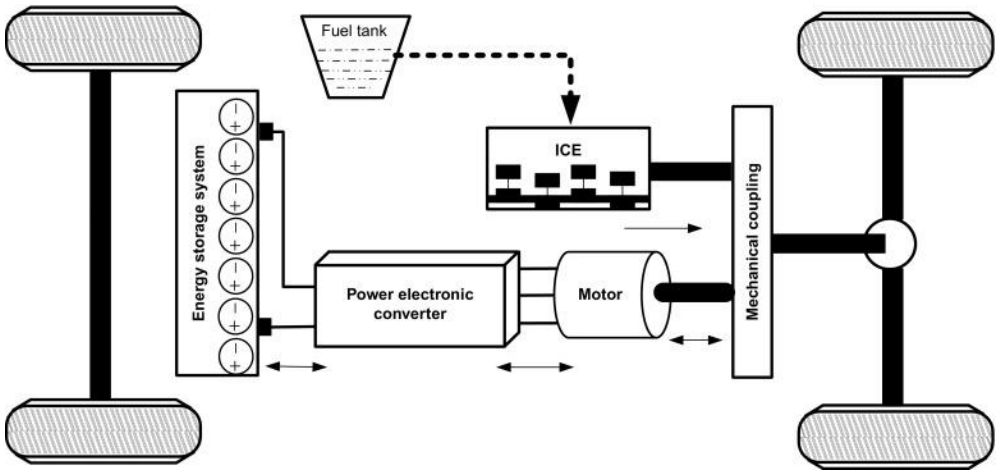
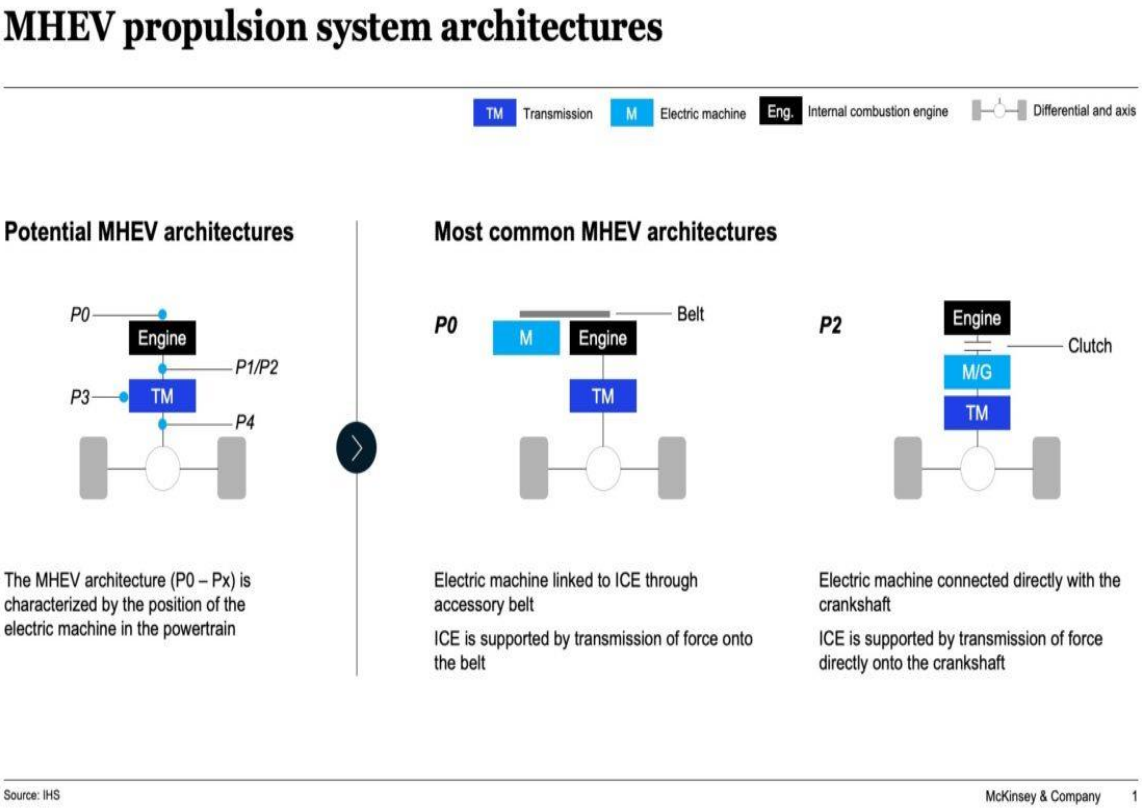
Design the components of Hybrid EV with Parallel Hybrid architecture for 48V

