



DEMOSOFC - Demonstration of SOFCs at large scale (www.demosofc.eu)

The project was launched in September 2015 and has the goal to build and operate the largest European biogas-fed SOFC industrial plant

Energy efficiency, renewable and carbon-neutral fuels, multi-generation and the minimization of air pollutants: these are the key topics that DEMOSOFC aims to answer by means of efficient, modular and flexible fuel cell technology, ready to be exploited at the industrial scale. DEMOSOFC is also part of broader context of circular economy that is focused on the energy recovery of biogas from urban sewage and its valorisation to electricity and heat.

The DEMOSOFC plant will be the first industrial-size example in EU of a high efficiency cogeneration plant with a SOFC system fed by biogas. The plant will be constructed of Convion fuel cell modules that are currently being commercialized and are already available also for other installations.

The Fuel Cell and Hydrogen Joint Undertaking (FCH-JU), a public-private joint initiative that promote fuel cells and hydrogen technology, finances the project within the H2020 program. The project has an overall budget of 5.9 million of Euro of which 4.2 million Euro provided by FCH-JU.

The project aims to install and operate the largest European biogas fed Solid Oxide Fuel Cell (SOFC) plant in Torino (Italy), exploiting the produced gas in a wastewater treatment plant managed by SMAT – Società Metropolitana Acque Torino – one of the project's partner. The plant will operate starting from November 2016.

Wastewater treatment plants typically have a significant electricity and heat consumption for the treatment of water and resulting sludge. At the same time, they produce biogas from the anaerobic digestion of sludge: the fuel cell generator (SOFC) is able to convert biogas to electricity with a net efficiency in the range 53-55%, well above the competing technologies (e.g., internal combustion engines). Thanks to the SOFC heat & power generation application, the WWTPs energy self-sufficiency will leap significantly ahead.

DEMOSOFC concept is related at plant level engineering and integration in order to show that the entire system is fully replicable and scalable

Torino is a large city, with more than 900.000 inhabitants living in a post-industrial environment. Traditional industry is still present in key engineering sectors like automotive, aerospace, ICT, but an innovative approach to economic development based on technology and research is also consolidated: this is the context in which DEMOSOFC will develop its activity for the next five years. A good environment to develop and apply - in a real context - an innovative technology ready to be replicated in many different fields at industrial scale.

Politecnico di Torino takes the lead of the international team acting together in order to bring the project toward success; its team, from the Energy Department, will follow the entire deployment of the industrial plant.

The DEMOSOFC plant will consists of three main sections: biogas processing, SOFC modules and heat recovery unit. First, the biogas processing unit where raw biogas from the digester is de-humidified, compressed and cleaned from contaminants (mainly sulphur and silicon compounds), which are harmful for the fuel cell (the clean-up and biogas conditioning system will be provided by

the Italian company). The SOFC power generation island consists of the 3 modules, whose overall expected electrical capacity is 174 kW_e and thermal around 100 kW_{th}. Zero gas emissions are expected from the plant in terms of SO_x and NO_x. Thermal power, recovered through a water loop, will be used to pre-heat part of the sludge feeding the anaerobic digester.

In fact, DEMOSOFC plant will cover on average 30% of the WWTP electricity consumption and around 100% of the thermal needs, depending on the season.

DEMOSOFC will install an innovative fuel cell module designed by Convion, a Finnish SOFC's manufacturer. CONVION modules can flexibly operate with different kind of fuel – biogas, natural gas, hydrogen – with also flexible scalability that enables the system to adapt to the needs of energy production.

DEMOSOFC is coordinated by Prof. Massimo Santarelli, from the Energy Department of Politecnico di Torino (<http://www.polito.it>). Project partners are: SMAT (IT, <http://www.smatorino.it>), Convion Oy (FI, <http://convion.fi>), VTT Research Center (FI, <http://www.vtt.fi>) and Imperial College of Science Technology and Medicine (UK, <https://www.imperial.ac.uk>).

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