DEMOSOFC

Demonstration of large SOFC system fed with biogas from WWTP

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THE DEMOSOFC PROJECT

WASTE WATER SOFC ENERGY

PROJECT OVERVIEW

Project Information	
Call topic	FCH 02.11-2014 – Large scale fuel cell power plant demonstration in industrial/commercial market segments
Grant agreement number	671470
Application area (FP7) or Pillar (Horizon 2020)	Stationary application
Start date	01/09/2015
End date	31/08/2020
Total budget (€)	5'905'336.25
FCH JU contribution (€)	4'492'561.00
Other contribution (€, source)	130 k€ (from local funds Regione Piemonte)
Stage of implementation	43% project months elapsed vs total project duration, at date of November 1st, 2017
Partners	POLITO (IT),CONVION (FI),SMAT (IT), VTT(FI), ICL (UK)

PROJECT SUMMARY

DEMOSOFC objectives:

- 1. **DEMO** and deep analysis of a **industrial size (174 kW_e) CHP system based on SOFC**, fed by a biogenous CO2-neutral fuel (**biogas** from waste water treatment plant) in a real industrial installation: electrical efficiency, thermal recovery, low emissions, plant integration
- 2. **EXPLOITATION and BUSINESS** analysis for replication of this type of innovative energy systems
- 3. **DISSEMINATION** of the high interest (energy and economic) of such systems

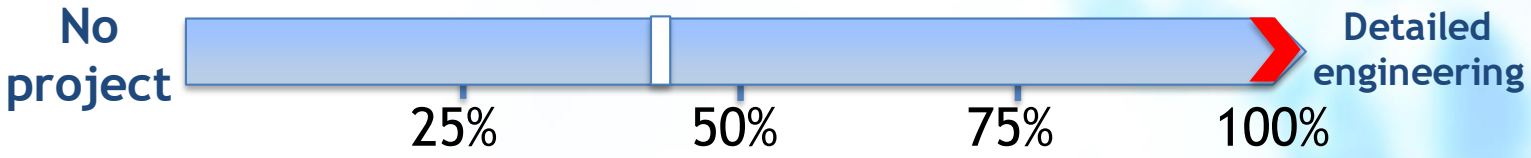
Global positioning vs international state-of the art:

- **Largest SOFC installation in EU (174 kW_e + 90 kW_{th}) fed by biogas from WWTP**

