SYSTEMIC
Fact sheet
Recovery of nutrients and resources from digestate
2021

Market opportunities for advanced bio-refinery products from digestate

Ammonia as energy carrier

Extract from D 3.4 Market study for biobased fertilising products from digestate within a European context

Solid Oxide Fuel Cells

Fuel cells provide an opportunity to develop thermodynamic systems that generate electricity on the basis of electrochemical reactions by consumption of reactants from external sources. Moreover, fuel cells are recommended because of their high efficiency, low environmental footprint and attractive technology for the direct conversion of fuel to electricity.

Among these different types of fuel cells, Solid Oxide Fuel Cells (SOFC) have a big advantage on combination of environment-friendly power generation with fuel flexibility. In recent years, ammonia (NH3) has emerged as a promising fuel for electricity generation in SOFCs (Afif et al. 2016).

Considering the electrolyte and electrodes, the direct ammonia-fed SOFC-H is the most promising energy source for next-generation fuel-cell technology. However, its development is not yet at the commercialization stage and further investigation is required.

Internal combustion engine

Ammonia has been proposed as a practical alternative to fossil fuel for internal combustion engines (Olson and Holbrook 2012). Ammonia was used during World War II to power buses in Belgium, and in engine applications prior to 1900.

Since ammonia contains no carbon, its combustion cannot produce carbon monoxide, hydrocarbons or soot and high compression ratios prevent NOx production (David et al. 2014).

However, ammonia is a much less active fuel compared to gasoline, it doesn't combust easily on its own. But, with a small amount of combustion enhancer (gasoline, diesel or pure hydrogen) mixed in, it burns and releases enough energy to drive the engine. A prototype of an NH3 car has already been built, equipped with a control system that makes the perfect mixture with combustion enhancer (gasoline, diesel or pure hydrogen), which burns and releases enough energy to drive the engine on NH3 with a radical reduction in carbon and greenhouse gas emissions (http://www.nh3car.com/how.htm).

However, alternative fuels first have to overcome a technology-change cost (CAPEX) hurdle, which, for the incumbent fuel, is always zero (Lloyd's Register 2017).

This underlines the importance of policy and regulation as drivers for change, since market forces alone appear unlikely to prove sufficient.(Brown 2017)

Still, some entities in the maritime sector operate in unique, niche markets where ammonia fuel technologies are already competitive, and they have an unrivalled opportunity – today – to deploy these technologies (Brown 2017).

References

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