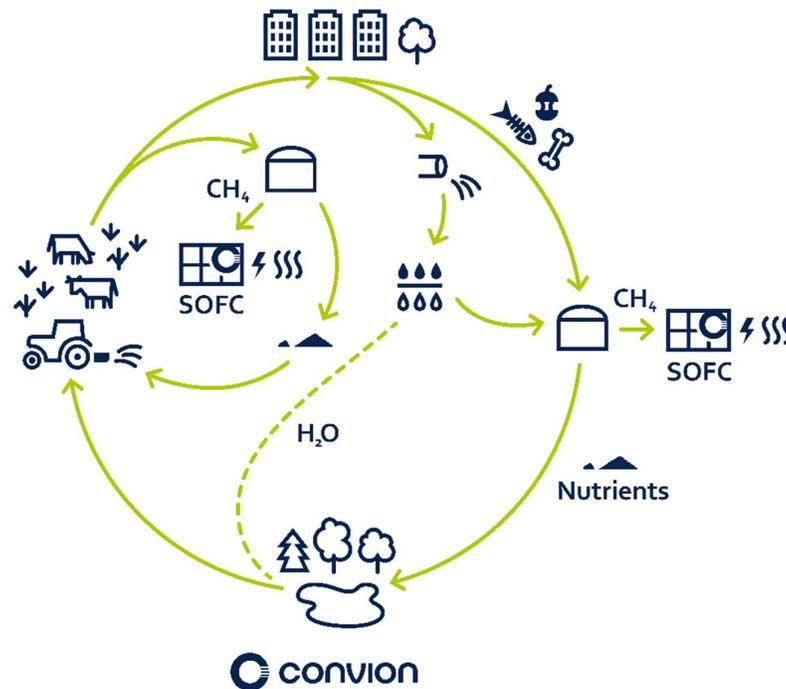


Harnessing the embedded energy in organic waste by SOFC

Embedded energy in waste biomass has vast potential to off-set fossil fuels by sustainable, renewable energy. Anaerobic digestion is a proven and scalable process for treating organic waste matter and producing by-product biogas for energy use. Sources of feedstocks for biogas production include e.g. household food waste, municipal waste water, agricultural waste streams and waste streams of food and beverages industries. The challenge to date has been, that waste is a distributed resource and converting biogas to electricity by conventional technologies in small scale is limited by low efficiency.

Convion C60 mini-CHP fuel cell systems offer a solution for directly converting diluted, digester quality biogas to electricity at world leading efficiency. A single module has electrical output of 60kW and multiple modules be installed in parallel to reach desired capacity and redundancy.



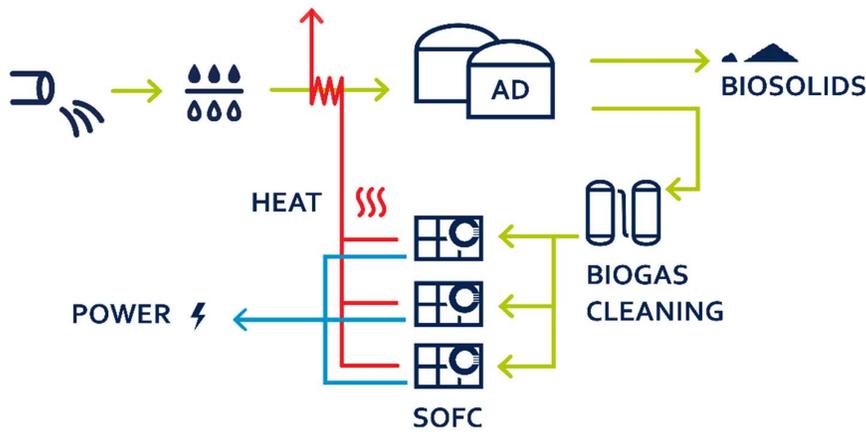
Benefits of integrated power generation by Convion fuel cell systems include

- Cost savings in energy and waste management
- Resiliency and energy autonomy
- Zero local emissions of SO_x, NO_x, HC and PM

Convion products are designed to operate flexibly with either natural gas or digester quality biogas with minimum of 55%-vol CH₄ without a compromise in efficiency. Convion has demonstrated net electrical efficiency >53% and total co-generation efficiency >80% with biogas, resulting to 1.5-2 times as much electricity produced from the same amount of biogas used, when compared with conventional internal combustion engine generators.

In Europe, majority of wastewater is treated in plants with technical potential of power generation <500kW. In this power range, penetration of CHP is low due to modest efficiency of conventional generators. The concept of integrated SOFC co-generation from biogas changes the game as performance of SOFC is independent of scale and power and heat outputs match well with loads of a waste water treatment plant.

Convion's biogas fueled SOFC systems are currently demonstrated at a waste water treatment plant of SMAT S.p.A. in Turin metropolitan area in Italy. The facility is engineered and built in co-operation within an EU funded project **DEMOSOFC**, using Convion's fuel flexible mini powerplants at a core of the plant. Fuel cell capacity is matched with biogas production and to cover 100% of thermal energy consumption of the plant. On-site electricity generation of 175kW by SOFC fuel cells covers approximately 30% of the plant's electrical energy need.



Integration concept of the DEMOSOFC project in Turin.



The DEMOSOFC project has received funding from the Fuel Cells and Hydrogen Joint Undertaking under grant agreement No 671470. Other partners in the project are Società Metropolitana Acque Torino S.p.A., Politecnico di Torino, VTT, a research center of Finland, and Imperial College of London.



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