PROJECT PROGRESS/ACTIONS
Detailed engineering

Achievement to-date

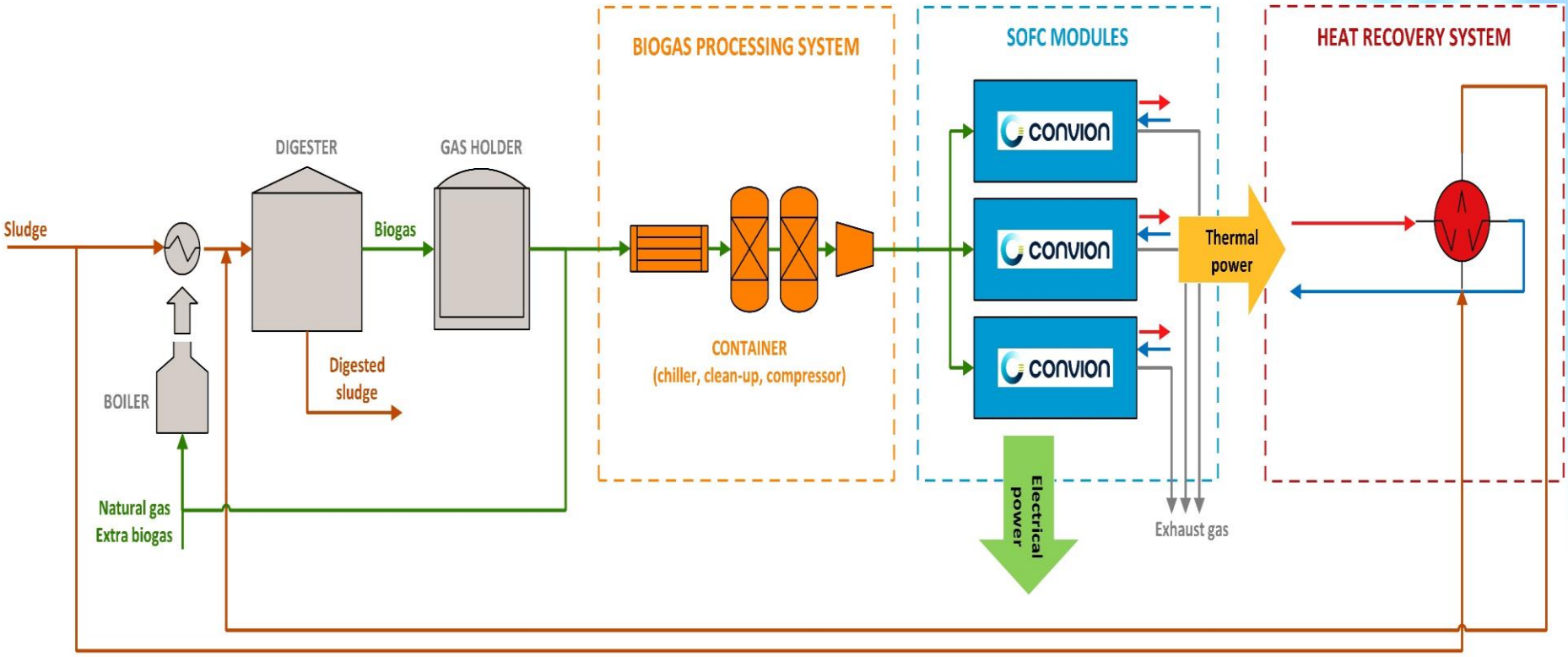
% stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Detailed engineering	The project target demonstration of solutions integrating 50 kW up to several MW power and heat from natural gas, biogas or hydrogen	1	No industrial size SOFC-based systems fed by biogas in EU	FC-based industrial size systems		

