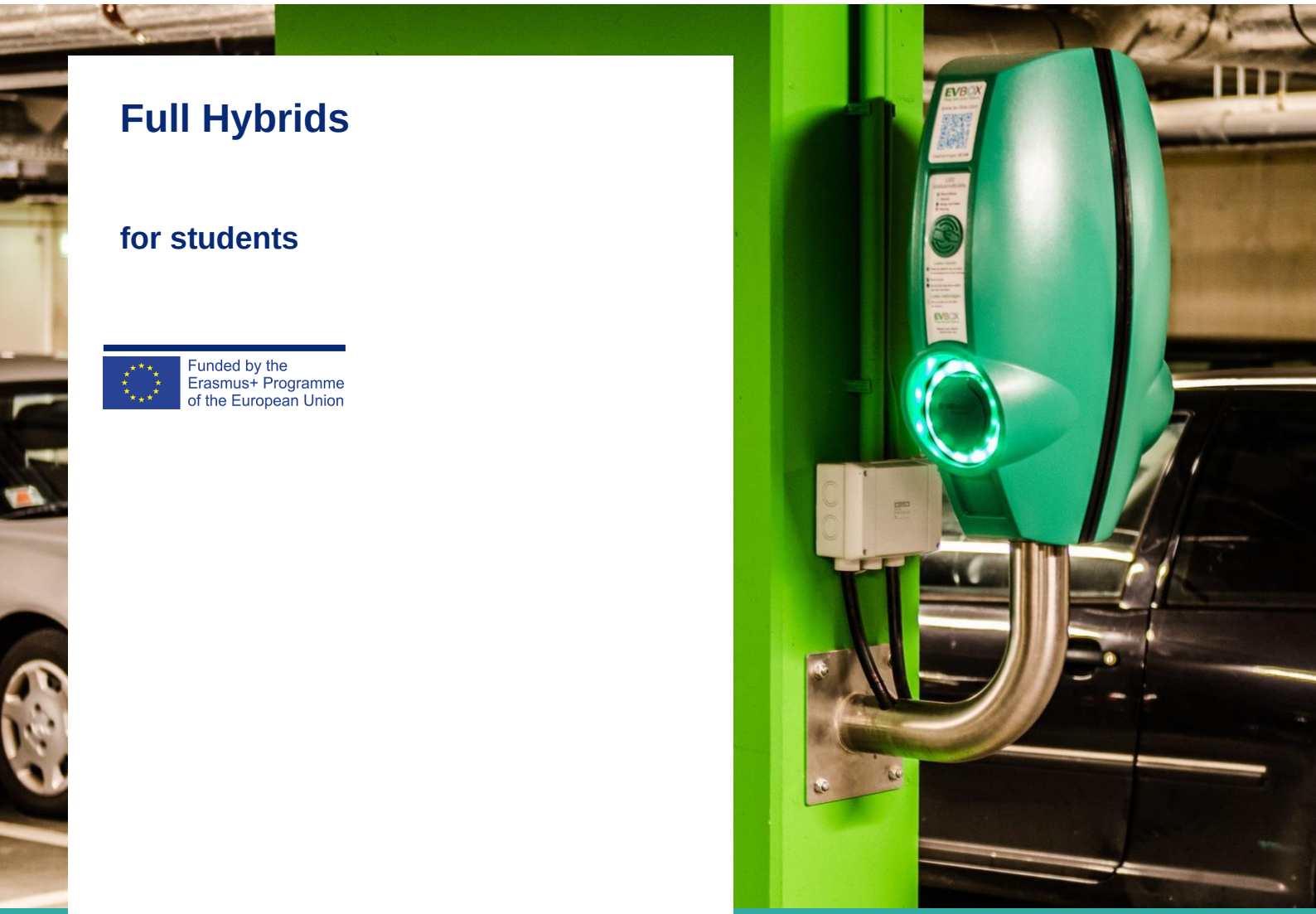

Full Hybrids

for students

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STEP AHEAD II

The support of Professional development of VET teachers and trainers in following of New trends in Automotive Industry
Automotive Innovation & Teacher training Academy
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Full hybrids

