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Life Cycle Cost Analysis – Public Summary

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Executive Summary

Fuel cell micro-combined heat and power (FC mCHP) is an innovative, emerging technology which promises significant increases in the efficiency of heat and power production compared to traditional heating appliances and grid electricity. This can lead to several benefits for the European energy system including CO_2 emissions reductions, reduced peak loads on electricity networks and reduction of electricity transmission losses. However, the near term economic proposition is challenging.

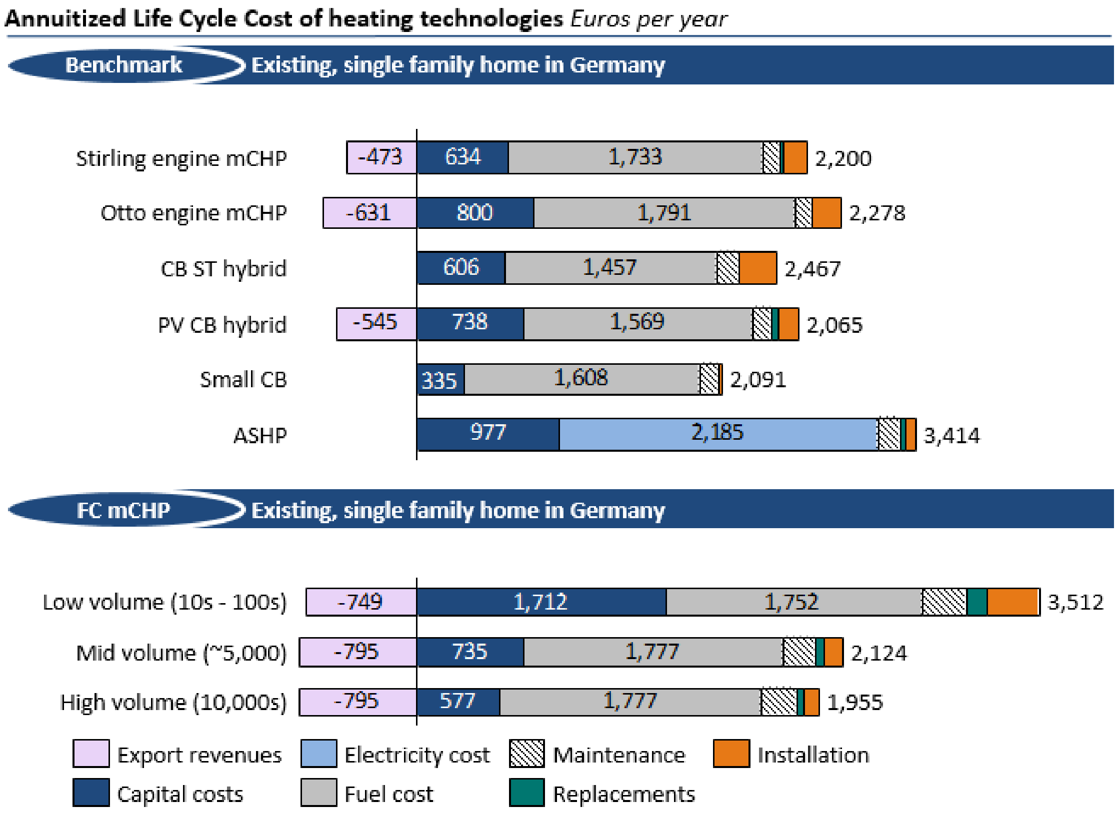
At today's capital and maintenance costs FC mCHP are significantly costlier than traditional heating technologies. However, as serial production begins, economies of scale can be unlocked, and previous studies suggest these costs are expected to drop significantly[1]. Over the last two years, deployment of FC mCHP in Europe has gone from 10s of units to thousands, and several European manufactures have made considerable steps towards commercialisation. In turn, this has led to updated estimates of cost and technical improvements that can be made as production scales increase.

This study examines the Life Cycle Cost of fuel cell mCHP, compared to incumbent technologies based on an aggregated, updated set of manufacturer cost and performance projections. These suggest increased electrical efficiency, reduced costs and longer stack lifetimes than have been previously estimated. Life-cycle costs for fuel cell mCHP technologies have been compared for a number of key European markets, based on typical household heat demands and gas and electricity price data[2].

The analysis suggests that in the most attractive markets, fuel cell CHP can become competitive with all incumbents (including gas condensing boiler) on a Life Cycle Cost basis when manufactured at scales of 5,000 – 10,000 units per manufacture (cumulative) for the smallest (0.7kW$_e$) systems, and larger systems (2-5kW$_e$) can become competitive when produced at scales of 1,000 units per manufacturer (cumulative). This is shown below for the case of 0.7kW$_e$ systems in single family homes in Germany.

[1] Roland Berger for the FCH JU: *Advancing Europe's energy systems: Stationary fuel cells in distributed generation (2015)*

[2] http://ec.europa.eu/eurostat/data/database



Overall, the analysis suggested the following key conclusions:

Economies of scale are crucial for improving the value proposition of FC mCHP

Future improvements to the economics of FC mCHP are likely dominated by the reduction in capital cost which are driven by production volume. Therefore, scaling up production is of paramount importance to the economics of the stationary fuel cell.

FC mCHP has the best economic performance in buildings with high heat loads

Fuel cells are likely to perform well in settings where there is high heat demand, they can be operated for long run hours, and where the spark spread is high.

At scale, FC mCHP can become economically competitive

The analysis has shown that FC mCHP units are likely to become competitive with competitor systems when produced at volumes of 5,000 to 10,000s of units per manufacturer. In countries with lower spark spreads e.g. the UK, the economics are more challenging, but can be improved significantly by increasing self-consumption of electricity. Thus, in less competitive countries, the long-term business case for FC mCHP may not only rely on achieving economies of scale, but could also require manufacturers to explore options to support customers to maximise on-site consumption of the electricity produced. Due to their lower capital costs per kWe installed, 2 – 5 kW_e units could become competitive with other low carbon heating systems and with gas condensing boilers at around 1,000 - 5,000 UPM. However, a series of non-economic barriers concerning installation of CHP in multi-family homes may need to be resolved to unlock such deployment volumes.

Subsidies can improve the near-term economics of FC mCHP, but can have the same effect for competitor technologies

Subsidies for low carbon heating technologies will increase the competitiveness of fuel cells with condensing boilers, and conventional mCHP. However, depending on the subsidy regime, other low carbon generation and heating technologies (e.g. PV – condensing boiler hybrid systems and air source heat pumps) may be even more competitive when subsidised. Therefore, the fuel cell cannot rely exclusively on subsidies, and should be subsidised only to allow production volumes to increase to drive down capital costs.