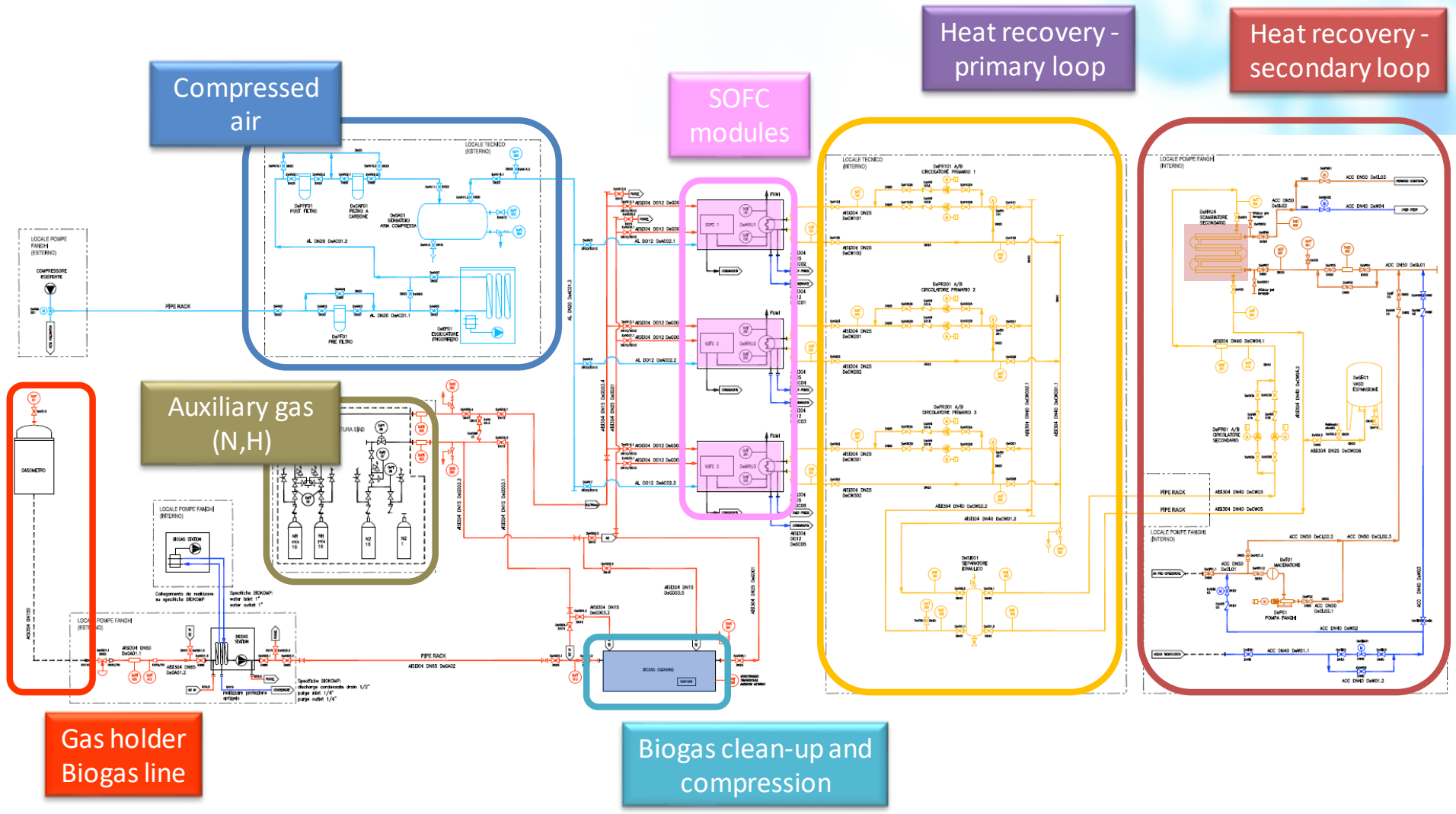
PROJECT PROGRESS/ACTIONS

Detailed engineering - General schematic



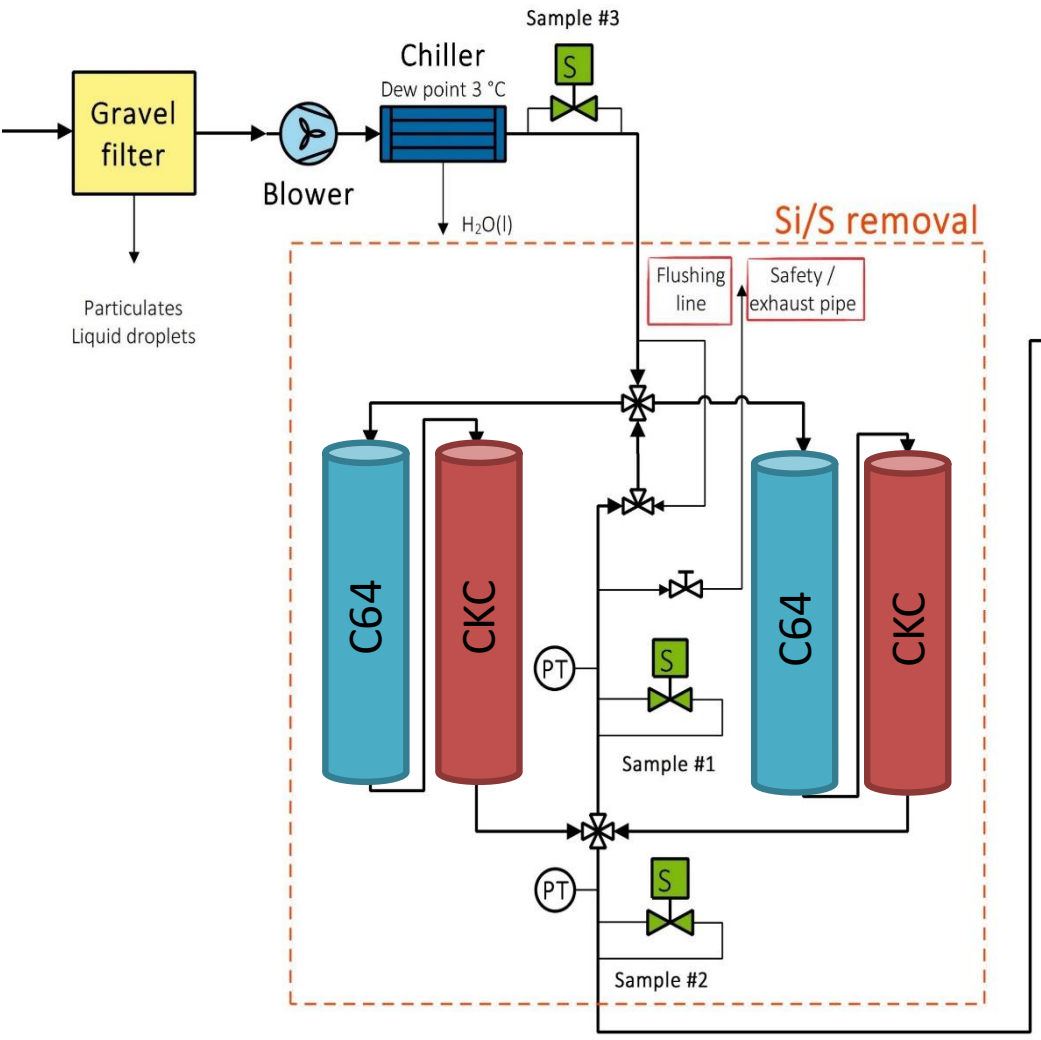
