

## **Mitsubishi Outlander PHEV**

### **Milestones**

Over the last years, the global auto industry has started to embrace electro-mobility as a contribution to combat climate change, developing showcase products and forging alliances to support the vast developments this effort requires whether in the area of batteries, drivetrain components or electronics.

For Mitsubishi Motors Corporation (MMC) though, electro-mobility has long been a core business, deeply ingrained in the R&D philosophy of the corporation as it started researching electric vehicles (EV) in October 1966.

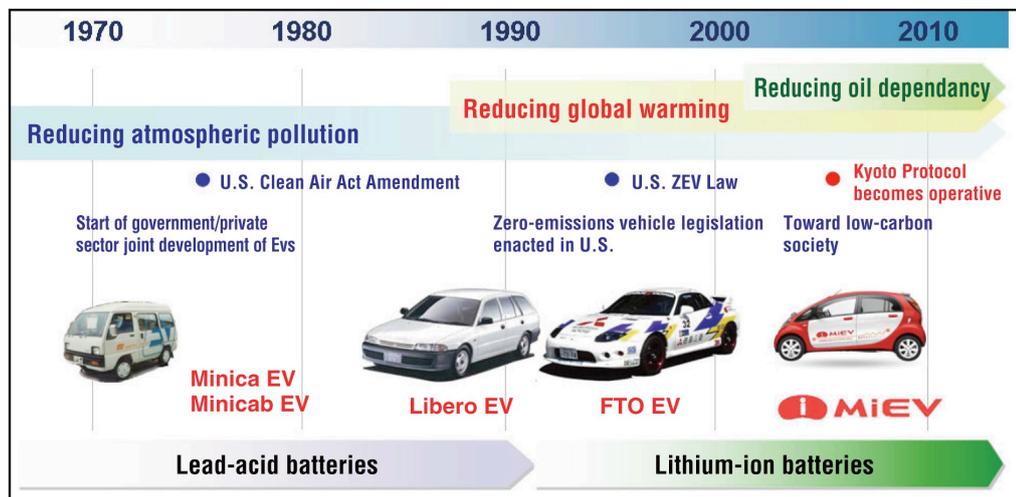


In that sense, today's Outlander PHEV is the latest in a long line of Mitsubishi electric vehicles AND the fore-runner of a wider range blending SUV architecture with EV powertrain, whether full electric or the derived MMC plug-in hybrid electric solution.

A unique case in the Industry, Outlander PHEV enjoys the benefits of a EV-based architecture, from significant weight saving (and therefore energy efficiency), to seamless operation, efficient packaging, standard multiple charging possibilities (on-the-go, regenerating, charge mode, normal plug-in, quick plug-in), zero emission in daily use for most drivers and limited emissions on long haul travelling, not to mention full compatibility with tomorrow's intelligent electric eco-systems, including V2G/V2H smart grids. A set of assets gradually developed by Mitsubishi since 1966...

#### - 1966 / 1971 – The electric roots

The 1960s saw a remarkable growth in the private ownership of automobiles. In the 1970s this was accompanied by an increasing density in motor traffic in urban areas, a factor which led to traffic disasters and heavy congestion. In addition, the pollution stemming from vehicle emission gases and noise became a major social problem. The zero-emission EV came to be seen as a measure for reducing and preventing such pollution.



In 1966, Mitsubishi Heavy Industries (MHI) signed an agreement with Tokyo Electric Power Company consigning to it *"The building and testing of a prototype electric vehicle using improvements in current battery technology."*

At the same time MHI was working with Mitsubishi Electric and Japan Storage Battery Co., Ltd. (today's GS Yuasa Corporation\*) on the development of a future city car and special service vehicles that would help preventing urban pollution.

After completion of the prototype, in May 1971 the newly formed MMC delivered ten E12-type EVs (*Minica Van*) to Tokyo Electric, based on the standard Minivan and powered by lead accumulator batteries, with a top speed of 80 km/h (where legal).

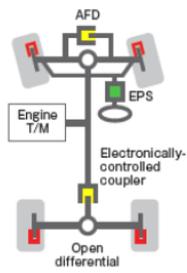
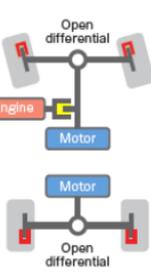
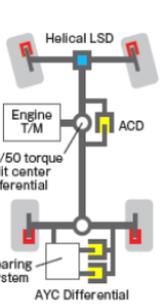
MMC followed this by delivering electric vehicles based on the *Minica Van*, *Minicab Van*, *Minicab Truck* and *Delica Van* to power companies. This 1971 inaugural EV program was followed by several others during the next thirty years, laying the foundations for today's

i-MiEV and Outlander PHEV, consistent with the issues the world was then stumbling on:

- **1987 / 2007 – The 4WD racing connection**

Amongst Mitsubishi Motors' signature technologies, Super-All Wheel Control (S-AWC) holds a special place as it came about through the evolution of motor sports regulations, branching out Mitsubishi's long 80+ years 4WD heritage – from the 1936 PX33 torpedo to the 1982 life-style-orientated Pajero and its 12 Dakar wins, etc,... – in a new direction inaugurated by the high tech 1987 Galant VR4.

Through their successful works-team participation in WRC, both Galant VR4 and then Lancer Evolution provided the opportunity to develop advanced technologies which Mitsubishi Motors then fed back into production model, of which 'all-wheel control' has become one of the Brand's signatures. All the way to today's Outlander PHEV.

	Outlander	Outlander PHEV	Lancer Evolution (for reference)
System configuration			
F/R torque split system	Electronically-controlled 4WD	Twin Motor 4WD	ACD (Active Center Differential)
L/R torque split system	AYC (Active Yaw Control)	AYC (Active Yaw Control)	AYC (Active Yaw Control)
Control system	Electric Power Steering (EPS) Active Front Differential (AFD) Brake	Brake	AYC Differential Brake
Drive Mode	AWC ECO / NORMAL / SNOW / LOCK	NORMAL / 4WD LOCK	TARMAC / GRAVEL / SNOW

In short, 'Super-All Wheel Control' (or 'S-AWC') can be understood as an umbrella technology covering different interpretations of the same principle: whatever the car, it is always meant to manage the driving forces and braking forces of the each four wheels, through the regulation of the torque split between the front & rear as well as between the left & right.

#### - **1994 / 2009 – The strategic (electric) move**

Continuing its research and development of batteries, electric motors and other major EV components, MMC took interest in the lithium-ion cell, with its superior energy density and power output over conventional types of battery, from an early stage in its history.

Spurred on by the zero emission vehicle (ZEV) legislation enacted in the State of California in 1990, MMC in 1994 set about developing the *MITSUBISHI HEV* plug-in hybrid EV powered by a lithium-ion battery module made by Mitsubishi Chemical Corporation.

Fast forward twelve years and once MMC was confident that it would be able to commercialize the lithium-ion battery, motor and other major EV technologies, the corporation announced in October 2006 the start of the "i MiEV" project (no hyphen at that time...) which would eventually lead to "i-MiEV" (with an hyphen), the first series production electric vehicle offered by a mainstream manufacturer within its standard range of cars.



In July 2009, MMC started selling i-MiEV to corporations and followed in 2010, on schedule with its announcement, with the general public, first in Japan and then to selected global markets. This effort did not go unnoticed as i-MiEV won the "Most Advanced Technology" award at the "2009 - 2010 Car of the Year Japan", amongst many other accolades.

## - 2009 / 2012 – From EV to PHEV

Running almost in parallel to the “i MiEV” electric car project, an even more ambitious endeavor was shaping up secretly at MMC R&D in Okazaki, near Nagoya, that of a large plug-in hybrid electric 4WD SUV.

Taking a few pages from the i-MiEV technology text book (including the highly sophisticated MMC-developed “MiEV OS” operating system – the electronic brain of the car) this next big bold step first materialized at the 2009 Tokyo Motor Show with Concept PX-MiEV, followed two years later at the same motor show by Concept PX-MiEV II, both previewing the forthcoming series-production Outlander PHEV.

While Concept PX-MiEV II was touring the global motor show circuit, PHEV mules were engaged in endurance & development testing in Japan, wearing the bodyshell of the outgoing 2nd generation Outlander.



Eventually, the moment of truth came at the 2012 Paris Motor Show, with the world premiere of Outlander PHEV, the first twin-motor plug-in hybrid electric SUV offered by a mainstream manufacturer within its standard range of cars.

Outlander PHEV stood (and still stands) apart from all other plug-in hybrid solutions as it uses the basic architecture of an electric car (drive-by-wire, no gearbox,...) instead of a mere electric power unit grafted at the back of a conventional ICE vehicle.

- **2012 / 2018 – Success story**

Disruptive to the core, Outlander PHEV entered the market a few months later (January 2013 for Japan, October 2013 for Europe), passing the 50,000th sales milestone in Europe in 2015, the year it also starred at the Baja Portalegre cross-country race in Portugal. In the meantime, it was also awarded with the "RJC Technology of the Year 2014" accolade by the Automotive Researchers' and Journalists' Conference of Japan (RJC).

Over the last four years, Outlander PHEV has met its public – with 100,000 cumulated sales in Europe, it has become the best-selling plug-in hybrid vehicle in Europe (all segments) in 2015, 2016 and 2017 while making its North American debuts in December 2017.

Today, more SUV and more EV than ever, Outlander PHEV has definitely evolved from early adopters' fare to corporation's flagship and core business, paving the way for MMC's next generation of SUVs.

Amid heated debates in Europe about the future of Diesel and more generally the place of the automobile in society, the 2018 Geneva Motor Show global premiere of Outlander PHEV's newest iteration vindicates Mitsubishi Motors ambition to offer new frontier propositions for those who want to embrace change ahead of the game.

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