

# **RX 450h Hybrid Luxury Utility Vehicle With EPA- Estimated Rating of 30 MPG Combined**

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The RX 450h hybrid luxury crossover is one of Lexus' best-selling hybrid models. When the RX hybrid first launched in 2006, it was a pioneer in the luxury hybrid category. Now, Lexus stands as the luxury hybrid leader with its offering of five hybrids. With impressive fuel economy ratings, powerful drivetrain and a comfortable ride, the RX 450h provides an engaging driving experience with an abundance of technology and convenience features. For 2012, the RX 450h adds Nebula Gray Pearl to the exterior color choices as Smoky Granite Mica is discontinued.

## **Hybrid Powertrain**

The RX 450h's Lexus Hybrid Drive features a 3.5-liter V6 Atkinson-cycle engine, electric motors, a small and light power-control unit and other fuel-saving innovations. It offers performance similar to V8s, 295 total system horsepower and in many cases better combined fuel economy than the average four-cylinder mid-size sedan. The Front Wheel Drive (FWD) model has EPA-estimated 32 mpg city and 28 mpg highway (30 mpg combined) fuel economy ratings, while the All-Wheel Drive (AWD) model has estimates of 30 mpg city, 28 mpg highway, 29 mpg combined.

As a full hybrid, the RX 450h can operate in electric-only or gas-engine-only modes as well as a mode that combines the power of both. Extended electric-mode operation during low-speed or stop-and-go driving conditions helps reduce fuel consumption. Under certain circumstances, a driver-selectable EV mode can allow the vehicle to be driven short distances using only the electric motors. The RX 450h achieves Super Ultra Low Emission Vehicle (SULEV) certification in California (Tier 2-Bin 3 in other states).

With the Atkinson cycle, the gasoline engine's intake valves are closed late to delay beginning of compression, resulting in a higher expansion ratio. That reduces intake and exhaust energy losses for more efficient combustion and improved fuel economy. The gas engine alone produces 245 horsepower at 6,000 rpm and 234 lb.-ft. torque at 4,800 rpm. The Atkinson cycle also reduces exhaust temperature.

A cooled Exhaust Gas Recirculation (EGR) system reduces it further still, helping economy by eliminating the fuel enrichment otherwise needed to help prevent catalyst overheating under high loads.

A compact 288V DC Nickel Metal Hydride (Ni-MH) battery pack fits neatly under the rear seat. A boost converter efficiently raises voltage to 650V DC, and an inverter changes this to 650V AC for the front-mounted 123-kW electric motor-generator. The boost converter and inverter are enclosed in the power-control unit, which also houses the condenser.

The RX 450h FWD model's hybrid powertrain employs two motor-generators: MG1, the engine-driven generator, is a starter and can charge the battery pack or power other electric motors as needed; MG2 is the front-drive motor. Power from the gas engine and MG2 is distributed to the drive wheels via a planetary gear-type continuously variable transmission. MG1 controls the output speed of the transaxle through the planetary gear set, without clutches or a viscous coupling. MG2 delivers torque over a wide range for better response and smooth performance. When the RX 450h is coasting or braking, the electric motors function as generators, capturing energy that would normally be lost as heat through the brakes and transforming it into electricity to recharge the batteries.

RX 450h AWD adds a third, rear-mounted motor-generator (MGR) to drive the rear wheels, eliminating the need for power-transfer gearing or a driveshaft from the front. The hybrid system electronically varies front and rear

torque distribution depending on traction conditions. A two-step flywheel damper absorbs small torque fluctuations and also the minor vibration produced when the gasoline engine starts and stops. A SNOW mode slows accelerator-pedal response to help reduce the possibility of wheel spin.

Multi-Mode, a feature adapted to the vehicle's electronically controlled continuously variable transmission, allows the driver to control engine braking for enhanced maneuverability on rough or winding roads. The Intelligent Shift Control feature selects and holds the optimal range when driving downhill or on inclines, providing a smoother driving experience.

The power-steering pump, water pump and air-conditioning compressor are driven electrically rather than by the engine, reducing parasitic losses.

To enhance fuel economy, an exhaust heat-recovery system circulates engine coolant through a unit installed in the exhaust pipe behind the catalytic converter. This feature reduces engine warm-up time, allowing it to stop earlier, more often, and for longer periods, improving both fuel economy and emissions.

### **All-Wheel Drive**

The RX 450h AWD uses a separate rear electric motor-generator to provide power to the rear wheels when road conditions or throttle response dictates. When accelerating, or starting off on a low-grip surface, torque is quickly provided to all four wheels. At steady speeds, torque is sent only to the front wheels, enhancing fuel efficiency. For handling agility and control, the AWD system increases rear-wheel torque when the vehicle's front tires start to lose traction and decreases rear-wheel torque when the vehicle's rear tires start to lose traction.

### **Chassis/Body/Suspension/ Brakes/Tires**

Lexus engineers provided the RX with an engaging driving experience, and a quiet and smooth ride. A key factor in the RX models' handling agility is the uniquely designed double-wishbone rear suspension. Another key benefit of the rear suspension is that the packaging yields greater cargo area room. The front suspension geometry was optimized with a thick stabilizer bar. Inversely wound front coil springs compress in opposite directions, preventing the negative effects of suspension compression on steering.

The standard electric power steering system contributes to agility and better steering feel while eliminating the parasitic losses of a hydraulic steering pump. Eliminating hydraulic oil also provides an environmental benefit and reduces maintenance. When the driving conditions involve little steering input, energy consumption is reduced, improving fuel economy by nearly three percent. Steering assist is automatically adjusted in response to vehicle speed, with greater assist at low speeds and greater feel at higher speeds. In addition, maneuverability in the RX is easy with its 40 foot turning circle curb-to-curb.

Vehicle Dynamics Integrated Management (VDIM) handling technology is standard on the RX 450h. VDIM system anticipates loss of vehicle control and governs all of the vehicle's dynamic handling systems – the Anti-lock Braking System (ABS), Brake Assist (BA), Vehicle Stability Control (VSC) and Traction Control (TRAC) – with the electronic throttle control system. The system employs them collectively and seamlessly to help make corrections while allowing higher dynamic capability.

The system's enhanced VSC function adds steering assist torque to help aid handling on a split-friction surface. The VDIM system also provides a limited slip differential effect. The TRAC and VSC functions can also be switched off, for example, when the driver needs to free the vehicle when stuck in mud or snow.

The RX stops with the help of two-piston front caliper brakes and brake feel is enhanced by optimizing pads, pedal ratio and booster output characteristics. On the RX 450h, Electronically Controlled Brakes (ECB2) work closely with VDIM, translating brake pedal stroke speed and pressure to generate the precise amount of hydraulic pressure needed.

Standard Hill-start Assist Control (HAC) uses brake pressure to help prevent the vehicle from moving backward when starting out on an incline. This system does not wait to detect rollback, however. It can be controlled by

the driver and works in both forward and reverse. While the vehicle is stopped and the brake pedal is depressed, pushing it further activates the feature. Brake pressure is then maintained for approximately two seconds after the brake pedal is released and the driver switches to the accelerator pedal.

Standard 18-inch aluminum-alloy wheels, which were designed to appear as if carved from a single block, have 235/60R18 tires. Optional 19-inch split five-spoke aluminum-alloy wheels with 235/55R19 tires are available with a hybrid-exclusive design.

### **Safety/Security**

The RX 450h features Intelligent Adaptive Front-lighting System (AFS) for high beams of HID headlamp equipped models, and for the low beams of the LED equipped models. When entering a corner, AFS estimates where the vehicle will be based on the vehicle speed and the angle of the tires, and adjusts the lateral aim of the headlamps. AFS can be switched off by the driver if desired and includes an auto-leveling function.

Also available is an automatic high beam system which uses a camera mounted on the inner rear view mirror to switch between high and low beams in response to oncoming vehicles and those traveling in front, or when other ambient sources are detected, helping reduce driver inconvenience.

The optional Pre-Collision System (PCS) with Dynamic Radar Cruise Control uses millimeter-wave radar to measure and help maintain a pre-set following distance from a vehicle traveling ahead. The radar sensor can detect certain obstacles in front of the car, and a PCS computer with vehicle speed, steering angle and yaw-rate inputs helps to determine whether a collision is highly possible. In such a situation, PCS preemptively retracts front seat belts and pre-initializes BA so that increased braking will be applied the instant the driver depresses the pedal.

A high-strength cabin design and comprehensive Supplemental Restraint Systems (SRS) are designed to help provide a high level of crash-energy management. Approximately 42 percent of the entire structure uses high tensile strength steel. The structure was engineered to help provide collision compatibility with vehicles of varying heights and weights.

The RX 450h is equipped with a segment-leading 10 standard airbags, including side curtain airbags, front seat-mounted side airbags, rear side airbags (for the outboard seating positions) and knee airbags for the driver and the front passenger. A roll sensor signals the side curtain airbags to inflate if a predetermined threshold of vehicle tip-up is detected.

The front-passenger airbag is a dual stage, twin-chamber design that, when deployed, helps provide optimal protection. Active front headrests help reduce the severity of a whiplash injury in the event of certain types of lower speed rear collisions.

### **Luxury/Comfort/Convenience**

Lexus luxury begins with how the customer first interacts with his or her vehicle. All RX models are equipped with the SmartAccess keyless entry with push-button start. As the driver approaches the vehicle, interior and exterior courtesy lamps illuminate. Opening the door, the instrument panel lighting gradually fades in. When the hybrid system is started, the instrument gauge needles and markings illuminate, followed by the multi-information display. After the driver exits the vehicle, the lights fade out at different intervals.

RX 450h is equipped with a power tilt and telescopic steering column. To ease entry and exit, the seat automatically slides up to two inches rearward and the steering wheel tilts upward and slides forward when the hybrid system is switched off. Upon pushing the "ON" switch, the seat and steering wheel return to their last position automatically.

The standard 10-way power front seats are shaped to accommodate arm movement when operating the available Remote Touch, while helping to hold the occupants in place. Both the driver and passenger seats also feature power lumbar adjustment. Also available on the RX is a ventilation function for the front seats to help improve comfort on hot and humid days. The shape and texture of the armrests and switches offer an ideal combination of

tactile feel and functionality.

The leather-wrapped three-spoke steering wheel features integrated audio controls and a unique cross-section that is designed to provide a more natural grip than a conventional round-section wheel. An optional leather and wood trimmed wheel is also available.

Three seat materials include standard fabric, optional smooth leather or even softer semi-aniline leather. The RX 450h also exclusively offers a Black and Light gray interior with striking black accents. In addition to Light gray and Black, Parchment is available as an interior color. Standard wood trim comes in Brown Walnut matched to Parchment, or Espresso Bird's-eye Maple matched to Light gray and Black.

The center console box provides more than 0.75 cu. ft. of storage capacity, enough space to comfortably store CDs/DVDs or the vehicle's owner's manual. The three-part (40/20/40) rear seats can slide fore and aft, recline, and fold down using the one-touch levers mounted in the luggage compartment. The double-wishbone rear suspension, due to its compact packaging, yields a larger luggage compartment; the width between the suspension towers is increased by nearly six inches.

The quiet climate-control system offers quick cooling and warming. A high-efficiency compressor detects refrigerant flow in order to optimize engine control and fuel economy. An available smog sensor is designed to detect harmful particles (CO, HC, NOx) in other vehicles' exhaust emissions and automatically switch between fresh air and recirculation modes. An electric compressor on the RX 450h includes a humidity sensor to help optimize air-conditioner operation, helping to enhance fuel economy.

The RX continues the tradition of offering the Lexus Premium Audio system as standard equipment, in this case a powerful nine-speaker system with a six-disc changer. Creative placement and angling of the speakers perfectly cross-channel sound to the occupant on the opposite side of the vehicle to transform the cabin into a clear, crisp acoustic environment. Bluetooth® hands free phone capability is also standard.

RX models can accommodate a variety of music sources, providing available auxiliary and USB inputs, Bluetooth Audio wireless connectivity and a standard integrated XM Satellite Radio receiver (complimentary 90-day trial subscription included). When an iPod® is attached via the USB port, information such as names for the artist, track and album is displayed on the available navigation or audio screen, while the iPod can be controlled through the audio system. The large center console storage box easily accommodates a variety of electronic devices while keeping wires out of sight.

### **Luxury Options**

An available 12-speaker system audio system comes with the optional Comfort Package or rear seat entertainment systems and includes two-rear-door tweeters and a compact, L-shaped subwoofer in the rear-luggage compartment.

The optional 15-speaker Mark Levinson® Surround Sound system allows listeners to enjoy 330 watts at 0.01 percent THD through 7.1-channel surround sound. The Mark Levinson system, a Lexus exclusive, features a center channel coaxial speaker, metal-cone midrange speakers, tweeters and a 100-watt amplified subwoofer. A 2.5-inch speaker built into each D-pillar provides the right and left surround-sound channels. The diffusion of sound provides each occupant the same level of audio quality.

The available Hard Disc Drive (HDD) navigation system eliminates the need for DVD map discs and offers a unique voice recognition system, which can work using casual-language inputs on certain functions. An optional rear-seat entertainment system includes two high-definition seven-inch screens, one on each of the front seatbacks. Each screen can display video from separate sources. A remote control allows independent control of each screen. Rear-seat occupants can also choose to listen to audio through the wireless headphones instead of vehicle speakers.

The available wide-view side and backup cameras help provide the driver with a wider range of visibility. The driver can check hard-to-view areas by simply pressing the camera-select button on the steering wheel or, when in reverse, viewing the camera images on the navigation screen. An optional back-up camera displays images on the eight-inch navigation screen; systems without navigation have a 2.5-inch display in the rear-view mirror. RX 450h also offers a telematics system, Lexus Enform<sup>®</sup> with Safety Connect<sup>®</sup>, available by subscription. Complimentary one-year trial subscriptions are included on all purchases of new Lexus vehicles equipped with these features. Safety Connect is standard on all vehicles while Lexus Enform with Safety Connect is on all vehicles equipped with the optional Navigation system. The Lexus Enform and the Safety Connect response centers operate 24 hours a day, 7 days a week—every day of the year. Lexus Enform vehicles are factory ready for subscriptions to a variety of innovative SiriusXM services including NavTraffic, NavWeather, Sports, and Stocks. SiriusXM services include complimentary 90-day trial subscriptions and require separate audio and data subscriptions.

## **Exterior Design**

The Lexus RX models blend a dynamic version of L-finesse design to create a sleek profile that is accentuated by broad “shoulders” for an athletic yet elegant presence. Bright finish side-window moldings follow a subtly concaved line across the A- and C- pillars, extending at the front and rear ends.

The Lexus design cue of placing the grille lower than the headlights, along with sharper headlight graphics, yields a strong frontal expression. The RX 450h offers standard halogen and optional HID and LED headlights. The RX 450h’s unique grille features a finer pitch than on the RX 350, creating a fluid-like surface, accentuated by its silver color.

Pronounced front fenders flow into the doors, and integrated rear fender flares neatly sweep around to pull together the taut rear corners of the vehicle. The lower body emphasizes the standard 18-inch wheels. Passenger doors extend below the entry sill, helping keep out dirt and moisture.

Several exclusive design features, including the grille and front bumper, distinguish the RX 450h hybrid from the RX 350. Exclusive optional LED headlights offer a more distinctive appearance as well as longer life and lower energy consumption. Lexus hybrid blue is used for the front and rear emblems, hybrid logos, rear combination lights, and headlights.

A distinctive feature of the door handles is that the surface subtly twists outward from the front to the rear to give a comfortable grip. The side mirrors feature integrated LED turn signal lamps.

The rear spoiler’s primary function is to help lower the vehicle’s Coefficient of drag (Cd), but it also conceals the rear wiper and houses the AM/FM radio antenna and high-mount stop lamp.

## **Interior Design**

Based on Lexus L-finesse philosophy, the dramatically designed interior clearly separates the interior into two distinct zones – the “display zone” to provide information, and the “operation zone” for interaction with controls.

The shoulder of the door trim comfortably envelops the occupants, the clear line of the trim beginning inside the cabin and tapering outward toward the exterior. The design imbues a feeling of a continuous line encircling the occupants and defining the controls and displays. Neatly sculpted metallic surfaces, especially on the asymmetrical center stack, showcase a bold contrast of shadow and light.

A high contrast white Organic Light Emitting Diode (OLED) is used for the multi-information display located next to the speedometer. Vibrant white characters are sharply displayed on a high-contrast black background for ease of use and a luxurious appearance. For the RX 450h, blue accented meters strengthen the hybrid image, and a hybrid system indicator replaces the tachometer to encourage driving in an economical manner.

In addition to an Eco Driving indicator light, RX models feature an Eco driving indicator zone that displays current fuel economy using a bar graph and alerts the driver when they are achieving low fuel efficiency.

To help reduce driver distraction and wasted movement, Lexus engineers strategically placed several features close to the driver including the multi-information switch, the Remote Touch console-mounted navigation controller and the optional Heads-Up Display. The available eight-inch navigation display (or seven-inch audio/HVAC display when navigation is not ordered) is placed at a higher, more distant position, providing a more natural visual angle. A multi-information switch on the steering wheel allows the driver to access numerous function settings without taking hands off the steering wheel, and reduces the number of individual switches, contributing to a cleaner instrument panel. Vehicle settings can be customized according to personal preference, including personal door-lock preferences, interior/exterior light adjustments, driver's seat easy exit, and window-closure settings.

The available navigation system can be controlled using either the Remote Touch device or by utilizing voice command. Remote Touch allows the user to operate the navigation system, climate, audio, phone controls and more. The screen menus are selected with the controller, eliminating the need to reach out and reducing eye movement.

The attribute that most distinguishes Lexus' navigation controller from other devices in other luxury models is its "haptic"-feedback technology, which provides a tactile response to the hand. As the user operates the controller near a screen icon, the cursor is pulled to that icon with feedback from a servomotor in the device enabling the user to feel it "click" into place. The driver or passenger makes a selection by pressing the side enter button on either side, and the feedback servo is adjustable for sensitivity. The system then confirms the action with a subtle sound. Remote Touch integrates the functions of seven hard switches used with the previous touch screen, helping users to operate those functions with reduced effort and distraction.

The available Heads-Up Display (HUD) utilizes white readouts. High-intensity LEDs project high-contrast white figures onto the windshield, which are easier to read – and easier on the eyes – than the typical green-colored readouts. The HUD offers displays for speed, navigation, and audio. A wedge-shaped windshield interlayer for the HUD projection area eliminates the distracting printed grid pattern seen on some other vehicles equipped with HUDs.

### **Warranty**

All new Lexus vehicles come with a 48-month/50,000-mile basic limited warranty with roadside assistance for 48 months/unlimited miles. Powertrain and restraint system coverage is provided for 72 months/70,000 miles. Corrosion perforation protection is covered for 72 months, regardless of mileage. The hybrid-related components, including the HV battery, battery-control module, hybrid control module and inverter with converter, are covered for eight years/100,000 miles.

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