Abstract:

In this 48V Parallel Hybrid Vehicle, we have concentrate about the Design the components of the vehicle. Here the 48V Parallel Hybrid vehicle, we all know this is one type of Mild Hybrid System (MHS). So in this Project mainly concern about the 48V Mild Hybrid System components. The automotive world may be moving toward electrification, but it will still be many years before full-on EVs become prevalent. In the meantime, automakers are developing better and more refined hybrid and plug-in hybrid vehicles. One type of hybrid that has become more common in recent years is the 48-volt mild-hybrid system. Its use has expanded the performance and efficiency of vehicles from many automakers, and has become a popular way to extract more power from a vehicle without negatively impacting fuel economy. A 48 V mild hybrid system recovers less braking kinetic energy than a HV (High Voltage) hybrid system due to the reduced peak power/current rating. However, the cost of the 48 V mild hybrid system is significantly less than the HV hybrid system which gives the 48 V mild hybrid system a much better cost-benefit ratio.

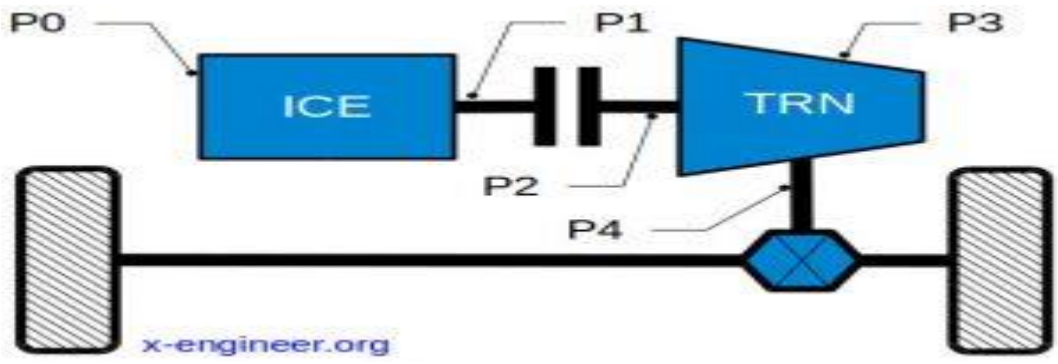
Block Diagram:





COMPONENTS OF 48V MHS:

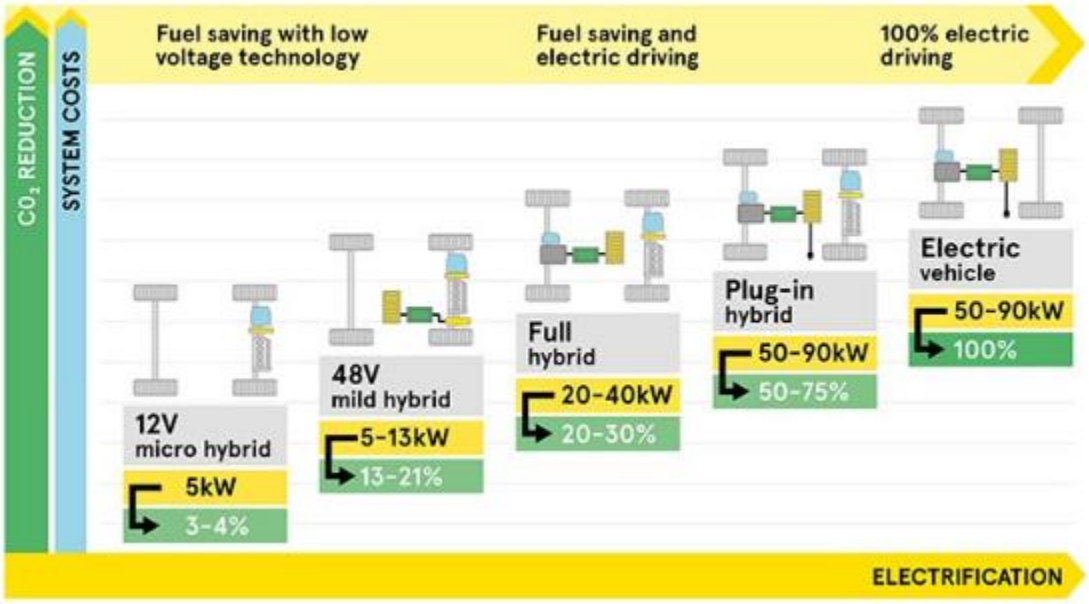
- Integrated belt starter generator (BiSG)
- Electric supercharger.
- An electric rear axle drive (ERAD)
- High voltage battery (48 V)
- DC/DC converter (48 – 12 V)



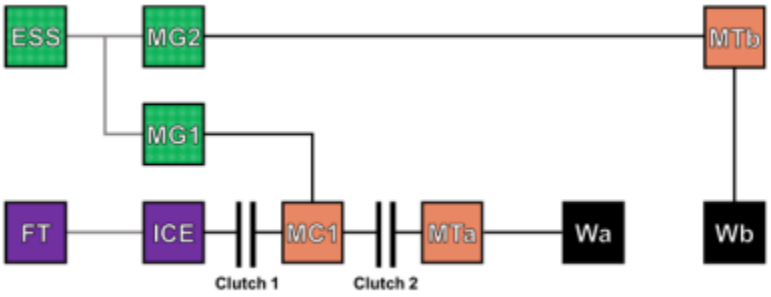
INTEGRATED BELT STARTER GENERATOR (P0):

The P0 powertrain configuration with the Belt-driven integrated Starter Generator (BiSG) is the lowest integration cost and lowest development effort for a 48V mild-hybrid electrical system. The electrical machine operates up to 10 kW maximum peak power with low power density in a 3-phase or 6-phase configuration. However, for the BiSG, the electrical machine torque is limited for boost by the belt connection and the engine and transmission friction losses reduce the recuperation efficiency.

48V MHS Design challenges:



Architecture:



ESS: ELECTRICAL STORAGE SYSTEM

FT: FUEL TANK

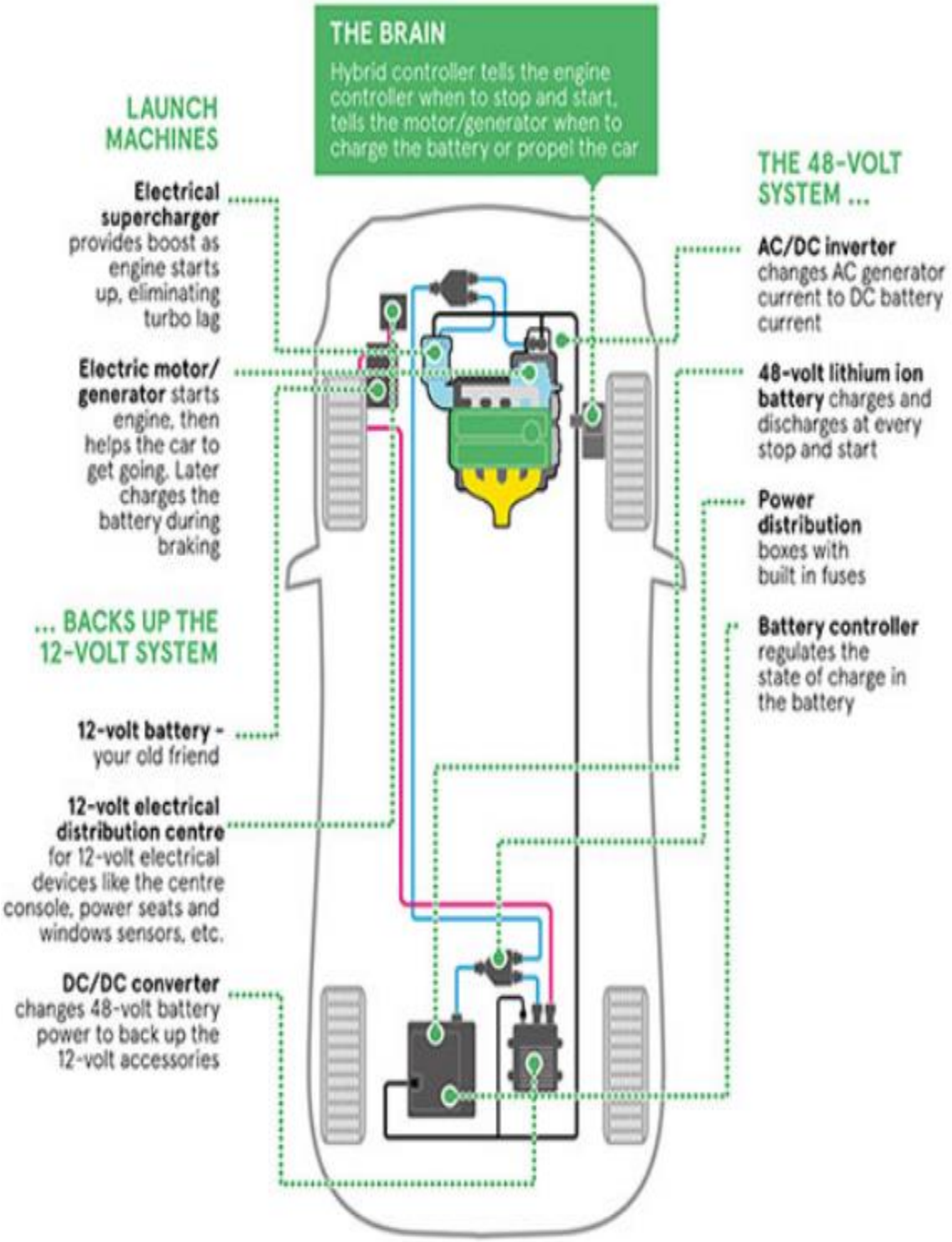
MG: MOTOR/GENERATOR

ICE: INTERNAL COMBUSTION ENGINE

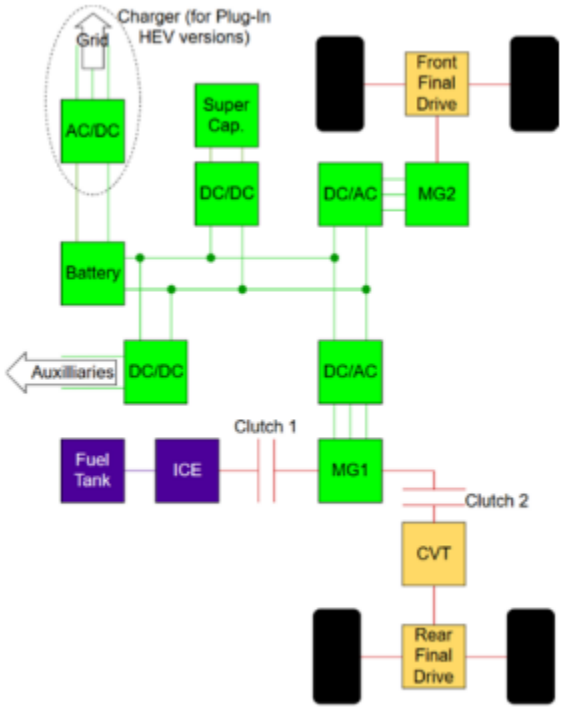
MC: MECHANICAL COUPLINGS

MT: MECHANICAL TRANSMISSIONS

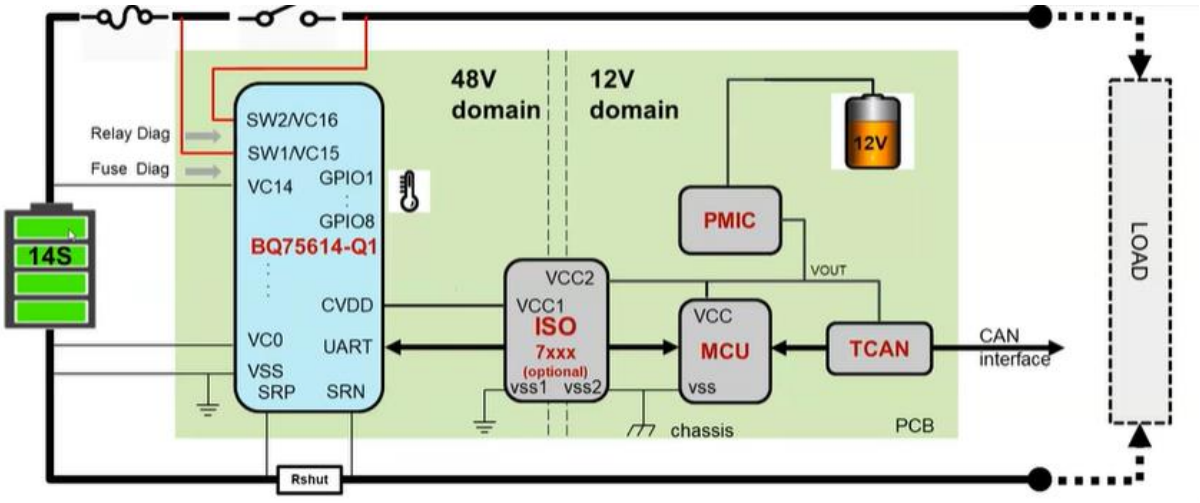
W: WHEELS


THE BRAIN
Hybrid controller tells the engine controller when to stop and start, tells the motor/generator when to charge the battery or propel the car
LAUNCH MACHINES
Electrical supercharger provides boost as engine starts up, eliminating turbo lag
Electric motor/ generator starts engine, then helps the car to get going. Later charges the battery during braking
... BACKS UP THE 12-VOLT SYSTEM
12-volt battery - your old friend
12-volt electrical distribution centre for 12-volt electrical devices like the centre console, power seats and windows sensors, etc.
DC/DC converter changes 48-volt battery power to back up the 12-volt accessories
THE 48-VOLT SYSTEM ...
AC/DC inverter changes AC generator current to DC battery current
48-volt lithium ion battery charges and discharges at every stop and start
Power distribution boxes with built in fuses
Battery controller regulates the state of charge in the battery

Detailed View of P1 and P4 Architecture:



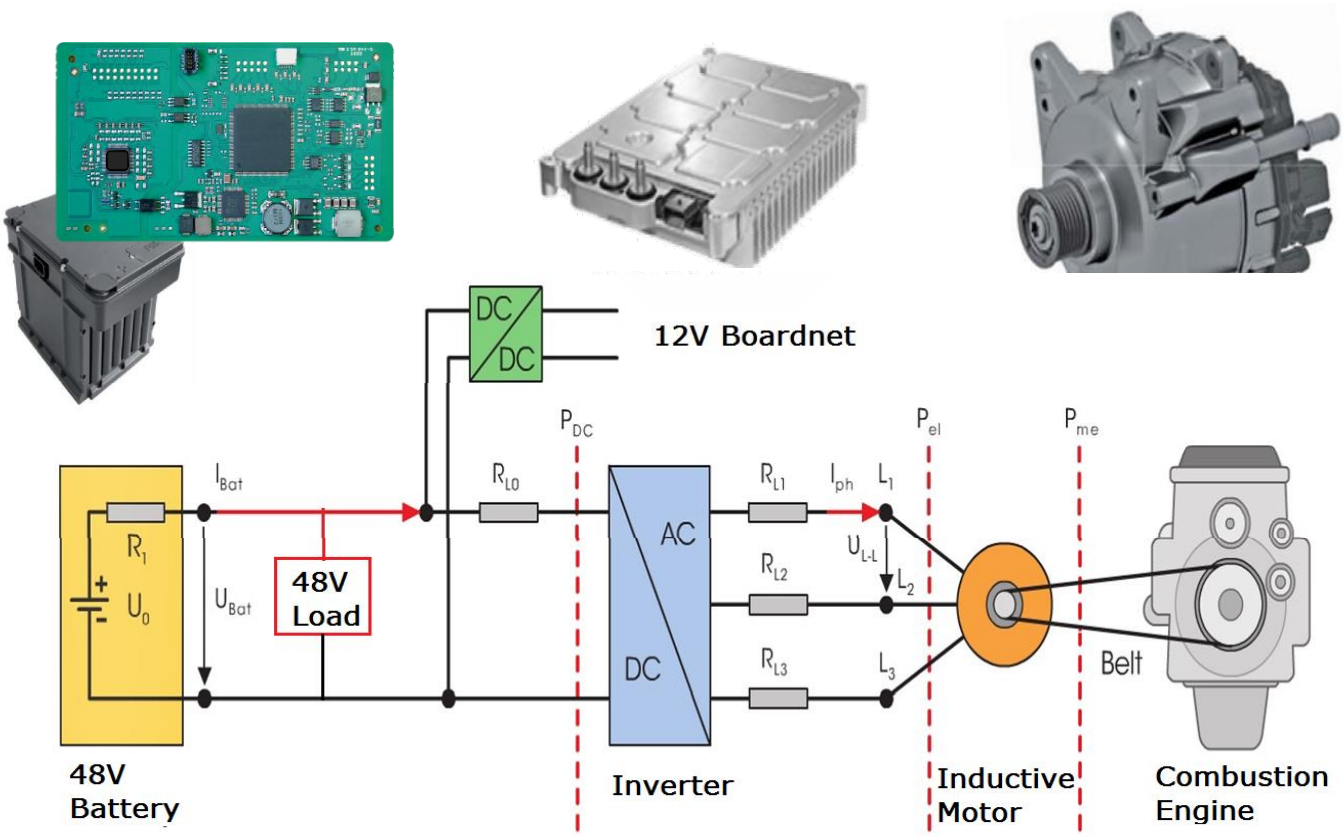
Detailed view of the P1*/P4 architecture



48V Technology :

- 48V electrification is primary driven by Co2 reduction.
- Future powertrain topologies with 48V enable even higher Co2 savings.
- Regenerated energy can be utilized for safety, comfort and efficiency functions.
- Maximum benefit can be achieved with a predictive driving Driving strategy via connected energy.

The Overall Circuit Diagram with (DC-DC converter, 48V Battery Back and Motor/Generator):



48V Battery Management System (BMS)

- Protect the energy storage system against over-current, over-discharge, over-load
- 14 Cell measurements and balancing
- Battery pack and 48V DC link measurements

- Current and thermal measurements
- Contactor(s) and Fan control circuitry
- State-of-Charge (SOC)
- State-of-Health (SOH)
- State-of-Function (SOF)

48V Hybridization and Electrification

Summary

- 48 volt technology is entering the mass market
- 48V P0 architecture offers significant efficiency improvements with acceptablecost and integration effort
- Additional efficiency improvement and electric launch capability with 48V P2architecture
- Much better efficiency potential in urban driving comparison to FTP and WLTC
- Advanced functions available like boosting, sailing, coasting, electrical parking
- Electric torque assist for significant improvement of acceleration
- Optimization of Electrical Architecture 12 V vs. 48 V