Mitsubishi Outlander PHEV – Best Of Both Worlds?

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Author: Kim Henson

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A Plug-in Hybrid Electric Sports Utility Vehicle? What a good idea… Kim Henson test-drives Mitsubishi's innovative 4×4 Outlander PHEV…



The Outlander PHEV's up-to-the-minute styling and a bold, but not aggressive, appearance add up to give a memorable presence on the road.

It takes some doing to combine, within a single Sports Utility Vehicle (SUV), electric propulsion (primarily for local runs), a petrol engine, four wheel drive, true practicality in a range of roles, and cost-effective operation. However, with their already widely-acclaimed Outlander PHEV (standing for 'Plug-in Hybrid Electric Vehicle), Mitsubishi has done just that.

For many years the company has been respected for its distinctive, competent vehicles, but this is surely the most clever car from the firm so far…



Large, wrap-around, highly visible rear lamp units are excellent from a safety point of view. Note the wide rear doors, aiding entry to and exit from the car.

Essentially Mitsubishi has taken its already well-received, but conventionally-powered, Outlander, and raised the model to a new level in terms of 21st Century technology.

The 'seamless' integration of electric propulsion (incorporating twin, permanent magnet, synchronous 60 kW electric motors; one at the front, one at the rear), a refined two litre petrol engine (incorporating a balancer shaft) and four wheel drive is a bold move, and one that has provided some fascinating challenges for the firm's engineers.

Two independent electric motors have been adopted to drive the front and rear wheels; as both motors deliver maximum torque 'instantly', the configuration is said to deliver acceleration similar to that of a conventional three litre engine.

The lack of a propeller shaft or inter-connection between the two electric motors reduces friction-induced power loss, while at the same time improving response and control.

The benefits to buyers of the overall approach adopted by Mitsubishi to this vehicle are

many. They start with the fact that the entry-level GX3h version of the five seater Outlander PHEV is priced at the same level as the equivalent diesel model, after taking into account the government's £5,000 grant for a 'plug-in' vehicle. (Incidentally, a commercial version is available too – so the Outlander PHEV is the first plug-in hybrid electric vehicle to be offered in this form).

Next on the long list of happy aspects is the emissions rating of just 44 grams per kilometre. Not only does this qualify the PHEV for zero-rate road tax (for car but not commercial versions), but also it means that company car drivers are subjected to a Benefit in Kind (BIK) rate of just five per cent…

In addition, for tax purposes a business operating a PHEV can claim 100 per cent writing down allowance in the first year.

Exemption from London's Congestion Charge is another plus point.

There's a Euro-NCAP five star rating on this car too; very reassuring.

WHAT DOES IT DO?



With the vehicle running in pure electric mode, the on-board lithium-ion drive battery (80 cells, total voltage 300) has enough power to enable up to 32.5 miles to be covered; this is said to be further than the average daily commute (which, according to the Society of Motor Manufacturers and Traders, is 25 miles).

On GX4h (mid-range) and GX4hs ('top

‘It does just what it says on the tin’!

of the tree’ model, as tested) trim level variants, by means of an app for iPhone/Android smart phones, if desired the car’s operator is able to remotely charge the vehicle, and to heat it using the car’s heating/air conditioning system.

For longer journeys, the petrol engine is brought into play, although if preferred electric power can still be used at normal cruising speeds (certainly, as I discovered, up to the UK’s motorway limit of 70 mph), as long as the battery has sufficient power remaining. The built-in, and user-controllable battery charge mode enables the battery to be charged by the engine, whether or not the car is actually moving. The vehicle can also be recharged by plugged into mains electricity outlets, at home (the car comes with a suitable charging lead assembly) or at strategic roadside recharging points.

It’s interesting that a petrol engine has been chosen rather than a diesel unit for long-distance travel, but of course petrol is a less expensive fuel than diesel in the UK…

Driver-operated controls for the sophisticated electric propulsion system include a ‘save’ button for saving battery charge when desired, and also a ‘charge’ button, which activates charging of the battery from the petrol engine. This delivers approximately 80 per cent of full charge in about half an hour, with the petrol engine running but the car stationary.

Three separate driving modes are provided, and changing between them is genuinely undetectable. The set-up was developed using technologies also used in the Mitsubishi i-MiEV for mid-size and larger passenger cars requiring long-distance cruising ranges. All components within the system are constantly monitored, and integrated control is applied to the petrol engine, twin electric motors, regenerative braking system, air conditioning and so on, to deliver optimum performance and emissions.

Pure electric propulsion ('EV' mode) is self-explanatory, and provides near-silent progress, zero CO2 emissions from the vehicle and zero consumption of petrol. However, it is important to note that – as I discovered during my time with the car – cold weather and associated use of the heating/air conditioning systems substantially reduces the available mileage range on electric propulsion only.

In addition to pure 'EV' mode, there are 'series hybrid' and 'parallel hybrid' arrangements, each brought into play according to varying driving conditions. When the car is running in 'Series Hybrid' mode, the petrol engine works JUST as a generator, supplying power to the electric motors. The system automatically switches to this mode when remaining battery charge falls below a pre-set level and also when enhanced performance is required – for example when climbing a hill or accelerating to overtake another vehicle.

When the car reaches high speeds it switches to 'Parallel Hybrid' mode, in which the petrol engine produces most of the motive power required, but is also helped by the electric motors as needed (again, under conditions when greater performance is required).

The four cylinder petrol engine incorporates a 'MIVEC' (Mitsubishi Innovative Valve Timing Electronic Control) system, designed to maintain engine running within optimised efficiency parameters, by continuously varying the timing of the air inlet valves according to engine speed (when in 'Parallel Hybrid' mode).

The exhaust system has been optimised to reduce noise, in addition to which the engine bay has been comprehensively soundproofed. The aim with these measures was to ensure that even with the petrol engine operating, the vehicle is as quiet as when driving in EV mode. However, at the same time, to help ensure pedestrian safety, an Acoustic Vehicle Alerting System (AVAS) produces an audible sound to warn pedestrians of the vehicle's approach (at speeds of up to 22 mph).

The vehicle incorporates an adaptive four wheel drive set-up, with the twin electric motors delivering power to the wheels. To aid easy driving in poor ground conditions, the car has

been endowed with a generous ground clearance of 190mm (about 7.5 inches).

Since the electric motors used do not need complicated transmission units, the transaxles at both the front and rear of the car work with simple, single-speed, fixed reduction gears, to provide smooth progress. The front transaxle incorporates a built-in clutch that brings in 'Parallel Drive' mode for petrol engine propelled travel at higher speeds.

'Super-All Wheel Control' (S-AWC) is an integrated vehicle dynamics control system which covers the Twin Motor 4WD system, combining front and rear wheel drive control with left and right wheel braking control, to enhance handling and stability. (There's a choice of two, switch-activated modes; 'Normal' for on-road driving, and 'Lock' for enhanced off-road motoring).

The PHEV has a low centre of gravity (helped by the location of the drive battery within the floor assembly of the vehicle), and this, in conjunction with carefully considered weight distribution, is intended to help provide good handling.

The PHEV has a 1,500kg towing capacity, or enough for a medium-weight caravan.

Performance figures are impressive, with a claimed nought to 62 mph acceleration time of just 11 seconds, and with huge reserves of torque on offer – up to 245 lb.ft.

Based on the 'EU drive cycle' and EU law, a theoretical fuel consumption figure of 148 mpg is quoted… However please note that for real world motoring this figure is very much hypothetical.

Everyday practicalities have not been ignored, for the Outlander's interior is spacious for all occupants, with generous head and leg room throughout. The rear seats are divided 60/40 to vary passenger/luggage carrying capacities, as required.

The load compartment is roomy, with a bumper-level load floor, a high-lifting tailgate (electrically-operated on GX4h and GX4hs variants), and a capacity of 463 litres (1,617 litres

for the commercial version).

HOW DOES IT DO IT?

Intended mainly for short runs, ‘EV’ (pure electric operation) mode offers a range of up to 32.5 miles before the battery needs to be recharged. For those who cover less than this distance each day, and with daily recharging, the vehicle’s petrol engine would seldom need to be used.

Taking both electric and petrol driving modes into consideration, the total cruising range is about 500 miles.



The underbonnet compartment accommodates both the petrol engine and the forward electric motor (there’s another one at the rear of the vehicle!).

The vehicle’s built-in technology automatically selects the most appropriate drive mode, according to driving conditions and the remaining level of charge in the battery.

Electric power is actively used to help minimise petrol consumption; it does this by keeping the petrol engine running within its most efficient parameters, and through its regenerative braking system it recovers energy used during deceleration. When the vehicle is decelerating, the electric motors operate as generators, producing electricity to recharge the drive battery.

The driver can vary the degree of regeneration/retardation by means of the ‘paddle’ control on the steering column, providing five ‘strength’ settings, or by the selector lever, with three such settings. The regenerative braking effect can also be increased by pressing the brake pedal.

An ‘ECO Mode’ can be activated by the driver to control electricity and fuel usage in the most efficient manner possible, and an ECO Driving Support System Display indicates how much energy is being saved while driving.

WHAT IS IT LIKE IN REAL LIFE?

I test-drove a GX4hs (range-topping) version of the Outlander PHEV. During the course of a week I deliberately used the car for a mixture of driving, including winding country lanes, fast main road/motorway running, and in-town work.

All Outlander PHEVs are comprehensively equipped, and the GX4hs in particular. Standard features on the test car (in addition to a host of other useful fittings) included, for example, Mitsubishi’s e-Assist safety system, incorporating Forward Collision Mitigation (FCM), Lane Departure Warning (LDW), and Adaptive Cruise Control (which automatically maintains a driver-controllable distance between the Outlander and the vehicle in front).

Active Stability Control (ASC), which forms part of the S-AWC system, is standard on all versions. It controls the delivery of drive and braking forces to all wheels, to help avoid skids.

The Mitsubishi Multi Communication System (MMCS) comes as standard equipment on the GX4h and GX4hs variants.



The gauge on the left in this shot displays information regarding battery charging/electrical power consumption levels while on the move. The small screen to the right shows remaining mileage in terms of both battery power and fuel, as well as 'bar' graphs showing battery state and remaining fuel quantity on board.

Driver information provided by the PHEV-specific instrumentation is comprehensive, and after a very few miles I found the displays very easy to assimilate. The dash incorporates a 'vehicle energy flow display' (indicating by clear diagrams, if, for example, the car is using power or generating it, or if the electric motors are assisting the petrol engine, etc.). Further useful features are a vehicle energy monitor, a charging point search function, a charging cost monitor, and a display showing the available cruising range.

When required, the vehicle's drive battery can be recharged by connecting to a domestic mains supply (via a standard 240 volt/13 amp socket, or ideally a professionally-installed 240 volt/16 amp charge point). I liked the fact that, to help when charging the vehicle at night, a light automatically illuminates when the lid of the charging socket area (on the right-hand side of the car, at the rear) is opened.

During the course of five hours or so if using a 13 amp socket (or around 3.5 hours with the aid of a 16 amp charge point), in a very cost-effective manner this will fully restore the drive battery's charge level. Alternatively the car can be connected to a public rapid charge point that will restore about 80 per cent of the battery's charge in approximately half an hour.



The twin electrical sockets for charging the Outlander PHEV are located beneath a hinged flap on the right-hand side of the car; the fuel filler is positioned on the opposite side of the vehicle.



During battery charging from a domestic electricity supply, the simple-to-use charging unit displays the 'current' state of play by means of a series of lamps.



The PHEV's charging equipment is stored in a separate compartment beneath the main floor of the luggage compartment.

COMFORTABLE AND PRACTICAL

The luxurious interior of the test car was smart and proved to be very comfortable on long

journeys. The leather-trimmed seats (heated, in the front of the car) were supportive and there was excellent head and leg room for all occupants; a central armrest was built into the rear seat.

Handy too were a multitude of storage compartments around the interior, incuding a lidded glovebox, long, deep bins (incorporating bottle holders) within the front doors, and shorter bins in the rear doors. In addition, positioned at the rear of the central console was a useful storage box, incorporating a sliding tray inside, at the top.

The load compartment was well thought-out too, with a long, wide and deep platform which could be loaded/unloaded from bumper level. Tethering points were provided for securing loads. The boot floor could be lifted to reveal a useful storage area (for accommodating the mains recharging leads and other items).

I also appreciated the deep storage bins on each side of the ‘boot’, and the twin cup/bottle holders positioned on the right hand side.



Multi-adjustable, comfortable sports type front seats make light of long trips, and the interior looks and feels well-made.



The instrumentation and the centrally-positioned control panel provides comprehensive and clear information to the driver.



The test car’s sun roof was a welcome feature on sunny days.



Rear seat passengers benefit from generous leg and head room, and the seats are comfortable.



The electrically-operated tailgate on our GX4hs test car opens from bumper level and lifts high out of the way to allow unhindered loading and unloading of luggage.



Even with the rear seats in use, there’s a decent sized, flat-floored load area, plus a multitude of smaller compartments (including cup holders) in the ‘boot’.