The aim of the lesson: Make a difference between various hybrid systems in automotive technology and turn focus on Full Hybrid System

ANNEX 1

Micro Hybrid & Hybrid Vehicles Explained
Source: https://www.yuasa.co.uk/info/technical/micro-hybrid-hybrid-vehicles-explained/

Stop/Start Technologies & Functionality (Micro hybrid 1)

Initially a manual system now becoming fully automatic, switches off the engine when the vehicle is stationary. The engine is restarted automatically by releasing the brake and depressing the accelerator pedal or clutch pedal dependent on transmission type. Initial Stop/Start systems could be manually switched off, but on next generation vehicles this option is disabled
Increases the number engine starts the battery has to deliver as well as supporting all of the electrical loads on the vehicle whilst the engine is stopped and the vehicle charging system is not operating
Requires new electronic methods of monitoring the battery status including State of Charge (SOC) and State of Health (SOH). As the number of Stop/Start cycles required are increased, the vehicle must be able to determine if the engine can restart when the vehicle comes to rest and the engine is switched off

Initial Stop/Start systems would function if the ambient temperature was below 3°C whereas the latest systems are projected to operate at -10°C. This reduction in system operating temperature increases the demand on the battery to supply minimum voltages to the electronic circuits and control modules on the vehicle when cranking the engine

Various vehicle manufacturers state that, on their standard European drive cycles a typical fuel saving of up to 8% can be achieved by the installation of a Stop/Start system. This in current terms of electronics technology means a relatively low cost solution to reduce exhaust emissions

New technologies such as the Enhanced Flooded Battery (EFB) and AGM (Absorbed Glass Mat) battery have been developed to achieve the new higher duty cycle requirements placed on the battery by particular OEM vehicle manufacturers

The introduction of Stop/Start technology has resulted in a new band of battery failure modes not previously experienced by vehicle manufacturers. This is based on evidence collected from a recent time dependent driving experiment. The experiment featured a journey across London which produced 87 Stop/Start cycles which when compared with a comparable timed motorway journey produced zero Stop/Start events as the feature was not activated

Charge Management & Regenerative Braking (Micro hybrid 2)

Charge Management

It is likely that vehicle owners would not be aware of the installation of this technology as its operation is seamless, unlike Stop/Start which is clearly detectable as the engine stops if all system operating conditions are fulfilled when the vehicle comes to rest

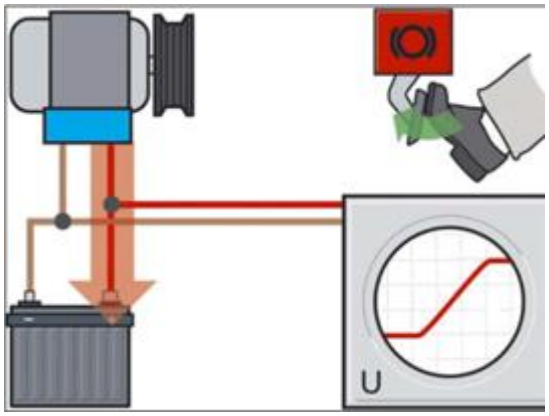
When the alternator is running it can typically consume up to 10% of the power produced by the engine. The charge management system effectively switches off the charging system by disconnecting the alternators drive from the engine. This increases the loads placed on the battery but significantly improves the fuel economy of the vehicle

The major fuel economy benefits of a charge management system are achieved on longer distance journeys. The use of this system shows that one technology alone is not the solution to every drive cycle but is important as part of an overall package of emission reduction and economy initiatives

The life expectations of the battery are greatly increased as it is supporting all of the electrical loads on the vehicle when the charge management system is operating

The introduction of charge management systems has resulted in the development of new battery technologies and designs with increased performance. These include EFB and AGM battery types which have a significantly better cyclic life and improved operation in low states of charge

