DEMOSOFC
Demonstration of large SOFC system fed with biogas from WWTP

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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)	Not yet
Stage of implementation	23% project months elapsed vs total project duration, at date of November 1, 2016
Partners	POLITO (IT),CONVION (FI),SMAT (IT), VTT(FI), ICL (UK)

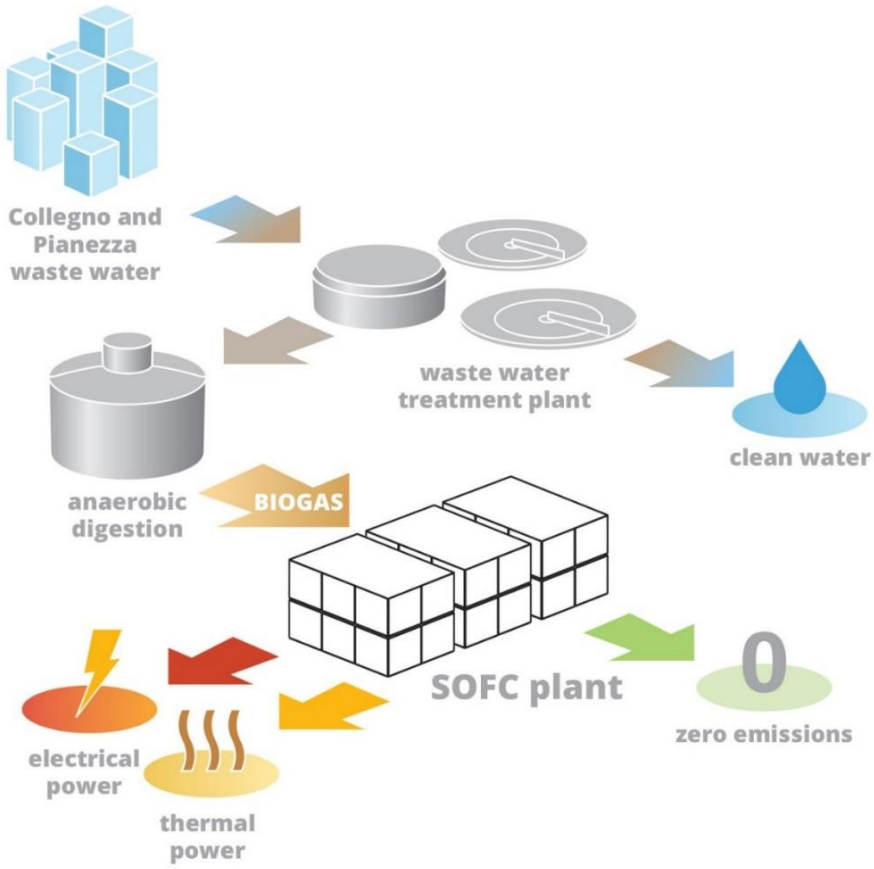
PROJECT SUMMARY

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 of 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:

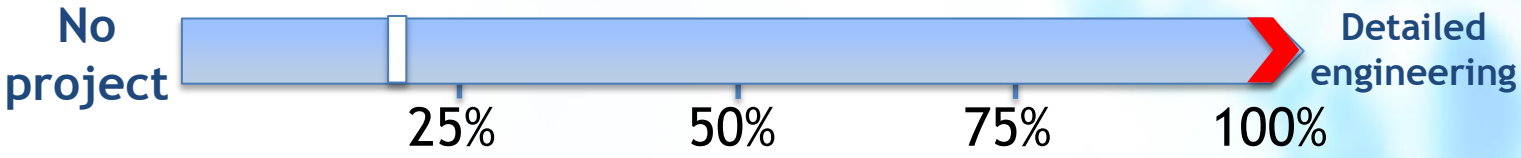
- Largest SOFC installation in EU (174 kW_e + 89 kW_{th}) fed by biogas from WWTP