PROJECT PROGRESS/ACTIONS

Detailed engineering - P&ID



PROJECT PROGRESS/ACTIONS

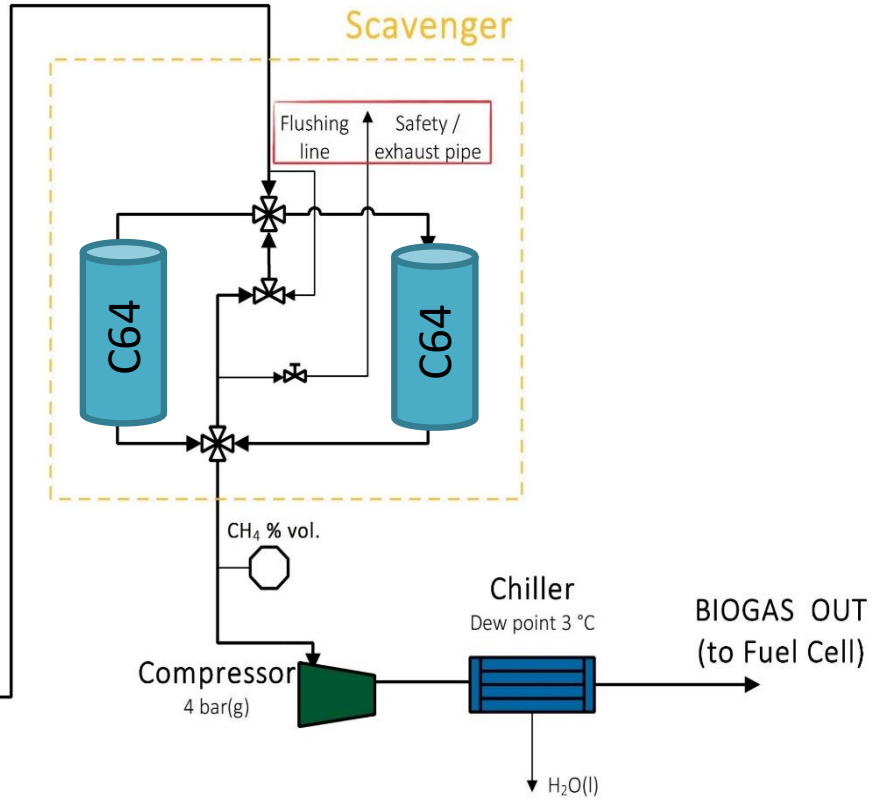
Detailed engineering - Biogas clean-up module



Required purification level for SOFC

H_2S: 30 ppb

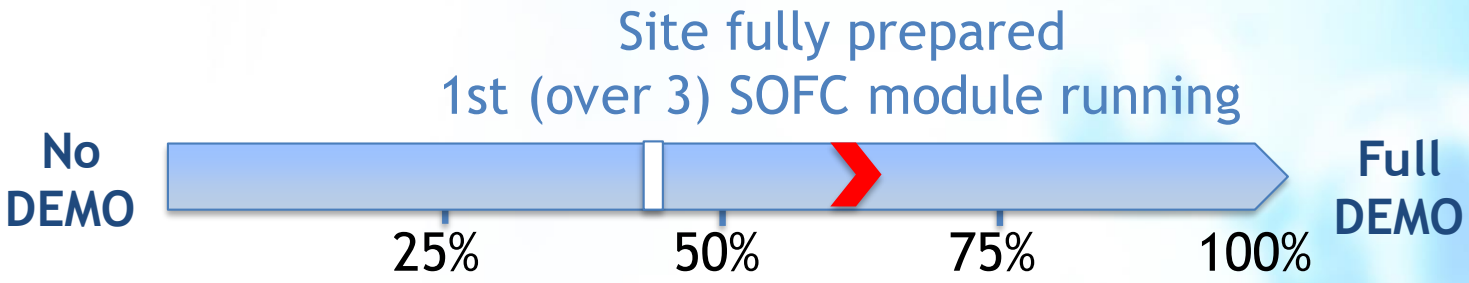
Siloxanes: 10 ppb



PROJECT PROGRESS/ACTIONS
Installation

Achievement to-date

% stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Installation	Boost the share of FCH technologies in a sustainable, low-carbon energy system	1	No industrial size SOFC-based systems fed by biogas in EU	FC-based industrial size systems		

PROJECT PROGRESS/ACTIONS

Installation (1/3) complete plant

PROJECT PROGRESS/ACTIONS
Installation (2/3) biogas clean-up

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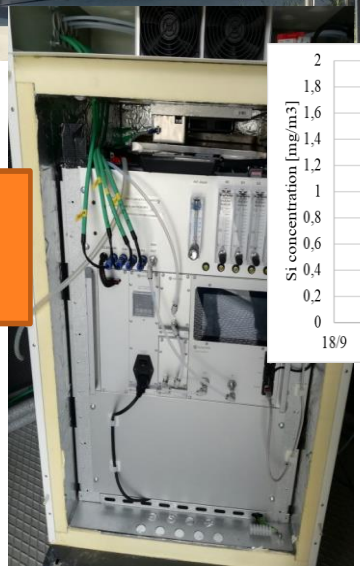
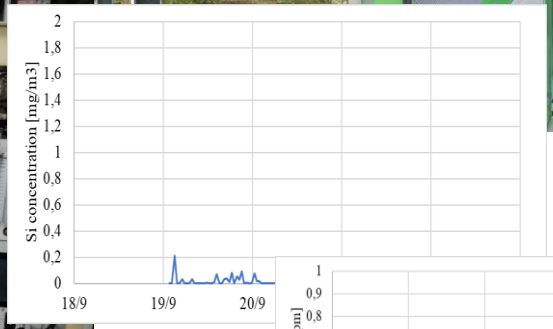
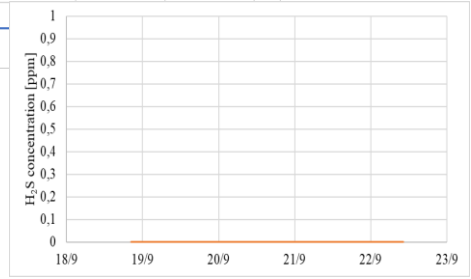
bio-komp

ACTIVATED CARBONS REACTORS

ONLINE GAS ANALYZER







QUALVISTA

COMPRESSOR

PROJECT PROGRESS/ACTIONS
Installation (3/3) heat recovery

CIRCULATION PUMPS

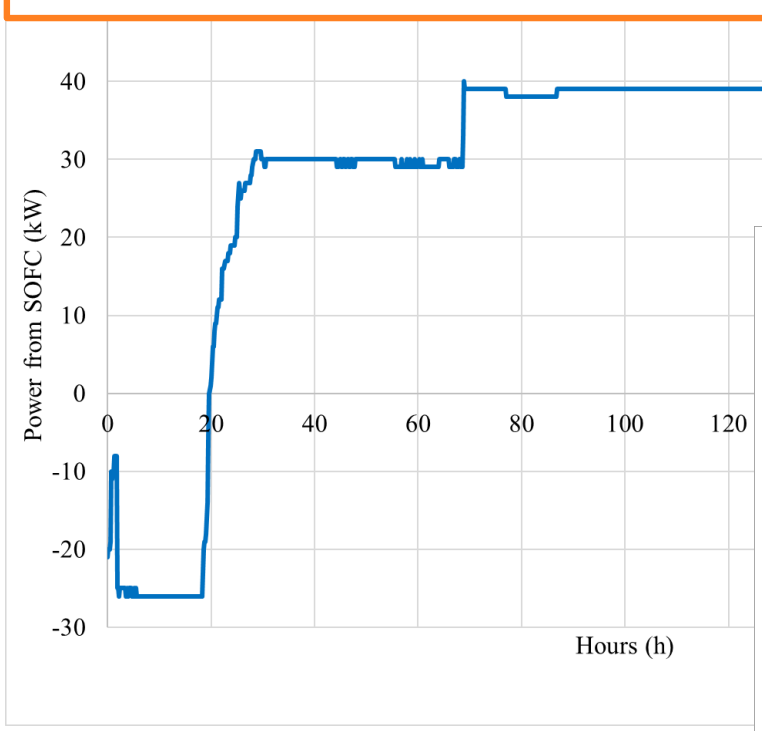
WATER-SLUDGE HEAT EXCHANGER

Hot water (design temperatures 42-78°C) able to cover from 50 to 100% (winter-summer) of thermal load required for sludge pre-heating (Total Solid Content 2%)

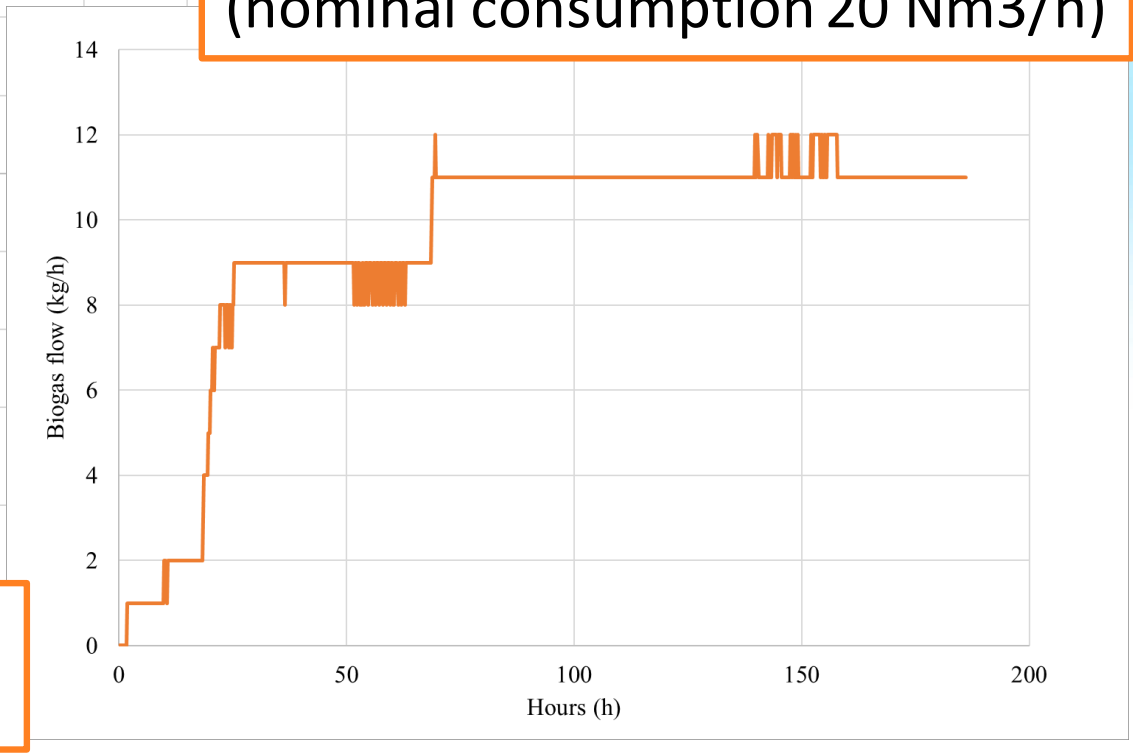
PROJECT PROGRESS/ACTIONS

Operation: results in the first 10 days

Electrical Power (kW)
1 SOFC module
(nominal power 58 kW)



