque.

## **HIGH VOLTAGE BATTERY**

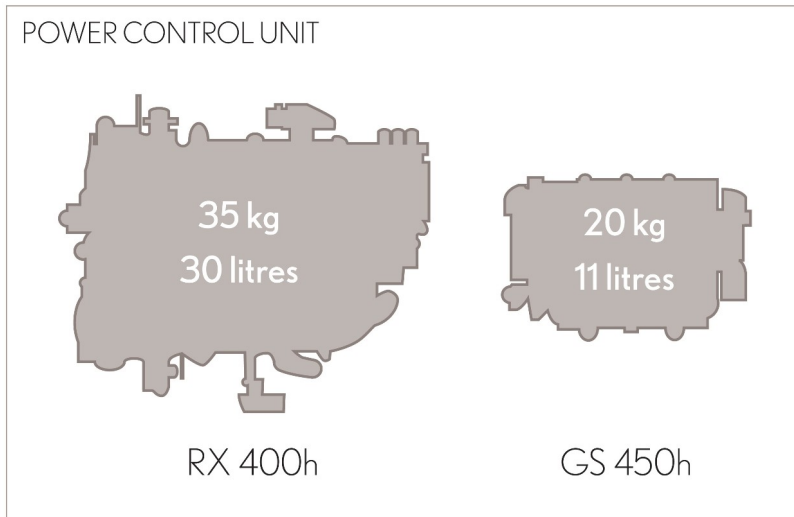
The Lexus Hybrid Drive system features a high-output, nickel-metal hydride (Ni-MH) 288V battery. This is linked to a unit which monitors battery recharging conditions, detects problems and performs fail-safe system management.

Although it has the same number of cells (240 1.2V cells), the battery is 13 per cent lighter than that in the RX 400h. Co-developed with Panasonic and virtually 100 per cent recyclable, it is located in the boot, directly behind the rear seats. As it is recharged through the running of the hybrid drive system, it requires no external charging and it is designed to last as long as the other principle powertrain components. A crucial factor in achieving such high durability is the nature of the battery's charge and discharge cycles. The hybrid system ECU, linked to the battery's monitoring unit, ensures that the state of charge (SOC) level never reaches high or low extremes and controls the speed of recharge and discharge.



## POWER CONTROL UNIT

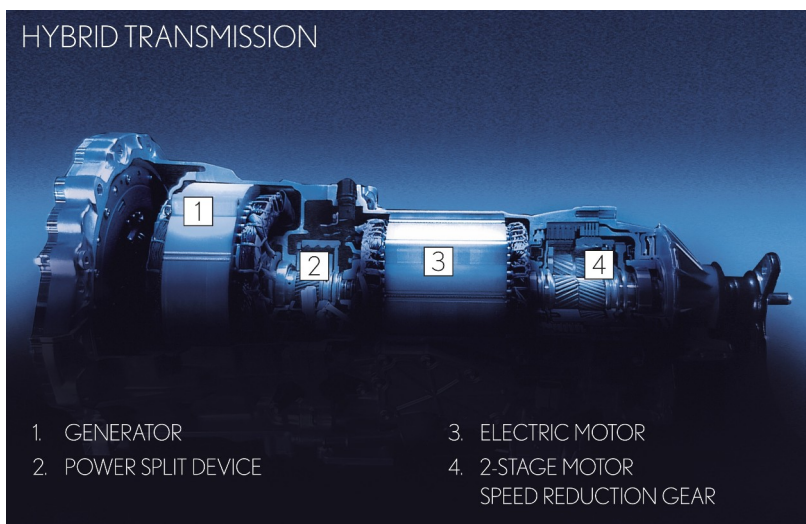
The Power Control Unit (PCU) consists of a voltage boost converter and a DC/AC inverter. The converter increases the battery's voltage from 288 to 650V to drive the motor and, occasionally, the generator. At the same time, the DC/AC inverter converts this current from direct (DC) into alternating (AC).



Extensive efforts have been made to reduce the size and weight of the PCU by using smaller capacitors and combining components to create a more compact transistor module. The complete unit has a capacity of 11.6 litres and is 63 per cent smaller and 43 per cent lighter than that in the RX 400h. In size terms, it is comparable to a conventional 12V battery.

## POWER SPLIT DEVICE

The Power Split Device is at the heart of the Lexus Hybrid Drive system. It uses a planetary gear set to divide the engine's power output between the two routes, with a central sun gear, an outer ring gear and intermediary planetary pinion gears which engage the central and outer gears.



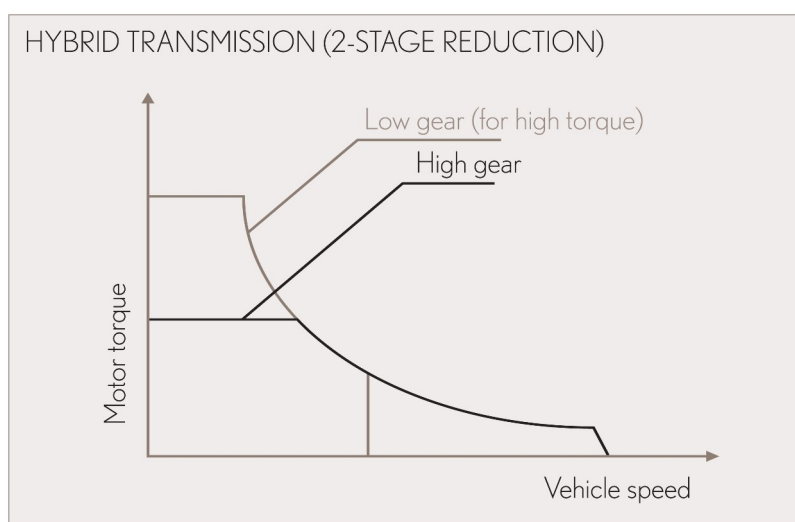
The generator is connected to the sun gear, the engine is connected to the planetary pinion gear carrier, and the electric motor is connected to the outer ring gear, which itself is directly connected to the differential, which drives the wheels. Thus, with power transmitted either from the engine, the electric motor, or a combination of the two, the rotational speed of the ring gear is directly proportional to the speed of the vehicle.

The planetary gear set enables the Lexus Hybrid System's full range of power transmission options: during initial start-up and at low speeds, the engine is not running and the planetary pinion gear carrier is stationary. Powered by electric motor, the ring gear revolves, driving the wheels and, via the pinion gears revolving on the stationary carrier, rotating the sun gear attached to the generator.

To start the engine as vehicle speed increases, momentarily stopping the sun gear generates sufficient force (via the ring gear's rotation of the planetary gears) to set the planetary pinion gear carrier in motion, turning the engine crankshaft. Once the engine has started, it transmits power back through the pinion gears on the revolving carrier to both the outer ring gear, driving the wheels, and the inner sun gear. Rotated by the sun gear, the generator supplies electric power via the PCU, to either recharge the battery or drive the motor.