PROJECT PROGRESS/ACTIONS
Detailed engineering

Achievement to-date

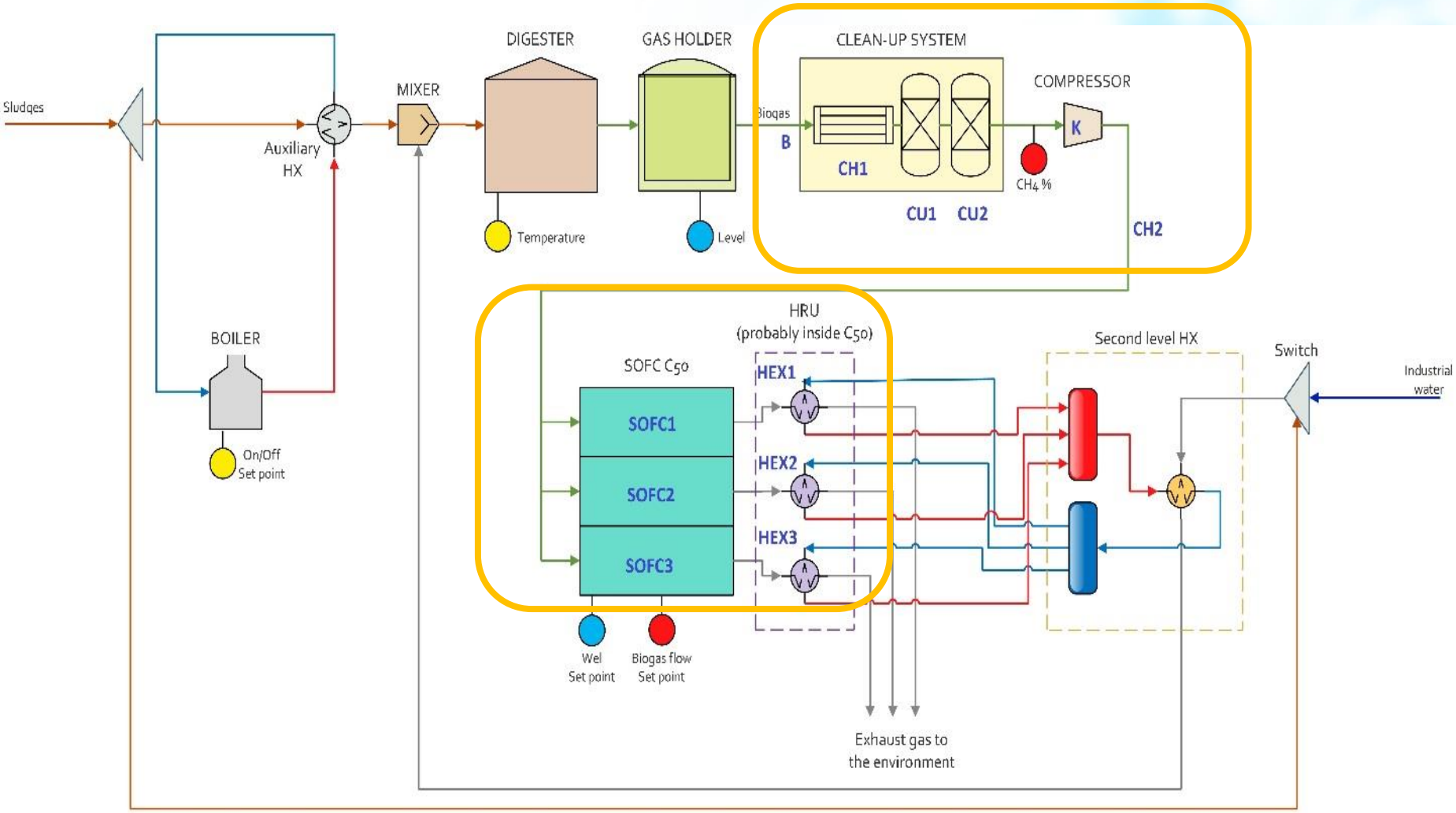
% stage of implement.



