

CLEAN ENERGY FROM WASTE WATER: THE FIRST PLANT IN EUROPE THANKS TO THE DEMOSOFC PROJECT

The European project DEMOSOFC coordinated by Politecnico di Torino will focus on the installation in the SMAT plant of Collegno of the first European industrial fuel cell system able to convert the sludge from the wastewater treatment process in clean and valuable energy, thanks to the high efficiency conversion of solid oxide fuel cells.

Turin, 24th September 2015 - The first industrial size plant in Europe able to produce high efficiency energy with solid oxide fuel cells (SOFC) using biogas from waste water treatment. This is the goal of the European project DEMOSOFC (www.demosofc.eu), which will be presented today at Castello del Valentino in Turin.

The project is coordinated by professor **Massimo Santarelli** from the Energy Department of **Politecnico di Torino** and involves 5 partners (European research institutes and companies): **Politecnico di Torino** and the **SMAT group** for Italy, the Finnish company **Convion Oy**, producer of the SOFC power modules, the Finnish research center **VTT** and the **Imperial College of Science, Technology and Medicine** (London). The total project budget is around **5.9 million euro**, and is financed by European Union with 4.2 million euro in the framework of the Horizon 2020 program, FCH-JU platform (Fuel Cell and Hydrogen Joint Undertaking).

The **DEMOSOFC** plant will concern the installation of three *fuel cell* modules able to co-produce 175 kW of electrical power and 90 kW of thermal power, with an electrical efficiency of 53%.

The system will be installed in the **SMAT Collegno waste water treatment plant (Turin)**, where currently biogas is produced from anaerobic digestion of sewage sludge. The DEMOSOFC plant will cover around 30% of the site needs (actually provided by the grid) and 100% of the thermal requirement.

The plant will employ the **Solid Oxide Fuel Cell (SOFC)** technology that can use directly natural gas or biogas. SOFCs are the most efficient and fuel flexible devices among the different fuel cell types available.

DEMOSOFC starts leverage from the results of the **SOFCOM** project (www.sofcom.eu), which has recently ended and was also coordinated by Politecnico di Torino. SOFCOM was born from the need of revamping from an energy saving point of view, the waste water treatment plant that is an essential service for the municipality. The project concerned the design and installation of a small scale demonstration plant with biogas fed SOFC which in addition to electrical and thermal production (cogeneration system) was also able to further purify water re-fix carbon contained in the fuel (biogas) in form of biomass (algae) which could be re-used.

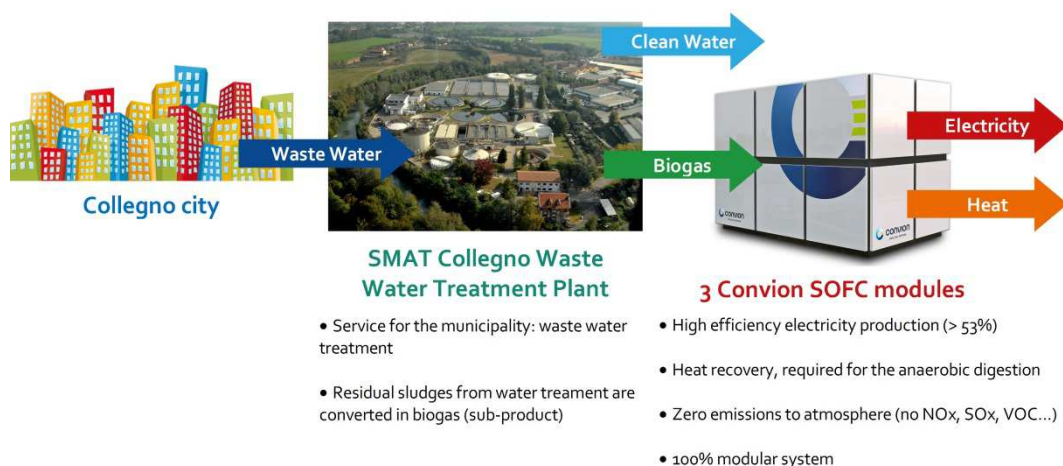
Biogas - a renewable fuel - is first cleaned (sulphur contaminants are removed) and then sent to the fuel cell where high efficiency electrical energy is produced (with an electrical efficiency up to 50%, while traditional competitors like engines and turbines reach only 35-38 %). The system is also cogenerative since the heat recovery from the exhaust gases is also performed.

From an energy point of view the system is able to demonstrate how Smart Fuel Cell (SFC) systems are a key driver for future energy plants, based on renewable fuels, with very high electrical efficiencies and total recovery of the processed elements (carbon, hydrogen and oxygen), trying to generate a new concept of poly-generation systems (heat&power + chemicals).

Furthermore, while traditional cogeneration systems generate exhaust gases with CO₂ mixed with a high nitrogen flow, with related complications in the sequestration processes, in a SOFC systems exhausts from the anode side are free from nitrogen, leading an easy CO₂-capture through a simple condenser to remove water.

DEMOSFC aims to carry the SOFCOM concept at an **industrial scale** through a product/process ready for the commercialization. Currently, the process components are produced mainly in Germany, England, Italy, USA and Japan. The market interest on this new technology is thus clearly evident and, thanks to synergies created by the **European Agency FCH-JU**, cooperation between industry and academy is strengthened. From the final user point of view, this specific application found its mainly application within biogas plants, not only from waste water. Similar plants can already be found in California, but fed by natural gas (methane). The possibility of biogas feeding (innovation point), and the environmental aspects, makes DEMOSOFC a strategic project for Europe, and its results could be replicated and help the development and consolidation of the industrial and scientific area.

Comment from the project coordinator Massimo Santarelli: *"This project aims to be an emblematic case, at industrial level, to show to companies, experts and society the advantages of fuel cells systems: from the comparison with traditional internal combustion engines and gas turbines, in the sub-MW area, efficiencies higher than 53% are expected for the SOFC system, compared to values in the range 25-38% for engines and turbines. On the thermal recovery side, numbers guarantee similar performance between fuel cells and traditional systems. The energetic interest is thus at high level. Furthermore, fuel cells are also competitive in terms of harmful emissions (environmental positive results) and CO₂ emissions. The investment cost challenge is still open for fuel cell technologies: being still not mature and with a current low penetration on the market, the economic advantages respect to traditional systems are still not guaranteed. Thus, as done for similar technologies (e.g., photovoltaics) a strong penetration on the market is required to move from the demonstration phase to an industrial optimal practice with reduced costs (both investment and operating costs). To accelerate this starting phase, the EU Agency FCH-JU funds new project with high interest for the scientific and industrial community and for the society. Projects like DEMOSOFC born from the need of deepen the knowledge of fuel cells based industrial applications and meanwhile demonstrating the significant energetic and environmental advantages promoting, at the same time, the penetration of industrial production and related costs reduction".*



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