## TWO-STAGE MOTOR SPEED REDUCTION GEAR

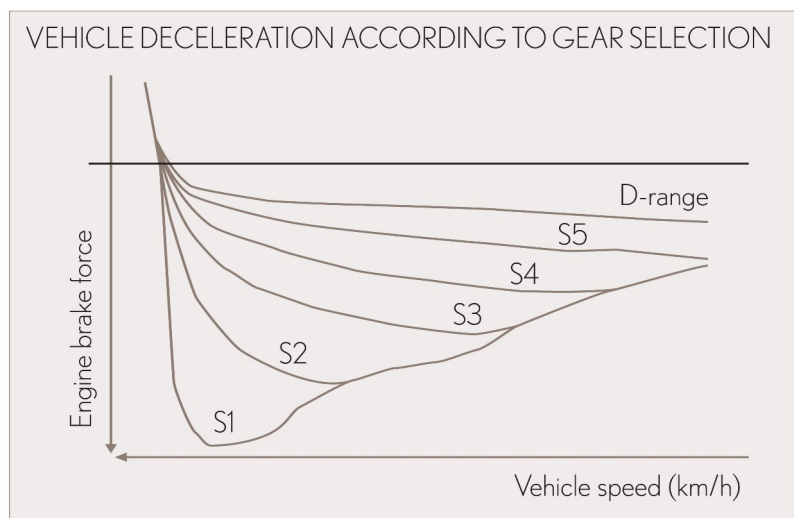
Unique to the GS 450h, the new longitudinal hybrid transmission incorporates a two-stage motor speed reduction gear, coupled directly to the electric motor. A hydraulic control unit, similar to a very compact automatic gearbox, automatically switches the bearing between low (3.900) and high (1.900) motor reduction ratio settings.



In normal conditions, during acceleration, the reduction system will make an imperceptible gear change at around 56mph. Thus the twin-stage gearing generates maximum low-gear wheel torque for significantly enhanced acceleration.

## E-CVT WITH SEQUENTIAL BRAKE SHIFT MODE

The GS 450h uses an Electronically-controlled Continuously Variable Transmission (E-CVT) with Sequential Shift Mode. E-CVT is the principle behind the operation of the hybrid transmission, which, by co-ordinating the speed of the engine and electric motor, can create an effect of continuous gear ratio variation that resembles a conventional CVT.

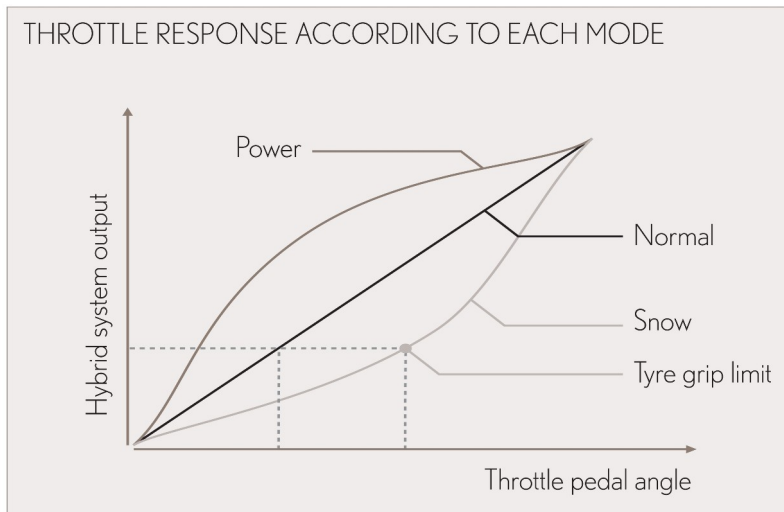


Again unique to the GS 450h, the E-CVT incorporates a six-speed sequential mode, engaged by moving the gear lever to its S position. This new feature improves vehicle control and enhances the driving experience, mimicking the “step” gear change feel of a conventional sequential-mode automatic. All up-shifts from first to fifth are made automatically, with the driver selecting sixth when desired, and each of the six sequential steps in gearing offers an equal number of engine brake force levels.

By selecting a lower gear under braking or deceleration, the brake control ECU increases the amount of engine braking as a percentage of the total brake force applied to the rear wheels, thus increasing the load on the generator to both charge the battery and make the engine spin faster.

## MODE SELECT

The new hybrid system offers a choice of three power response settings, a first for a hybrid power car: Normal, for the best balance of power and traction; Power for a more active throttle response; and Snow, for excellent traction in the most slippery road conditions. These are engaged by means of a Mode Select switch on the centre console.



## LEXUS HYBRID DRIVE IN OPERATION

Over the course of any journey, the Lexus Hybrid Drive system will operate in several modes to maximise the GS 450h's overall efficiency. When the engine is cold and the ignition is switched on, the system will start the engine to warm the unit. Thereafter, when the vehicle comes to rest, the engine stops automatically to conserve fuel. However, if the vehicle is at idle for prolonged periods, the engine will automatically run when necessary to charge the high-voltage battery via the generator.

In conditions where engine efficiency is low, such as during start-up and at low range speeds, the GS 450h runs on its electric motor alone, reducing exhaust emissions to zero. The system also gives the vehicle an in-gear 'creep' quality, similar to that of a conventional automatic transmission.

In normal driving, engine output is divided by the Power Split Device to drive the wheels directly and to power the generator, which in turn drives the electric motor and simultaneously charges the high-voltage battery. In these circumstances, power allocation is constantly monitored and adjusted between engine and motor to maximise efficiency. When sudden acceleration is required, the engine and electric motors again operate in tandem, with extra power from the battery to boost motor response.

During deceleration and under braking, the engine switches off and the electric motor acts as a high-output generator to effect regenerative braking, optimising energy management by transforming kinetic energy into electrical energy for storage in the high-output battery.

Under all driving conditions, the battery power level is constantly managed via the engine-drive generator, so there is no need ever to recharge the system from an external source.

## DRIVING EXPERIENCE

The Lexus Hybrid Drive powertrain gives the GS450h performance characteristics that position it between luxury E-segment V8 models and the top performance sports saloons in the same class.

The combined power output of 341bhp (345 DIN hp) nears the 100bhp per litre benchmark and gives the GS 450h nought to 62mph acceleration in 5.9 seconds and a top speed of 155mph – new highs for any hybrid power car.

Equally impressive is the potent low to mid-range torque produced by the system's powerful electric motor, which works as an electric supercharger to boost performance when urgent acceleration is required. The electric motor is capable of delivering a maximum 275Nm from standstill, something that cannot be achieved by a combustion engine. This ability is particularly useful under acceleration and in mid-range performance when overtaking: acceleration from 50 to 75mph takes 4.7 seconds.

Thanks to the close co-operation between both power sources, acceleration is uninterrupted and continuous, holding momentum right up to the maximum speed to give a driving experience that cannot be found in conventional cars.

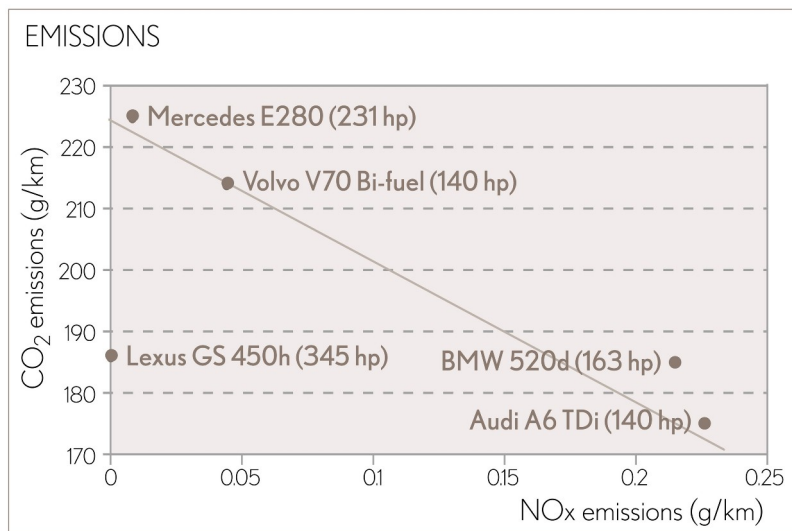
Apart from the performance aspect, the Lexus Hybrid Drive system provides a level of refinement and quiet operation that, again, is difficult to match with a conventional V8. Depending on the battery's state of charge and throttle operation, the GS 450h can be driven for up to 1.2 miles purely on the electric motor and battery, at speeds up to 20mph and with the climate control air conditioning system still operating. In these driving conditions, noise levels in the cabin are half what they are in the GS 430, which itself sets the benchmark in its segment for interior quietness. Even at 62mph, noise levels are three per cent lower than in the GS 430.

