Case study:
Battery electric plugin hybrid car with Methanol Fuel cell range extender

Serenergy is developing a battery electric car with methanol fuel cell range extender that can be fuelled by existing infrastructure thereby removing the need for costly infrastructure building. The concept is sustainable by using methanol from renewable sources and removes pollutants from cities. The Fiat 500 has a range of 800km and can be refuelled in 5 min.. Methanol is already a dominant alternative fuel e.g. in china approximately 10% of all automotive fuel is methanol.

The situation

The challenge of the future vehicle platform is to become sustainable in terms of emissions and more efficient when it comes to energy consumption. There are several solutions available to solve the challenge, however an economical feasible concept has yet to be proven. A main challenge is the deployment and operation of new infrastructures that aims to replace the liquid distribution and supply chain we know today.

Furthermore it is important to maintain a flexible transportation fuel that can be stored is significant quantity and be made from many different feedstocks/sources. Storage is both important to ensure energy security and supply but also to have the option for seasonal storage and import/export of fuel as we know it today.

The solution

The Fiat e500 is a Battery Electric car equipped with a Methanol fuel cell urban range extender that can charge the batteries while the vehicle is driving thus giving same range as known from combustion based cars. A secondary benefit to the concept is the fuel cell waste heat is used to heat the cabin which ensures all electricity is used for propulsion.
Serenergy develops and manufactures a unique fuel cell technology that operates at higher temperature than more widely adopted fuel cells for pressurised hydrogen. The higher temperature of the fuel cell enables reuse of waste heat for the methanol reforming process furthermore removes the need for gas clean up between reformer and fuel cell.

The methanol fuel is a mix of 60% methanol and 40%water which is liquid and non-pressurised which enables a simple and cheap on-board storage solution. Methanol like diesel and gasoline is flammable and poisonous and should be respected accordingly. The infrastructure deployed features a spill free connection which ensures the user can under no circumstances come into contact with the fuel thus removing any risk of exposure.

The concept results in no pollutants in form of particles, NOx, SOx and noise. Methanol however is hydrogen bound to CO2 which when reacted will be released into the atmosphere. Looking at the tank to wheel (WTW) CO2/km emissions one third that of a diesel/gasoline comparable vehicle model. Looking at Well to Wheel (WTW) CO2 emissions Methanol has a lower/similar CO2 emission than Grid electricity and Hydrogen both looking at Power from todays energy mix including coal/natural gas and looking into a future full renewable scenario.

The advantages of the FIAT e500

The concept results in a sustainable transportation fuel from renewable resources that is used in a non-polluting vehicle with full range and fast refuelling though existing infrastructure. Most importantly the concept is cheap both in terms of infrastructure, distribution and basic fuel cost. In the Danish scenario the methanol concept is one third cheaper per driven km in fuel costs compared to diesel.

Facts:

Sites: FIAT e500
Applications: Battery electric plugin hybrid with methanol fuel cell range extender.
System: H3 5000
Fuel: M60
(60 VOL % methanol, 40 VOL % water)
Objective: The Fiat e500 is a Battery Electric car equipped with a Methanol fuel cell urban range extender that can charge the batteries while the vehicle is driving giving same range as a combustion based vehicle.

Serenergy A/S

Serenergy is a leading manufacturer of fuel cell stacks and power modules based on the High Temperature PEM fuel cell technology. We provide everything from fuel stacks and systems for OEM integration all the way to providing complete turnkey solutions for diesel generator replacement.

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