DYNAMICS

I felt that the ride quality of the test car was firm but not uncomfortable, and the vehicle, although large, handled well, even on narrow, twisting country lanes with less than perfect surfaces.

Performance levels in all the circumstances in which I drove the car (always on tarmac; I didn’t test the vehicle off-road) were excellent, with the eager ‘instant torque’ acceleration (both from rest and on the move) and near-silent high speed cruising being much appreciated. However, it was the smooth and refined manner in which the car performed at

all times that provided the icing on the cake for me…

Around town, the electric motor worked near-silently, smoothly and efficiently as it rapidly whisked the car from standstill to 30 mph (when traffic allowed).

The car was similarly impressive on the open road, with electric propulsion providing several miles of ‘magic carpet ride’ hushed travel at cruising speeds, before it became necessary to use the petrol engine to recharge the drive battery.

This car is perfectly good at automatically setting the most appropriate drive mode for given traffic conditions. However, I found that it soon became second nature to switch manually as desired between the various drive and ‘save’/‘charge’ modes, and also in terms of altering the regenerative braking strength levels, to obtain the best balance for me personally, between charge levels and performance.

The car was very easy to drive (no more difficult than a conventional automatic vehicle) and although the technology incorporated within it IS complex, it is straightforward to operate the vehicle and to get the best out of it.

I especially liked the ultra-clear, unmistakable dash displays, and it was easy to switch between different screens to obtain the specific vehicle operation/range information (etc.) required at any time.

I have to emphasise that changing between the various drive modes really was ‘seamless’ in the true sense of the word. Apart from confirmation given by the dash displays, truly I could NOT tell (and nor could any of my passengers) whether the car was running in pure ‘EV’ (electric propulsion) mode, or with help from the petrol engine.

Any quibbles? During my time with the car I frequently found that the available range by electric propulsion was dwindling towards zero, necessitating recharging by the petrol engine or an external mains supply power source. None of this is a problem, as such, but I feel that the vehicle would be so much better if it had a longer ‘electric driving’ range.

At best, the quoted maximum range 32.5 miles is not enough (although at times, with careful use, and making the most of regenerative braking etc, I did manage to coax the dash display figure up to 40 miles). I found that on cold mornings, with the heater switched on, the available range on drive battery power would drop in dramatic fashion (for example, from 24 miles to just 17). I was tempted to turn off the heater to increase the available mileage on electric power…

If the electric driving range could be extended to, say, 100 miles, this would transform the usefulness of the vehicle, especially, of course, as the petrol engine is available to help with longer-distance travel.

Over all the miles I covered in the car, the average petrol consumption I achieved during my time with the Outlander PHEV, in a variety of types of use (and including 'electric' operation), was 32.2 mpg, with the best figure recorded by the on-board computer being just over 38 mpg.

VERDICT

A brilliantly thought-out, well-engineered, refined and practical SUV, which is good to drive and cost-effective to own and to run. Speaking personally I just wish it had a longer range in pure 'electric propulsion' mode.



WHEELS-ALIVE TECH. SPEC. IN BRIEF

Mitsubishi Outlander PHEV GX4hs

Drivetrain: Four wheel drive

Electric propulsion: Twin permanent magnet, synchronous 300 volt 60 kW electric motors; one at the front (137 Nm or 101 lb.ft torque), one at the rear (195 Nm or 144 lb.ft torque), plus petrol engine (please see below)

Petrol engine: 1998cc twin overhead camshaft, 16 valve four cylinder with Mitsubishi Innovative Valve Timing Electronic Control ('MIVEC') system

Power: 119 bhp @ 4,500 rpm

Torque: 190Nm (140 lb.ft.) @ 4,500 rpm

0–62 mph: 11.0 seconds

Top speed: 106 mph

Fuel consumption, actual overall figure achieved during a week-long road test: 32.2 mpg

CO2 emissions: 44 g/km (zero-rated road tax; 5% Benefit in Kind rating for company car drivers)

PRICE (‘On The Road’, after deduction of the government’s ‘Plug-in Car Grant, of £5,000): GX4hs as tested, £34,999 (including £1,000 for the remote control smartphone app and electric heater system)

The range-starter GX3h costs £28,249 (after the £5,000 grant), the GX4h is priced at £32,899 (after the £5,000 grant).

The final cost of the commercial version is £23,373 (after deduction of a £7,381 grant from the Office for Low Emission Vehicles/OLEV, and after reclaiming the VAT). Note that the commercial variant is subject to a flat-rate commercial vehicle road tax rate of £225.