## **ENVIRONMENTAL AND RUNNING COST BENEFITS**

In spite of its strong performance, the GS 450h delivers substantially better fuel consumption than comparable sports saloons, returning 35.8mpg in the combined cycle, a figure comparable with a D-segment petrol car.

Fuel saving is not confined to driving in town: Lexus research shows the GS 450h to be eight per cent more fuel efficient than the GS 430 at a steady 75mph.

Using the combined fuel consumption figure as the reference, the GS 450h has a possible range of more than 500 miles on a single tank of 95 octane fuel, far outdistancing any other vehicle capable of nought to 62mph in less than six seconds.



Where carbon dioxide emissions are concerned, the Lexus GS 450h emits 186g/km, which puts it on a par with economy-orientated premium segment four-cylinder diesel engines. In the UK this clean performance ensures a lower rate for company car tax, at 21 per cent. This can save owners more than £2,500 on their annual tax bill, compared to drivers of rival premium segment V8 models.

The low emissions profile extends to nitrogen oxides (NOx) and hydrocarbons (HC) output, which at zero and 0.01g/km are lower than for any current production car with an internal combustion engine.

## BODY AND CHASSIS

- Speed-sensitive Electric Power Steering (EPS) with Variable Gear Ratio Steering (VGRS), linked to AVS and Vehicle Dynamics Integrated Management (VDIM)
- 50:50 weight distribution between front and rear axles, taking driver into account
- Advanced suspension system with Adaptive Variable Suspension (AVS) with non-linear  $H^{\infty}$  control logic

The new Lexus GS 450h shares the same platform as the current GS 430 and 300 models, which provides excellent torsional stiffness. This supports the world's first purpose-developed rear-wheel drive hybrid powertrain, with a range of technological innovations designed to deliver superb sporting driving dynamics.

## BODY STRUCTURE

The GS 450h has a highly rigid body structure with a weight-saving aluminium bonnet. Extensive bracing in the floor improves torsional stiffness, helping improve driving dynamics.

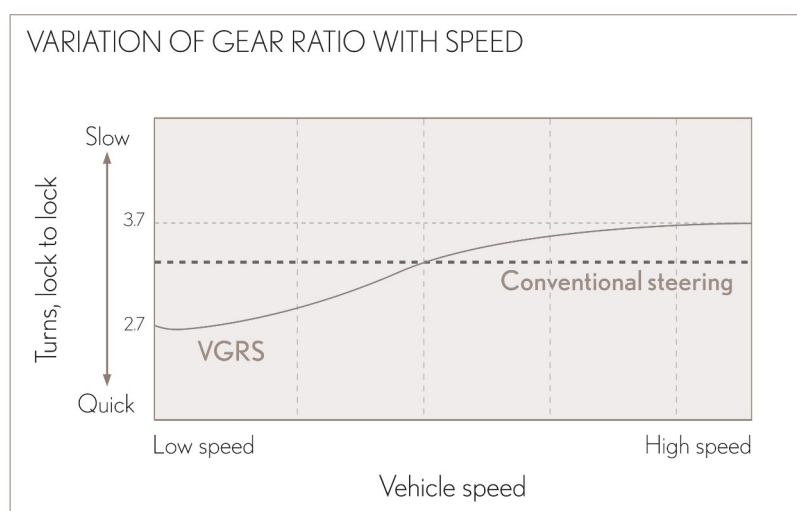
Careful positioning of the Lexus Hybrid Drive components gives the vehicle a 50:50 weight distribution between the front and rear axles (including the driver). And with an engine that weighs 17 per cent less than

the 4.3-litre V8 unit in the GS 430, and positioning of the heavier elements of the hybrid powertrain closer to the vehicle's centre of gravity, the car's moment of inertia is improved, making it more agile.

In addition, the GS 450h is equipped with a limited-slip differential, which, allied to the positioning of the hybrid battery directly over the rear axle, further improves rear wheel traction.

## VARIABLE GEAR RATIO STEERING

The GS 450h is equipped with an Electric Power Steering (EPS) system featuring Variable Gear Ratio Steering (VGRS).



VGRS employs an actuator attached to the intermediate steering column shaft, which alters the steering gear ratio according to vehicle speed. The adjustment is seamless and continuous, between 12.4:1 and 17.2: - a difference of about 39 per cent - while the number of turns lock-to-lock varies between 2.7 and 3.7.

At very low speeds the gear ratio is at its lowest, reducing the steering input and effort required for tight cornering and parking manoeuvres. At medium speeds, the gear ratio is adjusted for accurate vehicle response when cornering. And at high speed the ratio is at its highest, ensuring gentle response to inputs and maximum vehicle stability.

VGRS also co-operates with the Vehicle Dynamics Integrated Management (VDIM) to help the driver exploit the GS 450h's dynamic capabilities to the full.

## SUSPENSION

The Lexus GS 450h features double wishbone front and multilink rear suspension, delivering ride comfort with excellent handling and dynamic abilities appropriate for a luxury sports saloon.

### **Front suspension**

The front, high-mount, double wishbone suspension combines lightweight forged aluminium knuckles with high-tensile steel arms and a hollow anti-roll bar to reduce unsprung weight.

New, forward-mounted power steering gear and a low toe variation along the suspension stroke promote a more linear yaw response, precise steering control and excellent straight-line, high-speed stability.

### **Rear suspension**

At the rear the advanced multilink set up features toe control arms and an aluminium rear axle carrier. The components offer stiffness and help reduce unsprung weight, contributing to the level of ride comfort and high cornering stability. Using a double-linked upper arm and integrated bearings and hub optimises the system geometry, gives high rigidity and significantly reduces weight.

Using the multilink design makes it possible to balance handling, stability and ride comfort. The upper arms help reduce upward spring motion, the mid-arm reduces body roll, and the lower arm provides an improved anti-lift/anti-squat ratio.

### **Adaptive Variable Suspension (AVS)**

The Adaptive Variable Suspension (AVS) system lets the driver select the GS 450h's ride characteristics with a choice of two damper settings, activated by means of a switch next to the gear lever. 'Normal' mode is suitable for everyday driving comfort while the 'Sport' setting gives greater body control and precise steering response under cornering.

'Sport' mode automatically increases the difference between the inner and outer shock absorber damping force through corners to further reduce the level of body roll. At the same time, the Variable Gear Ratio Steering (VGRS) automatically reduces the steering gear ratio and the Electric Power Steering (EPS) increases steering assist torque to compensate for the increase in steering effort. The result of these measures is reduced body roll, sharper vehicle handling and improved steering feel.

AVS automatically adjusts the suspension's damping force on all four wheels independently. The system monitors a range of vehicle data, including engine speed, front wheel speed, steering, stop lamp activation, together with readings from three vertical acceleration, G-force sensors. In relation to this data, it continuously adjusts the damping force of each shock absorber through nine incremental steps.



In this way, AVS can adjust the damping to fulfil a wide range of vehicle control functions, including speed-sensitive damping force and body control (dive, squat and roll), in relation to driving style, vehicle body motion and road surface conditions.

In addition, an advanced, non-linear  $H^\infty$  control logic can improve ride comfort in particular situations. Vertical acceleration sensors monitor vertical movement of the body, enabling the AVS ECU to determine when the vehicle will experience vibration levels that will give the impression of a rough ride. In these circumstances, an adequate, lower damping force is selected, giving a flatter ride.

This control logic has clear advantages over the conventional Skyhook linear control as it responds more efficiently to change situations, reflected in better damping of the vehicle's vertical body movement.