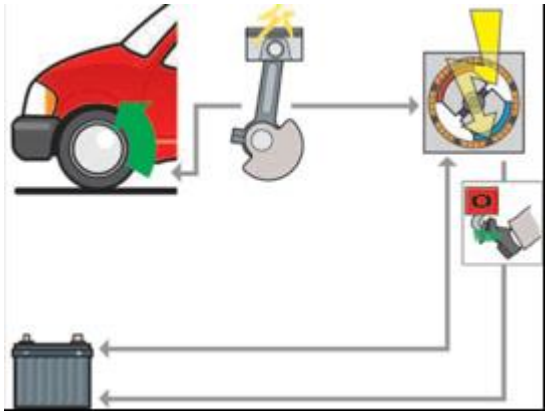
Regenerative Braking



Regenerative Braking systems recover the energy normally converted into and lost as heat during vehicle braking. When available the recovered energy is fed back into the charging system to recharge the battery

A conventional technology battery is very inefficient when utilized in in a regenerative braking system. This type of battery is only able to reuse approximately 5 to 15% of the recovered energy due to its relatively high internal resistance. New battery technology developments such as EFB and AGM with reduced internal resistances provide more efficient use of the recovered energy.

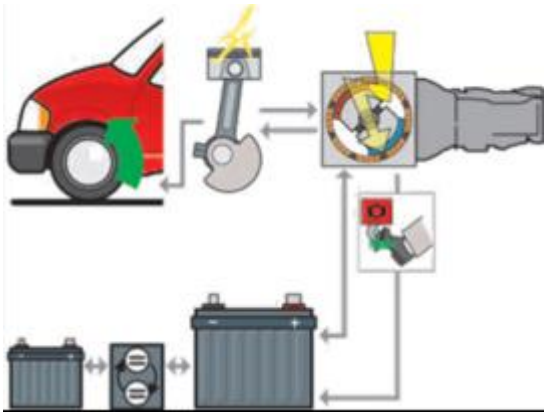
Starter/Generator (Micro hybrid 3)



Starter/generator technology replaces the conventional alternator and starter motor with a combined starter/generator unit installed between the engine and the transmission. The vehicle features both Stop/Start and regenerative braking systems that operate in the same way as for Micro hybrid 1 and 2 vehicles but utilises the starter generator for both start/stop and regenerative braking functions.

An AGM battery is therefore installed on the vehicle to support the stop/start and regenerative braking systems

Passive Boost (Mild hybrid)

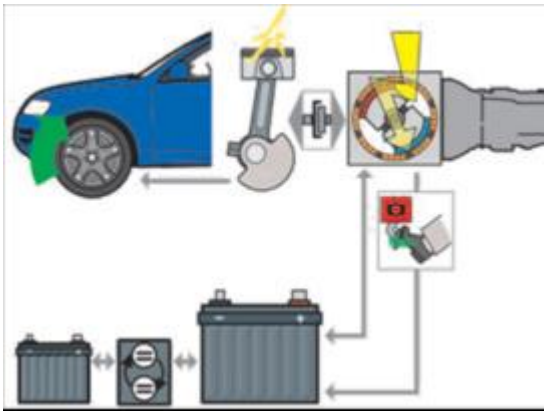


Future new technologies being introduced to the next generation of vehicles include a solution known as “Passive boost”. Passive Boost is a simpler more cost effective system related to the Kinetic Energy Recovery System (KERS) recently introduced into the Formula 1 race series

Passive boost technology replaces the conventional alternator and starter motor with a combined starter/generator unit installed between the engine and the transmission. The passive boost function reverses the generator polarity to convert the generator into a motor and utilise a high voltage battery to assist with the acceleration of the vehicle. The starter generator is only used to supplement the power produced by the internal combustion engine therefore the vehicle is not capable of full electric drive

An AGM battery is therefore only installed on the vehicle to support the electrically operated ancillary components only

Full hybrid



The full hybrid vehicle features a higher power starter generator and an additional clutch between the internal combustion engine and transmission. This allows the decoupling of the engine and starter generator.

The internal combustion engine features both stop start and regenerative braking functions, however this system only utilises the internal combustion engine when required which allows the vehicle to be driven on electric power only

An AGM battery is therefore only installed on the vehicle to support the electrically operated ancillary components only

These new requirements clearly expect significantly more from the battery and the technology has to be improved to match the further increase in demands.

NOTES: