GRID SERVICES FROM OUTLANDER PLUGIN HYBRID ELECTRIC VEHICLE - UPDATE

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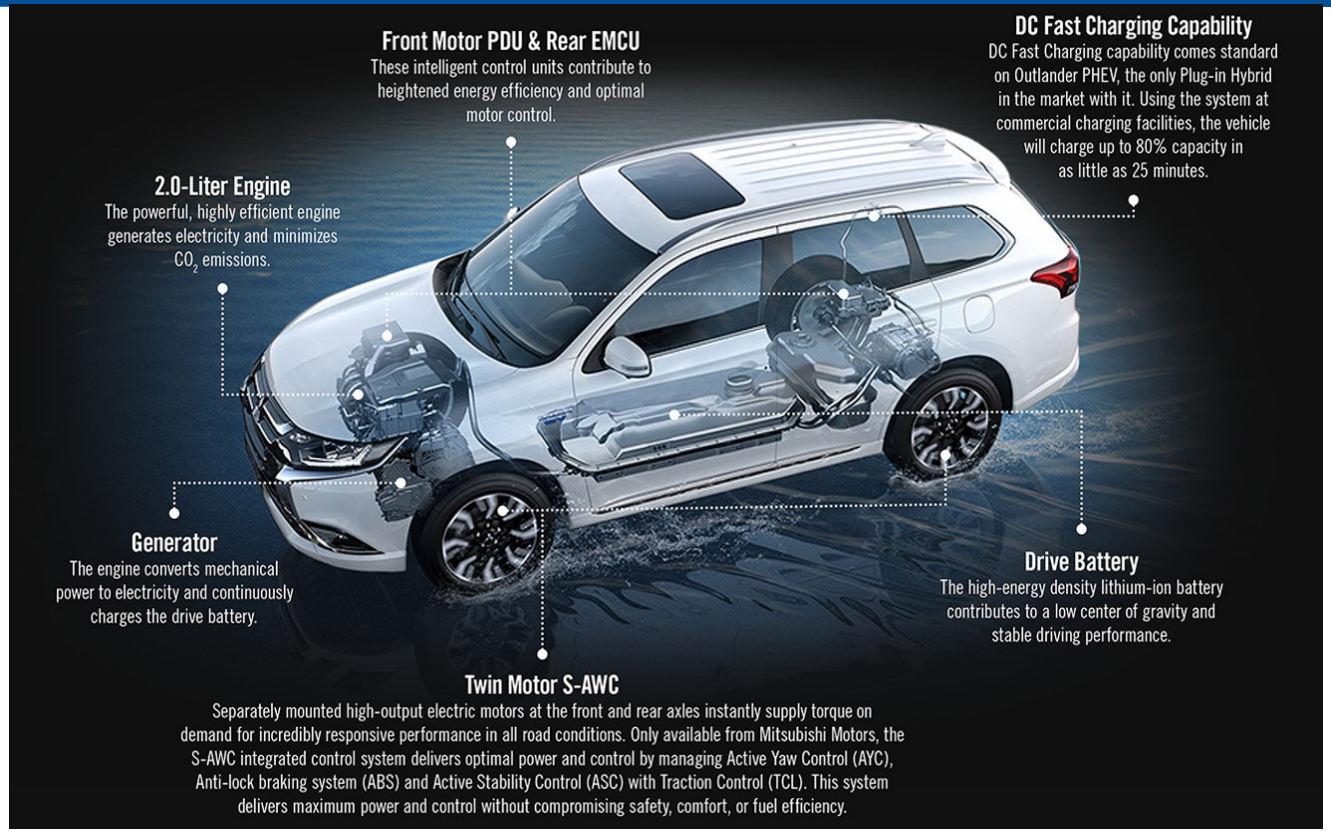
SAE INTERNATIONAL®

MITSUBISHI MOTORS

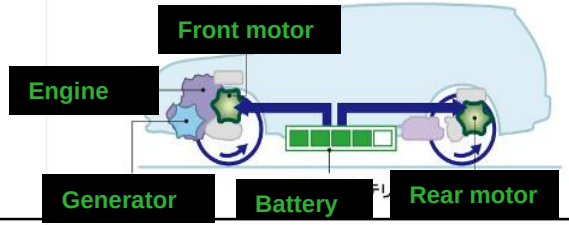
Overview – North American Outlander PHEV



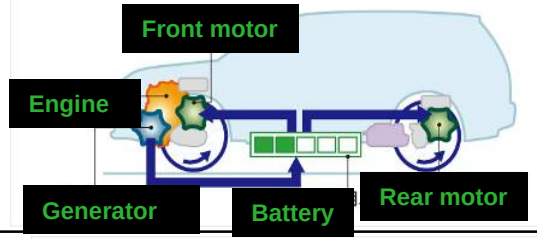
Outlander PHEV Driving Modes

Automatic selection of optimum drive mode

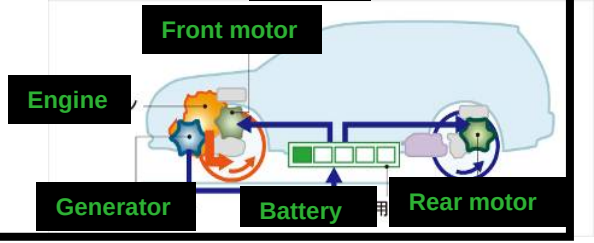
EV mode
Driven by electric motors



Series Hybrid mode
Driven by electric motors, engine operating generator to supply electricity



Parallel Hybrid mode
Driven by engine and electric motors.



Outlander PHEV Charging Options

Home:
Less than 8 hours (120V)
Less than 4 hours (240V)

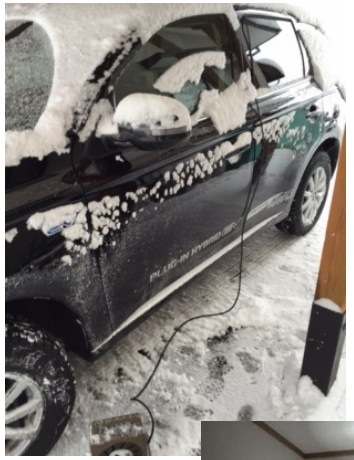
Public:
Less than 4 hours (240V)
80% in 25min (DC Fast Charging)

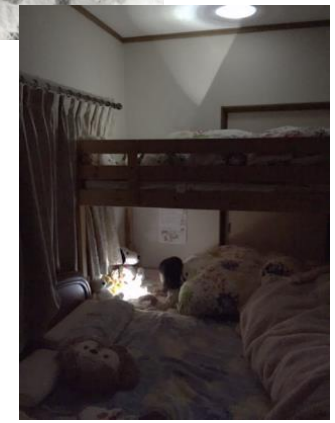
Level 1 (120V – Standard Outlet)

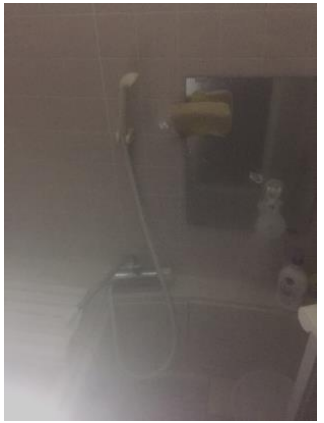
Level 2 (240V – Charging Station)

DC QuickCharging - CHAdeMO

Outlander PHEV – Emergency Power Example (Japan)

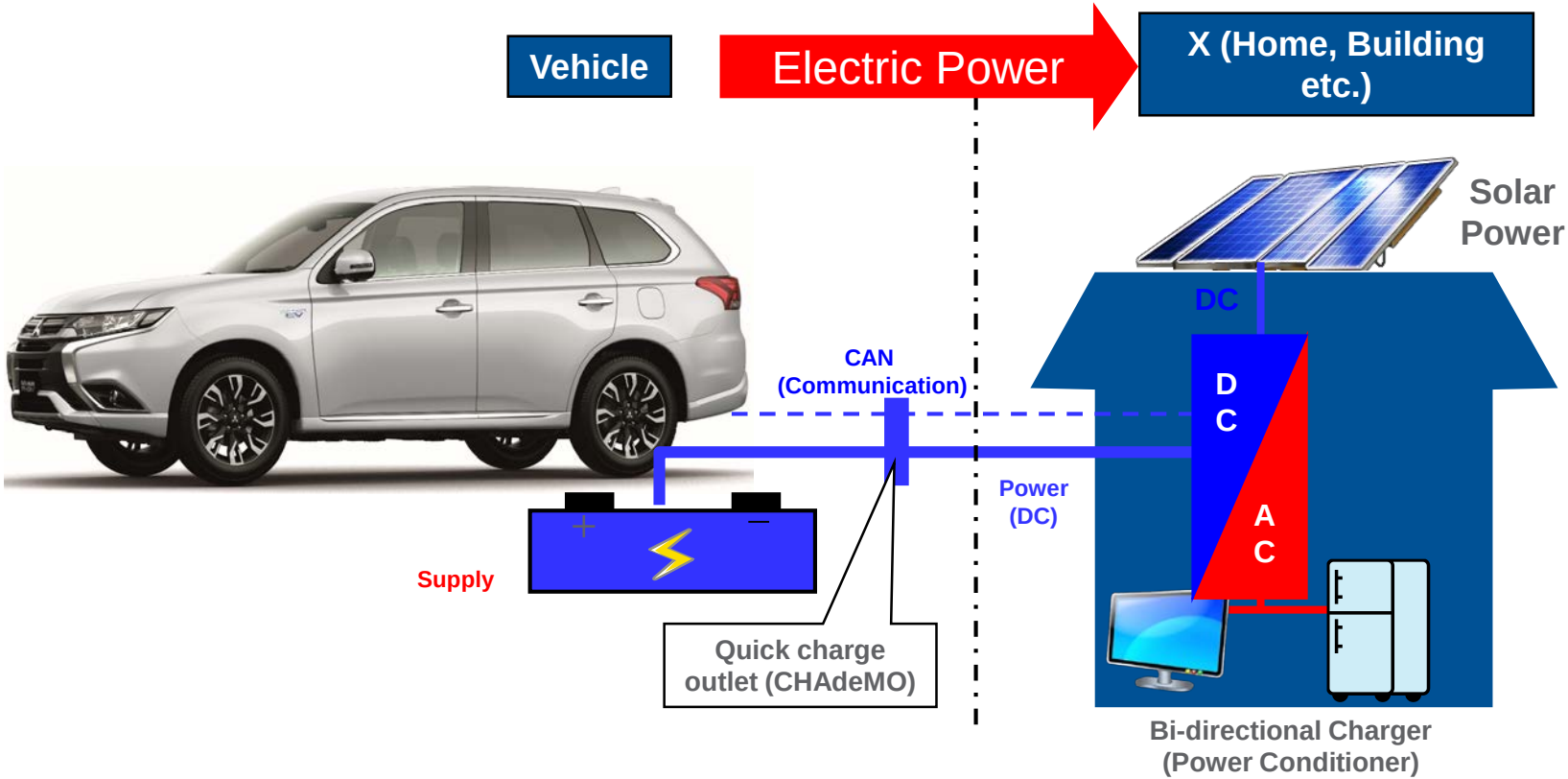




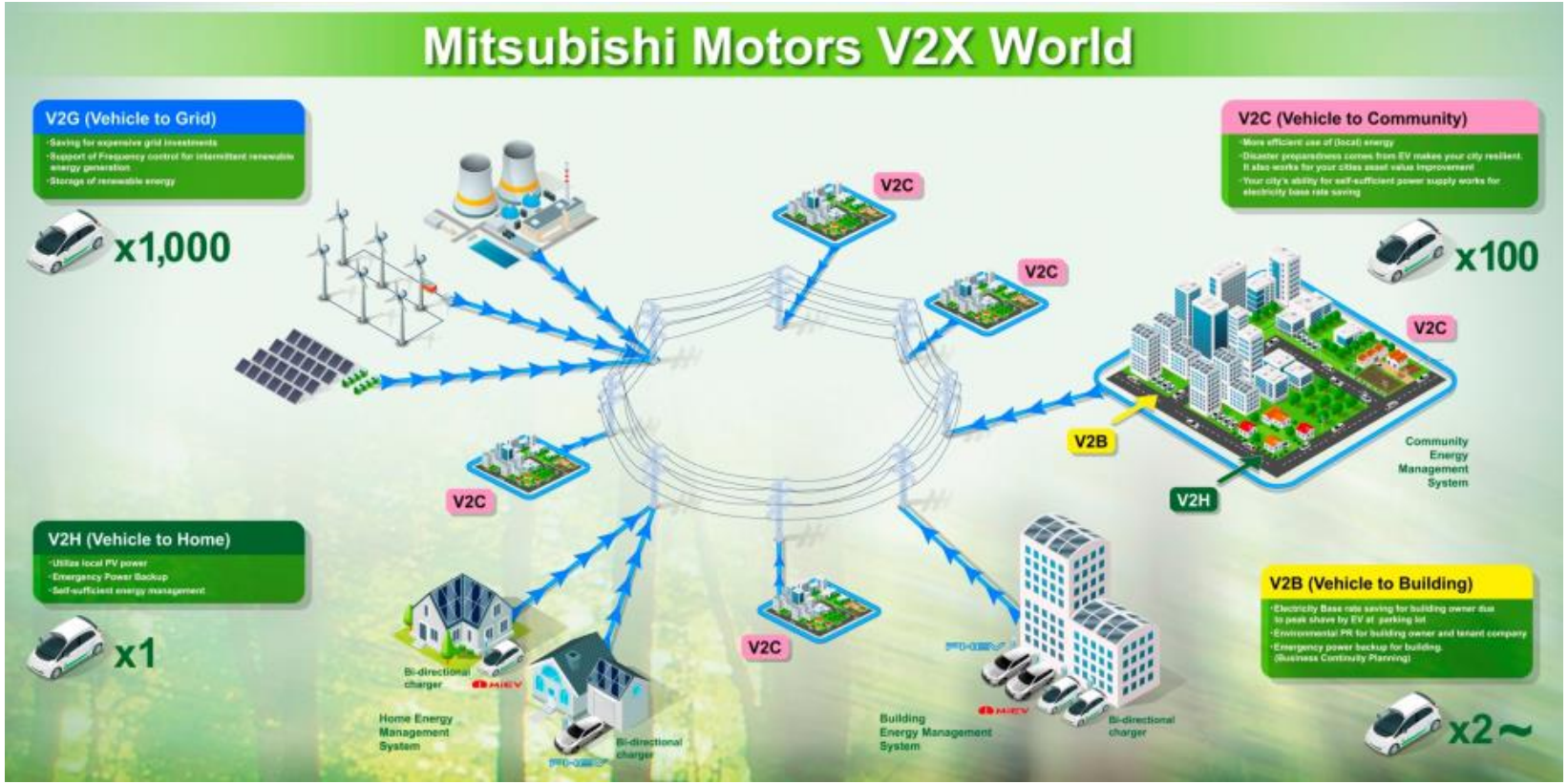


Lights and hot water for 3 days

V2X (Vehicle to anything) Concept



MITSUBISHI MOTORS V2X World



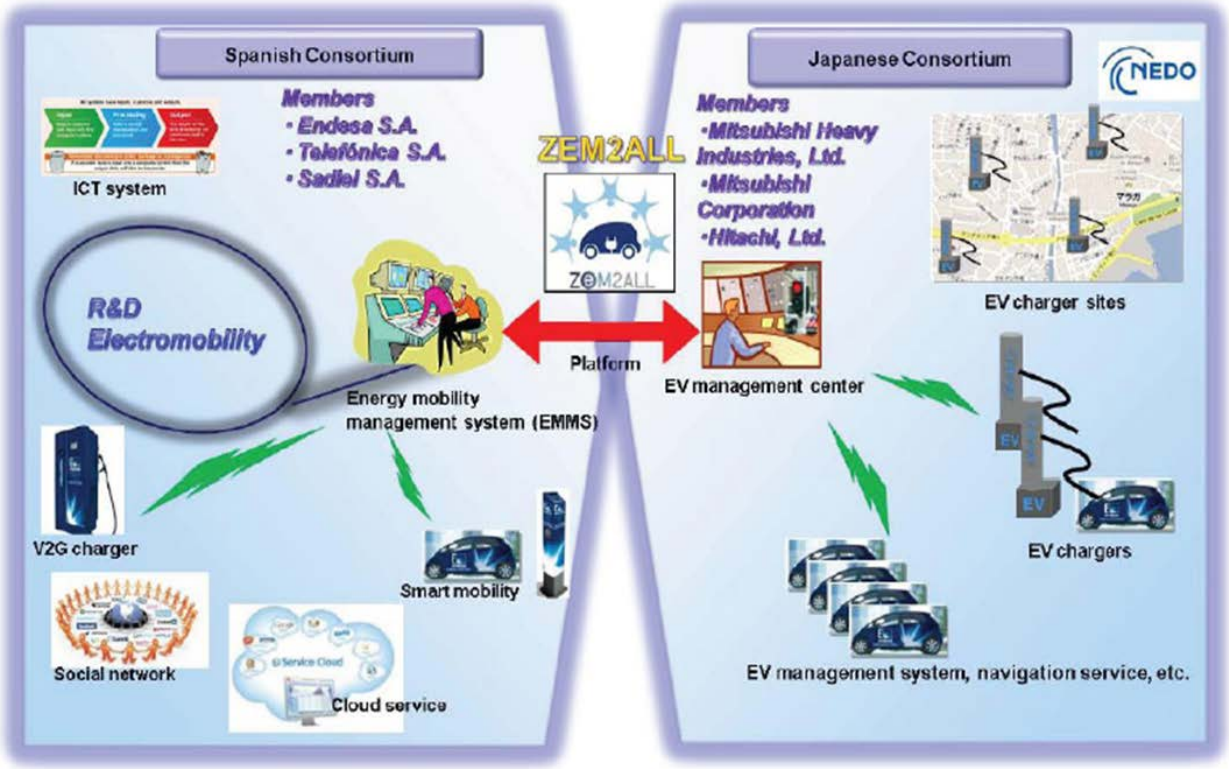
M-Tech Labo

Experimental system composed of PV, wind, power conditioners, EVs, EV chargers and used battery units. The test was launched in April 2012.

Charging Posts for EVs

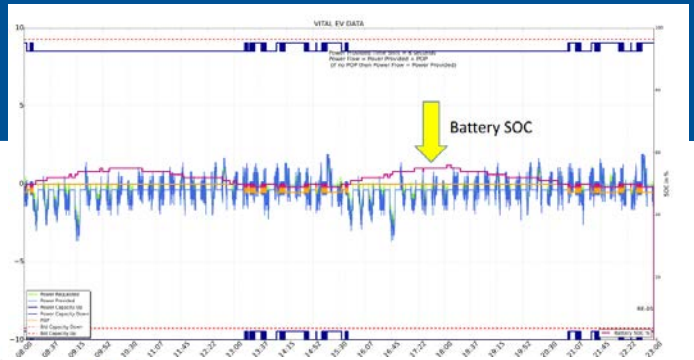
Used Battery Unit

Smart Community Project in Spain – completed 2016.



Source: press release from NEDO as of 8 March 2011

Parker Project Testing - NUVVE



File with canned DK1 frequency data

Aggregator executing on a blade on a server farm in the cloud

Enel 10 kW V2G Charging Station

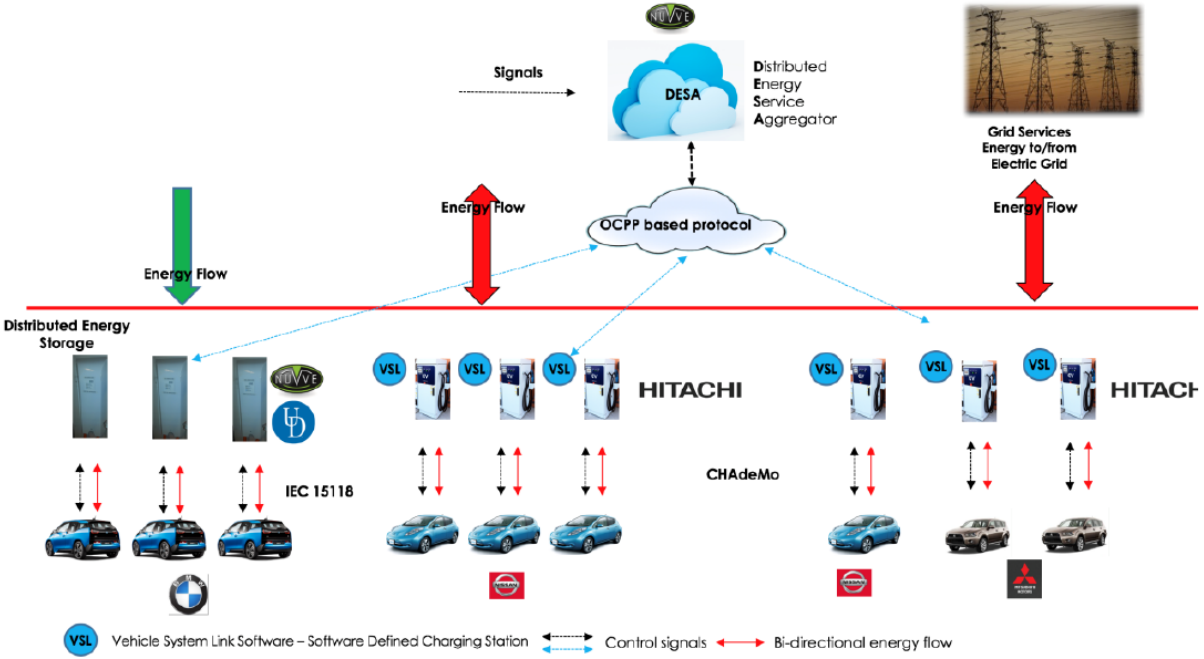
Mitsubishi Outlander PEV

DTU - Lyngby

EVlab – (001 PowerLabDK)

NUVVE California Energy Commission (CEC) Project

Primary goals – demonstrate large scale PEV fleet integration impacts on the grid, as well as assess and provide quantification of potential benefits of PEVs as grid assets amid a suitable population of vehicle users in concentrated and distributed areas.



IEEE Standards for DC Quickcharging

IEEE Conformity Assessment Program (ICAP) creates and implements initiatives that drive and accelerate certification programs throughout industry addressing a broad range of technologies. As ICAP progresses , it will evaluate test methodologies and develop a conformity assessment program to support the IEEE 2030.1.1 standard for DC quick charging. For more information, please contact Ravi Subramaniam, r.subramaniam@ieee.org

IEEE P2030.1.1 standard revision is being undertaken by the newly formed Working Group for Creating Technical Specifications of Quick Charger for Electric Vehicles Standards. Technical amendments to the standard will cover bi-directional charging (V2X), ultra-rapid charging up to 400kW, and CHAdeMO v1.2 and 2.0 requirements. Interested stakeholders should contact the Working Group chair Alexandre Beaudet, alex.beaudet@gmail.com.

Future Work

Upcoming study – based on projected 2025 California PEV fleet and supporting charging infrastructure, the project the estimated power available from in-use PEVs. Results expected Summer 2018.

Summary

- Outlander PHEV incorporates DC Quickcharging capability for both charging and discharging.
- On-board DC discharging capability allows emergency power supply.
- Mitsubishi Motors is joining numerous projects worldwide to understand the value to our customers as well as guide future PHEV electric development.

Thank you!

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