Biogas consumption (Nm3/h)
1 SOFC module
(nominal consumption 20 Nm3/h)



Electrical efficiency: 56%

PROJECT PROGRESS/ACTIONS

Video of the installation

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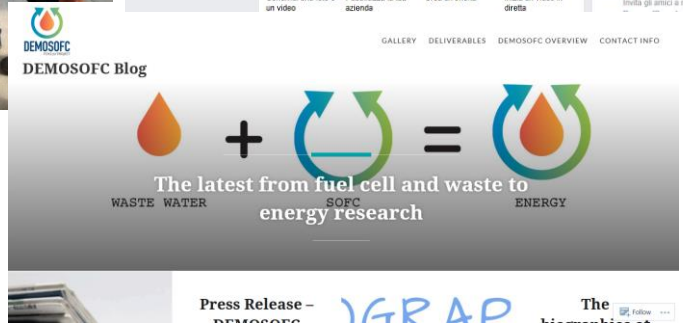
PROJECT PROGRESS/ACTIONS
Dissemination

The project's dissemination is focusing on professionals and stakeholders in energy, waste, hydrogen, green tech, reached by:

- A Website: www.demosofc.eu: 80 posts
- A blog: https://demosofc.wordpress.com/: 10 posts since October 2017
- Facebook: www.facebook.com/DEMOSOFCProject/: 190 posts, 160 followers
- Twitter: https://twitter.com/Steps_Polito: 272 tweet, 270 followers
- Linkeding groups: www.linkedin.com/groups/7037974: 66 professionals following



SYNERGIES WITH OTHER PROJECTS AND PROGRAMMES

Interactions with projects funded under EU programmes	
SOFCOM	Deep analysis of biogas contaminant effects on SOFC anodes
NELLHI	SOFC stack development for mass manufacturing
INNOSOFC	SOFC system integration and market assessments
HELTSTACK	Scientific networking and SOFC stack development
Interactions with national and international-level projects and initiatives	
EOS Project	Installation and operation of the CHP100 (Siemens Westinghouse, 100 kW_e + 60 kW_{th})
NFCRC (Irvine, US) for Orange County Sanitation District	National Fuel Cell Research Center (NFCRC) in the University of California, Irvine, CA (US): biogas-fed FC-based industrial plant (Orange County Sanitation District, CA, US):

DISSEMINATION ACTIVITIES

Public deliverables

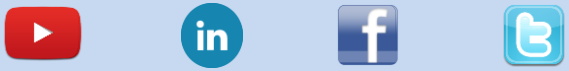
16 Deliverables already produced: the most importants:

- D2.4 Detailed engineering of the DEMO
- D2.5 Cost/benefit analysis of the system
- D3.1 Site preparation for the installation of the DEMO
- Deliverable D7.1 Plan for the dissemination of the results

Conferences/Workshops

- 2 organised by the project
- 19 in which the project has participated (but not organised)

Social media



Publications: 14

- Gandiglio M., .Lanzini A., Soto A., Leone P., Santarelli M., "Enhancing the energy efficiency of wastewater treatment plants through co-digestion and fuel cell systems", accepted for publication on October 10th 2017 - Frontiers in Environmental Science, Wastewater Management – OPEN ACCESS. Accepted, under publication.
- Giarola S., Forte O., Lanzini A., Gandiglio M., Santarelli M., "Techno-economic assessment of biogas-fed solid oxide fuel cell combined heat and power system at industrial scale", submitted to Applied Energy." ACKNOWLEDGMENTS TO DEMOSOFC – Accepted, under publication.

Patents: 0

Thank You!

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