

Fuel Cells on Gardening Duty

Four Danish companies have joined forces and successfully developed the fuel cell powered EcoMotion Truck, which has proved very useful to Danish gardeners.

Holstebro Cemeteries is a haven of peace and tranquility as any churchyard should be. What may surprise visitors is that the churchyard is a busy workplace for the gardeners, who work hard to keep the beautiful setting in good shape. However, they go about their work almost unnoticed thanks to a new Danish fuel cell driven electrical truck that runs in complete silence.

A mobile power station

The EcoMotion Truck is a mobile power station, powered by two HT-PEM systems (High Temperature Polymer Electrolyte Membranes) that run on methanol. As a result of not needing a humidifier, compressor and radiator as in LT-PEMs (Low Temperature Polymer Electrolyte Membrane), the HT-PEMs have a very simple internal architecture. This both reduces costs and broadens the application scope and effectiveness of the fuel cell systems in terms of lower parasitic power consumption, improved CO tolerance and a broader operating window temperature-wise. The higher CO tolerance compared to LT-PEM makes it possible to use the liquid methanol as fuel, which is reformed into a hydrogen rich gas internally in the system. The fuel cell system developed by Serenergy is the first commercially available mobile-RMFC (reformed methanol fuel cell) system in the world, based on the HT-PEM technology.

Once the fuel cells are active, they will continuously and silently recharge the built-in truck batteries. This allows for gardeners to operate the EcoMotion Truck up to one week before the ten liter fuel tank is empty, depending on how intensely the truck is used. Thanks to the effective fuel cell system, the truck also produces power for an inverter and two built-in 230 VAC power outlets. Thereby, gardeners can avoid using long cable spools for e.g. the use of electric hedge trimmers.

Successful test period at Holstebro Cemeteries

Cemetery Caretaker, Erik Søvndal, did not need to think twice before he accepted the offer to test the EcoMotion Truck:” We think this vehicle has three key advantages: It is environmentally friendly, quiet and it does not need constant recharging. The truck also makes our daily work easier and it gives our visitors a quiet walk around the cemetery”, says Erik. He adds that especially the continuous supply of power, which saves the gardening crew time, is an advantage:” Some days we are busier than others, so we run the risk that our current electric trucks run out of power by midday and have to be recharged. This typically takes four to six hours, and we do not always have time to wait. With the new solution, we just fill up on methanol, and we are up and running again”, states Erik.

The gardeners at Holstebro Cemeteries were so excited about using the EcoMotion truck that they have ordered a customized Ecomotion Truck for the cemetery. It will be delivered in September 2011.

Green dream of methanol as fuel

Methanol is traditionally made from wood and is also called wood alcohol. It is a very flexible fuel that can be blended directly with petrol to improve combustion properties, but it is also excellent as fuel for fuel cells. Methanol is currently produced mainly from natural gas, but in time will also be produced from a number of renewable energy sources such as biomass/biogas, household refuse and wind energy. In fact, surplus wind power can be stored as liquid methanol, thereby saving electricity for later use. It can also be used in the transport sector, which needs liquid, high energy density fuel.

Behind the EcoMotion Truck is the EcoMotion consortium comprising a group of Danish companies. EcoMotion's daily project manager, Johan Hardang Vium, from the Danish Technological Institute explains that the combination of methanol and fuel cells does more than reduce the impact of CO₂, hydrocarbons and particle pollution on the environment: "This technology is particularly interesting if the methanol is produced from renewable energy such as wind power or biomass. If we use methanol to store green energy, this will benefit the transport sector as methanol can be stored and handled in the existing distribution system. This ensures the benefits of liquid fuel while making exceptional use of the energy via a fuel cell system".

Fuel cells are an energy-efficient solution

The advantage of fuel cells is that the chemical energy is converted with high efficiency, low emissions and a low noise level. In addition, the technology is modular, which means that the efficiency is almost constant, whatever the size of the fuel cell system. The high-temperature fuel cells were chosen for the EcoMotion Trucks because the high working temperature makes the fuel cell less fuel-sensitive. Therefore, this kind of fuel cell can run on fuels such as methanol and natural gas and these are easier to handle than e.g. hydrogen.

Further, fuel cells can convert methanol into electricity and heat without any overall CO₂ emission, provided that the methanol production is CO₂ neutral. This makes fuel cells a highly eco-friendly alternative in energy production when (bio)methanol is produced from renewable energy sources. The low price on methanol on the global market eliminates the hurdle of a high fuel price until biomethanol is produced in a larger scale. Currently, new production capacity for highly CO₂ neutral methanol is on the way.

A partnership with a clear goal

The companies GMR maskiner A/S, Serenergy A/S and Energiselskabet OK a.m.b.a have joined forces with Danish Technological Institute to form the EcoMotion consortium. The consortium works to develop fuel cell driven electrical vehicles powered by reformed methanol.

EcoMotion took its first small steps in 2003 when GMR maskiner A/S began to investigate opportunities to create a stable, customer-oriented, future-proof work truck that, as a first priority, was not detrimental to the environment. The actual EcoMotion consortium was formed in 2010 with support from Danish Energy Agency and Danish Development Funds (EUDP, EnergiTekMidt). The EcoMotion Prototype Truck is the first fully operational product presented by the partners. Four other trucks are also being produced as part of the EcoMotion project.

GMR maskiner constructs the trucks used as integrators for the fuel cells. Oil and energy company OK supplies fuel and logistics, while Serenergy A/S develops and produces fuel cell systems. The Danish Technology Institute handles tasks such as project coordination, construction, tests and data collection.

Tested on baboons

The EcoMotion Truck has not only been tested at Holstebro Cemeteries, it has also proved useful in Aalborg Zoo, where the baboons had their daily meals delivered by the truck. The green keepers in the Danish Golf Club, Odder Golf Club, have had the pleasure of using the power from the EcoMotion Truck for mowing the green and at the large Danish music festival called Skanderborg Festival, the truck has been used for transportation of equipment and musicians between the different stages. A special towing truck for luggage hauling is also being produced for Billund Airport.