AVS co-operates with the Vehicle Dynamics Integrated Management (VDIM) and Pre-Crash Safety (PCS) to effect a stiffer shock absorber setting when these systems are activated.

## **SAFETY**

- Top 5-star Euro NCAP rating for passenger crash protection
- Vehicle Integrated Dynamics Management (VDIM) with integrated Variable Gear Ratio Steering (VGRS) and Adaptive Variable Suspension (AVS) control
- Adaptive Front-lighting System (AFS) standard on all models
- Pre-Crash Safety (PCS) system with Adaptive Cruise Control (ACC) standard on SE-L grade
- 10 airbags as standard with additional rear side airbags standard on SE and SE-L models
- Seatbelt pretensioners on front and outer rear seats

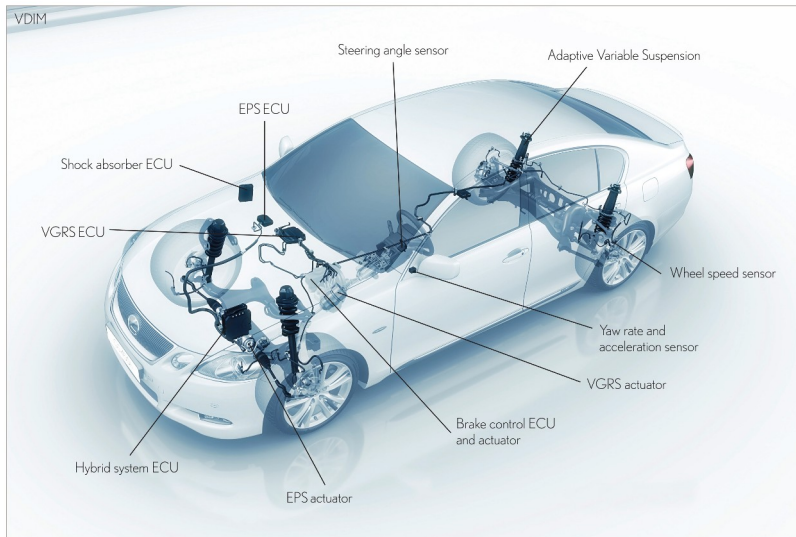
## **ACTIVE SAFETY**

### **Vehicle Dynamics Integrated Management (VDIM)**

The new GS 450h features the most advanced version of Lexus's state-of-the-art Vehicle Dynamics Integrated Management (VDIM) system, which improves performance, traction control and vehicle stability.

Using comprehensive status data fed from sensors throughout the vehicle, VDIM compares the actions of the driver (such as steering, acceleration, braking and gear shifts) with the trajectory of the vehicle (longitudinal and lateral acceleration, yaw rate and wheel speed). The system works automatically to match as closely as possible the vehicle dynamics to the intention of the driver.

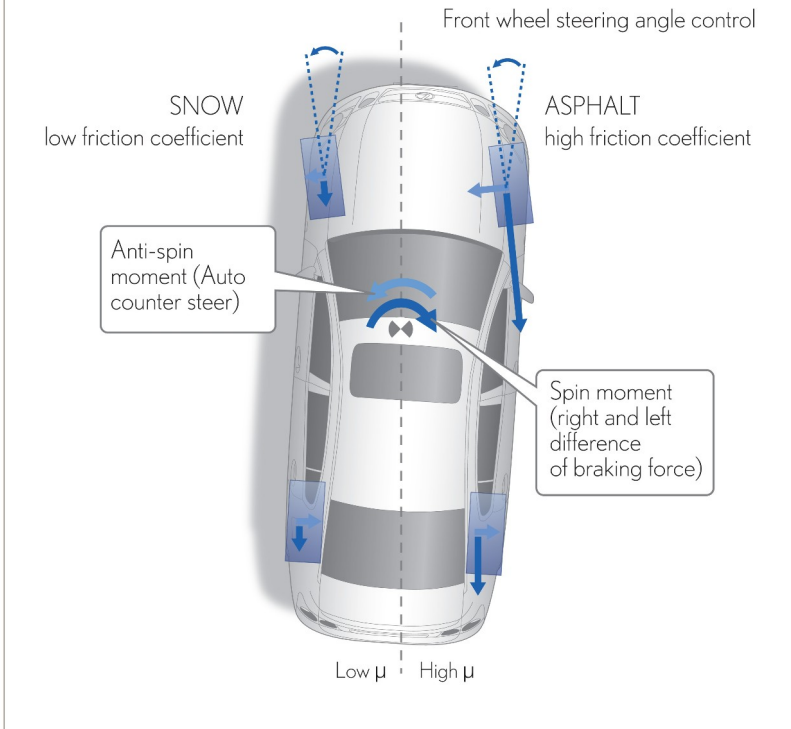
VDIM integrates the by-wire Electronically Controlled Braking (ECB), BA, Electronic Brakeforce Distribution (EBD), Traction Control (TRC) and Vehicle Stability Control (VSC) with the Electronic Power Steering (EPS) and Variable Gear Ratio Steering (VGRS). It also communicates with the Adaptive Variable Suspension (AVS) to prompt a stiffer shock absorber setting to aid body control in extreme conditions and reduce the level of vehicle nose dive under emergency braking.



VDIM's application of integrated control of all the elements related to vehicle movement, including the hybrid system's electric motor torque, brakes and steering, not only improves active safety, but also further improves the vehicle's overall kinetic performance.

Moreover, where conventional safety systems are only activated after a vehicle's performance limit has been passed, VDIM activates control before that point is reached.

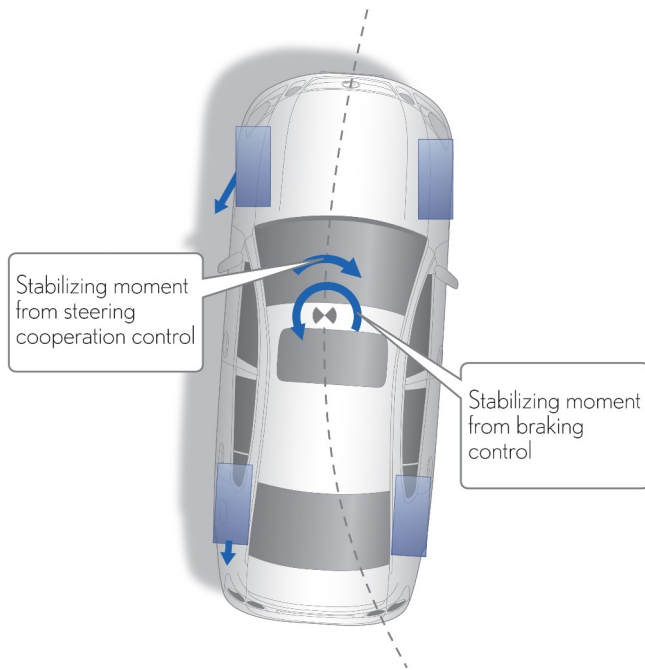
## VDIM - BRAKING ON SURFACES OF DIFFERENT FRICTION COEFFICIENT



For example, on a road surface with different levels of grip on either side of the vehicle, sudden braking will cause the car to pull towards the side offering the most grip. VDIM will control individual wheel speed and activate the VGRS to automatically regulate the steering angle and counteract the different left and right-side braking forces, minimising the amount of steering input the driver needs to make to maintain straight-line braking.

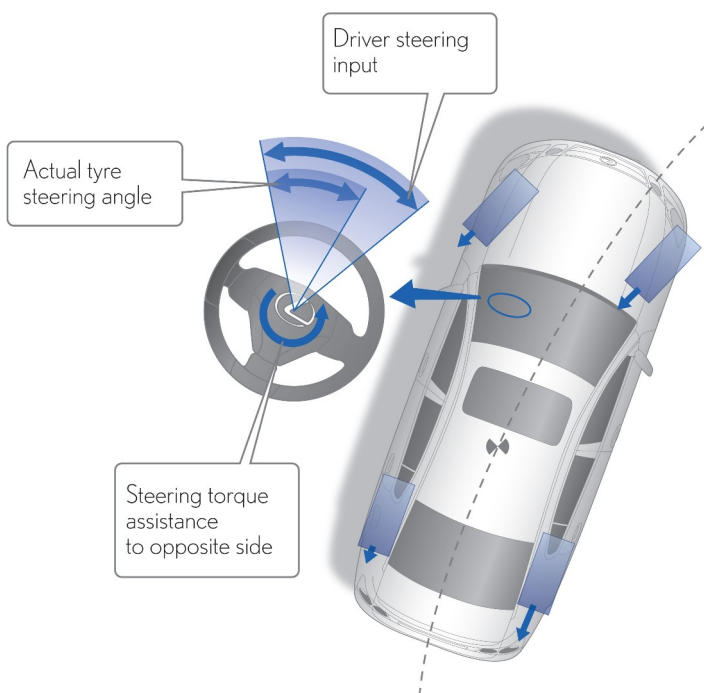
Similarly, if different levels of road surface grip cause the vehicle to pull towards the more slippery side under acceleration, VDIM automatically regulates the steering angle to keep the car under control with minimum input from the driver.

## VDIM - OVERSTEER CONTROL



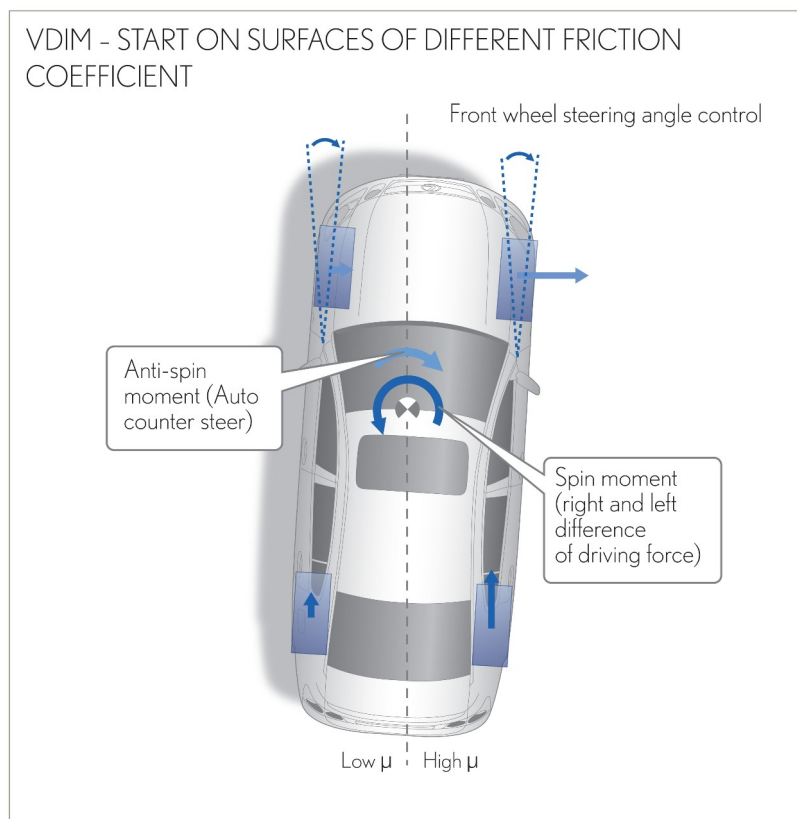
When detecting the onset of oversteer, VDIM prompts the VGRS to enable a counter-steer angle, a split second before the yaw moment reaches a threshold level. If the oversteer persists, VDIM commands the by-wire braking system and the hybrid system's torque output to bring the vehicle back to its original trajectory.

## VDIM - UNDERSTEER CONTROL



In understeer situations, VDIM begins by providing an additional steering angle and torque assist to the inside of the corner, in order to alert the driver to the situation. If this is insufficient in avoiding understeer, it will also prompt the brakes and powertrain to control the vehicle's yaw moment. At the same time, if the driver tries to steer too far towards the inside of the corner, VDIM will limit the steering through the VGRS and EPS, so that the front wheels retain their grip.

When co-operating with VDIM, VGRS can provide up to three degrees of additional steering input, effectively helping the driver make the right steering manoeuvre to keep the vehicle under control.



### Electronically Controlled Braking (ECB)

The GS 450h has a sophisticated Electronically Controlled Braking (ECB) system which enables interaction with all the vehicle's other brake control systems in a way that is not possible with a conventional, fully hydraulic system. Braking power is supported by 432mm ventilated front discs and 310mm ventilated discs at the rear with high-friction coefficient brake pads.

The system also anticipates braking: as the driver takes his or her foot off the throttle, ECB places the brakes in standby mode, bringing the pads as close as possible to the discs. ensuring the promptest operation when the brake pedal is depressed.

ECB not only improves overall braking performance but also enables better brake energy regeneration for recharging of the hybrid system's battery. The system uses a combination of hydraulic braking power and regenerative power from the electric motor under deceleration. A hydraulic pressure control function balances the total braking force between that supplied by hydraulics and by the motor.

ECB favours brakeforce distribution to the rear wheels whenever possible, both to reduce the burden on the hydraulic system and optimise the charging of the Lexus Hybrid Drive system's battery, while all the time keeping the vehicle well within its stability limits.

### **Hill Start Assist Control**

Hill Start Assist Control, which is linked to the vehicle's ECB, detects any slipping during hill starts and automatically increases brake pressure to all four wheels to give the driver ample time to step from the brake to accelerator pedal without the vehicle moving backwards.

### **Adaptive Front-lighting System (AFS)**

The Adaptive Front-lighting System (AFS) improves night-time vision when cornering, by swivelling the High Intensity Discharge headlights through up to 15 degrees, in line with the vehicle's speed and steering angle.

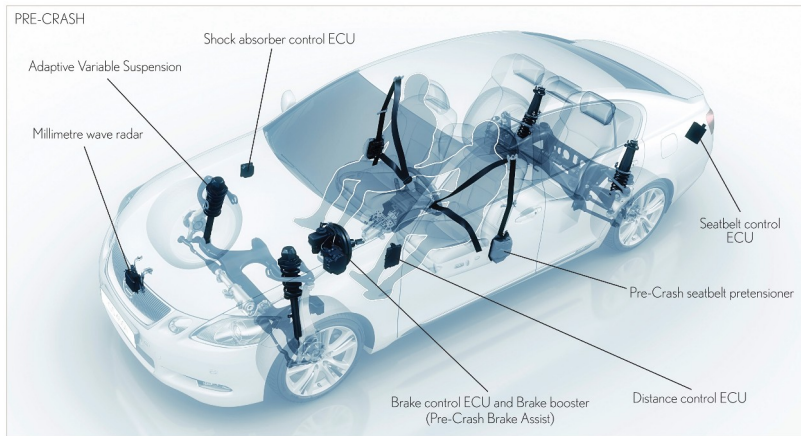
### **Tyre Pressure Warning System (TPWS)**

The Tyre Pressure Warning System (TPWS) can detect a loss of pressure in one or more tyres and alerts the driver via a warning light on the dashboard.

## **PREVENTATIVE SAFETY**

### **Pre-Crash Safety (PCS) system**

The Lexus GS 450h SE-L benefits from a sophisticated Pre-Crash Safety (PCS) system that can anticipate certain types of frontal collision and help reduce damage and injuries. PCS uses a millimetre-wave radar sensor with a 20-degree scanning amplitude to detect obstacles up to 150 metres ahead of the car. Using numerous sensors, the PCS computer monitors vehicle speed, steering angle and yaw rate to help determine in advance whether an impending collision is unavoidable. If that is the case, PCS pre-emptively activates the Pre-Crash seatbelt tensioners, taking up all the slack from the front belts, and simultaneously adjusts the emergency Brake Assist System (BAS) to give maximum braking force once the brake pedal is depressed.



At vehicle speeds of more than 9mph, PCS will also activate the front seatbelt pretensioners in cases of severe over or understeer and during emergency braking. Operating in conjunction with the AVS, the PCS system also automatically regulates the suspension's shock absorber stiffness to minimise the level of vehicle nose dive under emergency braking.

### **Adaptive Cruise Control (ACC)**

The GS 450h also features Adaptive Cruise Control (ACC), a system that is complementary to the PCS. This vehicle-to-vehicle distance control system can differentiate between vehicles directly ahead and those in an adjacent lane. It uses the PCS millimetre-wave radar sensor, linked to constant speed, decelerator, follow-up and accelerator controls to automatically slow the vehicle to match the speed of the vehicle ahead and, once the road is clear, accelerate back up to the selected cruising speed.

## **PASSIVE SAFETY**

### **Body structure**

The Lexus GS was created with the express aim of achieving class-leading levels of safety in terms of full-frontal, offset and side-on collisions.

The achievement of this ambition is independently acknowledged by the GS gaining a top 5-star rating for passenger crash protection from Euro NCAP. The tests yielded a perfect 100 per cent score in side impact performance. The GS was also awarded 4-stars for child occupant protection.

The bodyshell has numerous reinforcements which improve its energy absorption performance. These include thickened cross-members and extensive use of high-tensile steel to promote high skeletal strength.

The engine's rear support member has been designed to separate from the floor panel under collision loading from the engine and transmission during a frontal impact. This cuts the risk of the engine intruding into the cabin and thus reduces the risk of the front seat passengers suffering chest and foot injuries.

## **Airbags**

The Lexus GS 450h provides its passengers with the most comprehensive airbag protection in its class, with dual-stage driver and front-passenger front airbags and – a first in its class – two front knee airbags. Four curtain shield airbags provide protection down the full length of each side of the cabin and side airbags are fitted to the front seats.

In addition, rear side airbags are provided as standard on SE and SE-L models. Each side airbag has an independent door sensor to gain a more accurate reading of the type of impact.

The airbags are supported by seatbelt pretensioners with force limiters fitted to the belts on the front and outer rear seats.

## **DESIGN AND REFINEMENT**

- GS design inspired by Lexus's L-finesse philosophy
- GS 450h distinguished by features including 18-inch alloy wheels, boot spoiler and dedicated badging
- Class-leading aerodynamics with 0.27Cd
- Sequenced LED entry illumination

The GS 450h is the new high performance flagship of the third generation GS, the first range of production vehicles to express the Lexus L-finesse design philosophy.

L-finesse is a ground-breaking design rational that is rooted in Japanese culture and has three fundamental elements: Incisive Simplicity, perhaps best explained as purity; Intriguing Elegance, a sense of depth that appeals to the emotions; and Seamless Anticipation, inspired by the traditions of Japanese hospitality in anticipating the occupants' requirements.

Going beyond design, L-finesse builds a bridge with engineering, tasking Lexus engineers with developing advanced technical solutions in areas as diverse as entertainment and safety.

## **EXTERIOR**

The GS 450h shares numerous design cues with both the new IS and forthcoming LS luxury saloons, mixing contrasting simple and complex elements in a strong and purposeful overall shape, with striking convex and concave shadow surfacing.



At the front, the trademark vertically latticed grille is set lower than the headlamps to emphasise the vehicle's dynamic stance. The shape of the headlamp clusters follows the arrowhead motif, which flows through the strong coachwork lines on the bonnet and upper front bumper.

This key L-finesse motif is also evident in the sculpting of the tail-light clusters and the sling-shot profile at the rear end of the side glazing by the C-pillar. The strength of this sling-shot window graphic is further emphasised by the blacked-out B-pillar.

The GS 450h can be identified as the performance flagship of the GS range by the addition of a spoiler to the boot lid and discreet 'Hybrid' badging to the rear of the sills.

The vehicle boasts one of the lowest drag coefficients in its segment – 0.27 – thanks to a comprehensive aerodynamic package that extends from the smooth flowing bodywork with narrow panel gaps and minimal protrusions, to a series of strategic underbody elements that smooth the airflow beneath the car.

The GS 450h is available in 10 colours, including special multi-layer finishes, which use aluminium for the base coat and artificial mica for the second, giving highlight brilliance and greater change of colour intensity from light to shade.

## **INTERIOR**

The fundamental influence of L-finesse extends to the cabin of the GS 450h, where the qualities of Incisive Simplicity and Intriguing Elegance are expressed in a bold 'one motion' design that fuses luxury and dynamic style.

High quality wood, elegant metal highlights and leather accents are combined with unprecedented high levels of fit and finish that are characteristic of Lexus's craftsmanship and attention to detail.

The quality of Seamless Anticipation is witnessed in first contact with the new GS 450h through its bespoke, entry-sequenced lighting. The illumination system co-ordinates 11 different light sources, many of which use LED technology, before, during and immediately after entry to the cabin. Each move is anticipated through lighting focused in key areas such as the footwells, directly above the steering wheel and seats, the engine start button and even the door handles.

The electrically adjustable seats have a new backboard-type head restraint, which automatically rises when the seat base is retracted to accommodate taller occupants – another example of the vehicle's Seamless Anticipation qualities.

The GS 450h goes far beyond the conventional notions of perceived quality, for instance in the gaps between components. The Lexus Development Centre has also focused on details such as the working of all buttons, lids and mechanisms. Several components were redesigned to make their operation quieter, to levels below 45dB.

## **CONVENIENCE AND ENTERTAINMENT**

- Electro Multi Vision (EMV) touch screen with Bluetooth phone connectivity
- Smart keyless entry system with programmable electronic key
- Unique-in-class fully electric dual-zone air conditioning system
- Lexus Multimedia and Navigation System (SE and SE-L models) combining Mark Levinson surround system for CD and audio/video DVD, new-generation satellite navigation and the Lexus Parking Assist Monitor

The interior of the GS 450h is equipped with a comprehensive range of technologically advanced equipment designed both to simplify and enhance life on board. The 'Seamless Anticipation', fundamental to the L-finesse design philosophy and the Lexus ownership experience, is fully expressed in the way the car welcomes and interacts with driver and passengers. This is evident right from the moment of entering the vehicle, by means of the Smart Key access and the sequenced courtesy lighting design.

### **ELECTRO MULTI VISION WITH BLUETOOTH CONNECTIVITY**

The seven-inch Electro Multi Vision (EMV) touch-screen is fitted as standard to all GS models and displays status information on the air conditioning, audio system, vehicle maintenance menu, calendar and hybrid system operation.

Bluetooth connectivity is also standard, enabling hands-free use of most mobile telephones. The user can make and receive calls by using the touch-screen controls or switches on the steering wheel pad. The system can store up to 1,000 numbers.

### **SMART KEYLESS ENTRY SYSTEM**

The electronic key allows the driver to open up the vehicle and start the engine, simply by having the key on his or her person. When the electronic key comes within 0.7 to one metre of the locked door, it communicates with a transmitter built into the door handle and initiates automatic unlocking the moment the handle is touched.

The key also automatically activates the GS 450h's sequential entry illumination, first switching on the puddle lights in the door mirrors, followed by the main cabin dome lighting.

Once inside the vehicle, the electronic key identity is again automatically recognised, enabling the engine to be switched on by means of the start button. Each car is equipped with two keys for different drivers. These can be programmed to store preferred personal settings, including the position of the electrically adjustable seat, the door mirrors and the steering wheel.

The system can also be programmed to unlock one, two or all four doors with a single press of the fob control. Should the key battery run low, the driver is alerted by a warning message on the multi-information display.

### **OPTITRON INSTRUMENTATION WITH ECD**

The GS 450h features a light-sensitive Optitron instrument binnacle with metal dials. It also marks a world-first with Electronic Chromatic Device (ECD) glass to combat glare and ensure the instruments can be clearly read under all light conditions. ECD uses a light sensor built into the high-mounted rear stop lamp to determine conditions. In direct sunlight, ECD automatically reduces the glass transparency by up to 70 per cent. In normal or snowy conditions, ECD is inactive, increasing the transparency to render the dials brighter.

### **FULLY ELECTRIC AIR CONDITIONING**

The new GS 450h is equipped with the segment's first fully electric air conditioning system, incorporating an electrically-activated compressor and water pump. Using electric power isolates the air conditioning system from the car's engine, which means its operation has minimal impact on the running of the Lexus Hybrid Drive system or the vehicle's fuel efficiency.

The electronic climate control operates independently on the left and right hand sides of the cabin, with automatic control of the upper and lower air zones and an automatic cool air bypass control. The system delivers precise control and draught-free operation by using a humidity sensor and a complex neural network of sensors that mimic the human nervous system.

Fan noise is significantly reduced thanks to extensive use of sound-absorbent materials and a sound-reflective profile in the ducting. Front side window defrosters are now located at the bottom of the A pillars for greater

efficiency. The system also features an automatic recirculation mode which, linked to a sensor which detects nitrogen oxides, hydrocarbons and carbon monoxide, prevents exhaust gases from entering the cabin. A pollen removal mode frees the cabin from airborne allergens, working to an efficiency of 97 per cent.

## **STEERING-GUIDED PARKING ASSIST SENSORS**

The GS range is the first in Europe to be fitted with Parking Assist Sensors which incorporate a steering angle sensor. Four dual sonars are installed in the front bumper and two back and two corner sonars in the rear bumper. The front sonars change their scanning direction according to steering wheel angle, enabling the system to process obstacle position data and predict the likelihood of contact. The location and proximity of any object is displayed on the EMV touch-screen, together with a suggested steering correction to avoid contact.

This system, combined with a class-leading turning radius of 5.2m, gives the Lexus GS 450h unparalleled low speed manoeuvrability.

## **HIGH QUALITY HI-FI**

Lexus has well-established excellence in the field of in-car hi-fi and the entry-level GS 450h sustains this reputation with a sound system that includes a magazine-less, in-dash six-disc CD autochanger. There are 10 individual speakers, including tweeters in the front and rear doors, a large, 250mm subwoofer and a front centre speaker for improved definition and mid-range clarity.

## **LEXUS MULTIMEDIA AND NAVIGATION SYSTEM**

The Lexus Multimedia and Navigation System, fitted as standard to the GS 450h SE and SE-L models, includes a new Mark Levinson premium surround sound system, the latest generation Lexus Navigation System and the Lexus Parking Assist Monitor.

### **Mark Levinson Premium Surround Sound System**

The Mark Levinson audio system has been designed specifically to match the acoustic properties of the GS 450h's cabin and features an 11-channel DSP amplifier and 14 speakers. It uses Mark Levinson Surround (MLS) audio software and an all-digital signal path to reproduce a discrete 5.1 sound, via a surround sound 7.1-channel speaker topology, from both stereo CDs and DVDs.

The amplifier is fully media compatible with CD, CD-R, DTS 5.1 and Dolby Digital 5.1, DVD video and DVD audio discs, as well as MP3 and WMA files recorded on CD.

Each of the 14 speakers is custom engineered for the particular acoustic characteristics and location in the cabin. The system comprises four 25mm tweeters, five 65mm midrange units, four 160mm low frequency units

and one 250mm subwoofer.

The sonic benefits of this arrangement include lower distortion, higher resolution, natural dynamics through greater sound pressure levels and an extended frequency response for harmonic richness and musicality. The system's bespoke 7.1-channel surround sound speaker architecture, with separate side and surround channels, provides a greater sense of listening envelopment and depth for both front and rear seat passengers.

The system introduces Lexus owners to a complete home theatre experience, optimised for the playing of DVD movies via the EMV display screen.

### **New generation Lexus Navigation System**

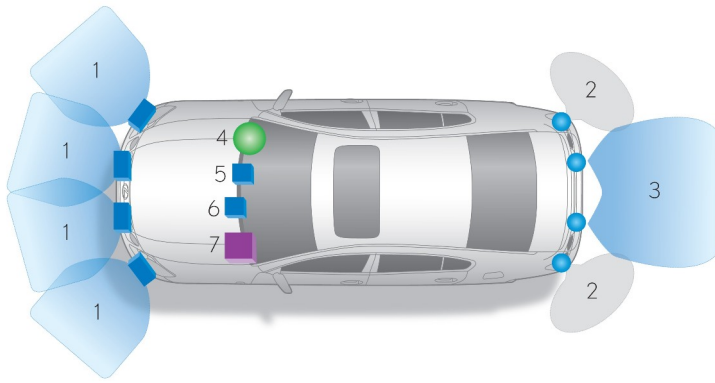
The high-speed Lexus Navigation System stores map information for all of western Europe on DVD. The latest generation is equipped with a new, faster processor, with a 65 per cent faster route calculation capacity. With increased hardware power, the EMV's seven-inch full colour has evolved from EGA (Enhanced Graphics Adapter) to VGA (Video Graphics Array) at 800 x 480 pixels, with a range of 32,000 colours.

The system provides voice command recognition in English, French and German, with voice guidance available in 10 languages. It is one of few on the market to combine the advantages of both touch-screen and voice command operation for the navigation, air conditioning and telephone functions. A help function has been incorporated, allowing the user to obtain additional instructions, simply by touching an on-screen help icon. A route tracing feature and lane guidance in a number of major European cities are also provided.

### **Lexus Parking Assist Monitor**

The Lexus GS was the first car in its class to offer a rear parking assist monitor. The system features a video camera mounted in the rear number plate surround that feeds a real-time full colour view of the area immediately behind the vehicle to the display screen in the centre console. Further help in making safe reverse manoeuvres can be gained from screen generated guidelines which indicate the prospective path of the vehicle, based on the current steering angle, for both serial and parallel parking.

## PARKING ASSIST SENSORS



- |                    |                      |
|--------------------|----------------------|
| 1. Dual sonars     | 5. Display indicator |
| 2. Corner sonar    | 6. Buzzer            |
| 3. Back sonars     | 7. ECU               |
| 4. Steering sensor |                      |

## LEXUS GS 450h EQUIPMENT SPECIFICATIONS

SAFETY	GS 450h	GS 450h SE	GS 450h SE-L
Driver and front passenger airbags	✓	✓	✓
Driver and front passenger side airbags	✓	✓	✓
Driver and front passenger knee airbags	✓	✓	✓
Rear passenger side airbags	x	✓	✓
Front and rear curtain shield airbags	✓	✓	✓
Passenger airbag detection function	✓	✓	✓
ABS with Electronic Brakeforce Distribution and Brake Assist	✓	✓	✓
Electronically Controlled Braking	✓	✓	✓
Vehicle Stability Control	✓	✓	✓
Traction Control	✓	✓	✓
Vehicle Dynamics Integrated Management (VDIM)	✓	✓	✓
Adaptive Cruise Control (ACC) and Pre-Crash Safety system (PCS)	x	x	✓
Whiplash Injury Lessening front seats	✓	✓	✓
Tyre Pressure Warning system	✓	✓	✓
Front seatbelt pretensioners with force limiters	✓	✓	✓
Outer rear seatbelt pretensioners with force limiters	✓	✓	✓
Seat integrated front seatbelt anchorage and support	✓	✓	✓

Seatbelt warning system	✓	✓	✓
Rain-sensitive windscreen wipers	✓	✓	✓
Photochromic auto-dimming rear view mirror	✓	✓	✓
<b>INSTRUMENTS &amp; CONTROLS</b>	<b>GS 450h</b>	<b>GS 450h SE</b>	<b>GS 450h SE-L</b>
Optitron instrumentation with Electro Chromatic Display	✓	✓	✓
Electro Multi Vision touch-screen display	✓	✓	✓
Lexus Navigator satellite navigation system with colour touch-screen display, Electronic Traffic Avoidance and voice command recognition (included in Multimedia pack)	x	✓	✓
Lexus Parking Assist Monitor (included in Multimedia pack)	x	✓	✓
Bluetooth connectivity	✓	✓	✓
Electric headlamp levelling	✓	✓	✓
<b>AUDIO</b>	<b>GS 450h</b>	<b>GS 450h SE</b>	<b>GS 450h SE-L</b>
10-speaker audio system with single CD player	✓	x	x
14-speaker Mark Levinson 5.1 surround sound system with 6-disc video and audio capable DVD autochanger (included in Multimedia pack)	x	✓	✓
<b>COMFORT &amp; CONVENIENCE</b>	<b>GS 450h</b>	<b>GS 450h SE</b>	<b>GS 450h SE-L</b>
Smart key entry system	✓	✓	✓
Push-button start	✓	✓	✓
Speed-sensitive Electric Power Steering	✓	✓	✓
Cruise control	✓	✓	✓
Electric tilt and telescopic-adjustable steering wheel	✓	✓	✓
LED entry and footwell illumination	✓	✓	✓
Leather-trimmed multi-function steering wheel	✓	✓	✓
Wood trimmed steering wheel and gear knob	x	x	Opt
Electric, auto-dimming heated and folding door mirrors	✓	✓	✓
One-touch electric front and rear windows	✓	✓	✓
Memory function for front seats and door mirrors	x	✓	✓
Steering-guided parking sensors	x	✓	✓
Electric headlamp washers	✓	✓	✓
Electric rear sunshade	x	✓	✓
Soft-close bootlid	✓	✓	✓
<b>VENTILATION</b>	<b>GS 450h</b>	<b>GS 450h SE</b>	<b>GS 450h SE-L</b>
Electric dual zone climate control with clean air filter	✓	✓	✓
Electric tilt/slide glass sunroof	x	Opt	✓
<b>SEATING UPHOLSTERY &amp; TRIM</b>	<b>GS 450h</b>	<b>GS 450h SE</b>	<b>GS 450h SE-L</b>

Eight-way electrically adjustable front seats	✓	✗	✗
Eight-way electrically adjustable front seats with lumbar support	Opt	✓	✓
Heated and ventilated front seats	Opt	✓	✓
Fabric seat trim	✓	✗	✗
Leather seat trim	Opt	✓	✓
Wood trim detailing (inserts on doors and lower centre console)	✓	✓	✓
Wood trim detailing including steering wheel and gearshift knob	✗	✗	Opt
<b>SECURITY</b>	<b>GS 450h</b>	<b>GS 450h SE</b>	<b>GS 450h SE-L</b>
Anti-theft system and immobiliser	✓	✓	✓
Double door locks	✓	✓	✓
<b>BODY EXTERIOR</b>	<b>GS 450h</b>	<b>GS 450h SE</b>	<b>GS 450h SE-L</b>
High Intensity Discharge headlamps	✓	✓	✓
Adaptive Front-lighting System (AFS)	✓	✓	✓
LED tail lights and rear brake lights	✓	✓	✓
Front and rear fog lamps	✓	✓	✓
Rear lip spoiler	✗	✓	✓
18-inch five-spoke alloy wheels	✓	✓	✓

## LEXUS GS 450h TECHNICAL SPECIFICATIONS

<b>HYBRID SYSTEM</b>	
Type	Series/parallel, full hybrid
Combined power (bhp/DIN hp)	341 (345)
<b>ENGINE</b>	
Engine code	2GR-FSE
Type	60-degree V6, longitudinally mounted
Valve mechanism	4 valves per cylinder, chain drive, dual VVT-i
Bore x stroke (mm)	94.0 x 83.0
Displacement (cc)	3,456
Compression ratio (:1)	11.8
Fuel system	Direct injection, two injectors per cylinder
Fuel type	95 octane petrol, or higher
Max. power (bhp/DIN hp @ rpm)	292 (296) @ 6,400
Max. torque (Nm @ rpm)	368 @ 4,800
<b>ELECTRIC MOTOR</b>	
Type	AC synchronous, permanent magnet
Max. power (bhp/DIN hp)	197 (200)
Max. torque (Nm)	275
Voltage (V)	650



<b>ELECTRIC GENERATOR</b>		
Type		AC synchronous, permanent magnet
Voltage (V)		650
<b>TRANSMISSION</b>		
Type		E-CVT, two-stage, longitudinal, rear-wheel drive
2-speed motor reduction gear ratios	Low	3.900
	High	1.900
Differential type		Hypoid gear, limited slip
Final gear ratio		3.266
<b>HIGH VOLTAGE BATTERY</b>		
Type		Nickel Metal-Hydride (Ni-MH)
Number of cells		240 (6 x 40 modules)
Voltage (V)		288
Capacity (Ah)		6.5
<b>PERFORMANCE</b>		
0-62mph (sec)		5.9
50-75mph (sec)		4.7
Maximum speed (mph)		155
<b>FUEL ECONOMY/EMISSIONS</b>		
Urban (mpg)		31.7
Extra urban (mpg)		39.2
Combined (mpg)		35.8
CO <sub>2</sub> emissions (g/km)		186
Nitrogen oxides (NOx, g/km)		0.00
Hydrocarbons (HC, g/km)		0.01
Carbon monoxide (CO, g/km)		0.10
VED band		F
<b>DIMENSIONS &amp; CAPACITIES</b>		
Overall length (mm)		4,825
Overall width (mm)		1,820
Overall height (mm)		1,430
Wheelbase (mm)		2,850
Track – front (mm)		1,535
Track – rear (mm)		1,540
Overhang – front (mm)		855
Overhang – rear (mm)		1,120
Luggage compartment capacity (l)		280
Fuel tank capacity (l)		65
<b>WEIGHTS</b>		
Kerb weight (min. – max. kg)		1,865 – 1,930
Gross vehicle weight (kg)		2,355

Towing capacity – braked (kg)	2,000
Towing capacity – unbraked (kg)	750
Max. roof load (kg)	75
<b>SUSPENSION</b>	
Front	Double wishbone
Rear	Multilink
Shock absorbers	Gas filled, monotube
Additional features	Adaptive Variable Suspension (AVS)
<b>BRAKES</b>	
Front (diameter x thickness, mm)	334 x 30 ventilated discs
Rear (diameter x thickness, mm)	310 x 18 ventilated discs
Additional features	Electronically Controlled Braking (ECB) Vehicle Dynamics Integrated Management (VDIM) Hill-start Assist Control (HAC) Regenerative brake system
<b>STEERING</b>	
Steering gear type	Rack and pinion Electric Power Steering
Ratio	12.4-17.2
Turns lock-to-lock	2.7-3.7
Minimum turning radius – tyre (m)	5.2
<b>WHEELS AND TYRES</b>	
Wheels	Alloy 18x8J
Tyres	245/40 R18