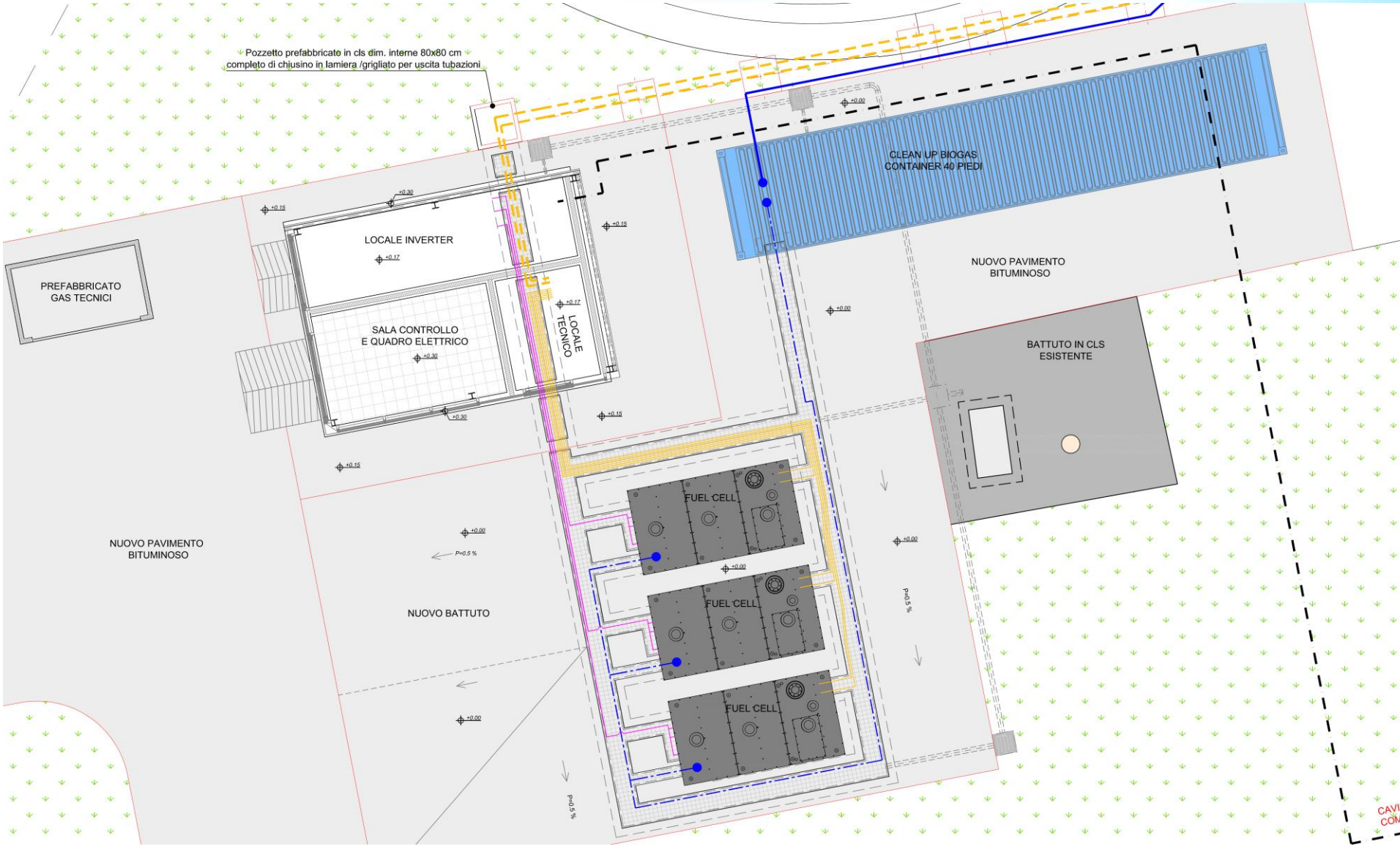
Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Detailed engineering	The project target demonstration of solutions integrating 50 kW up to several MW power and heat from natural gas, biogas or hydrogen	1	No industrial size SOFC-based systems fed by biogas in EU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

PROJECT PROGRESS/ACTIONS

Detailed engineering - General schematic



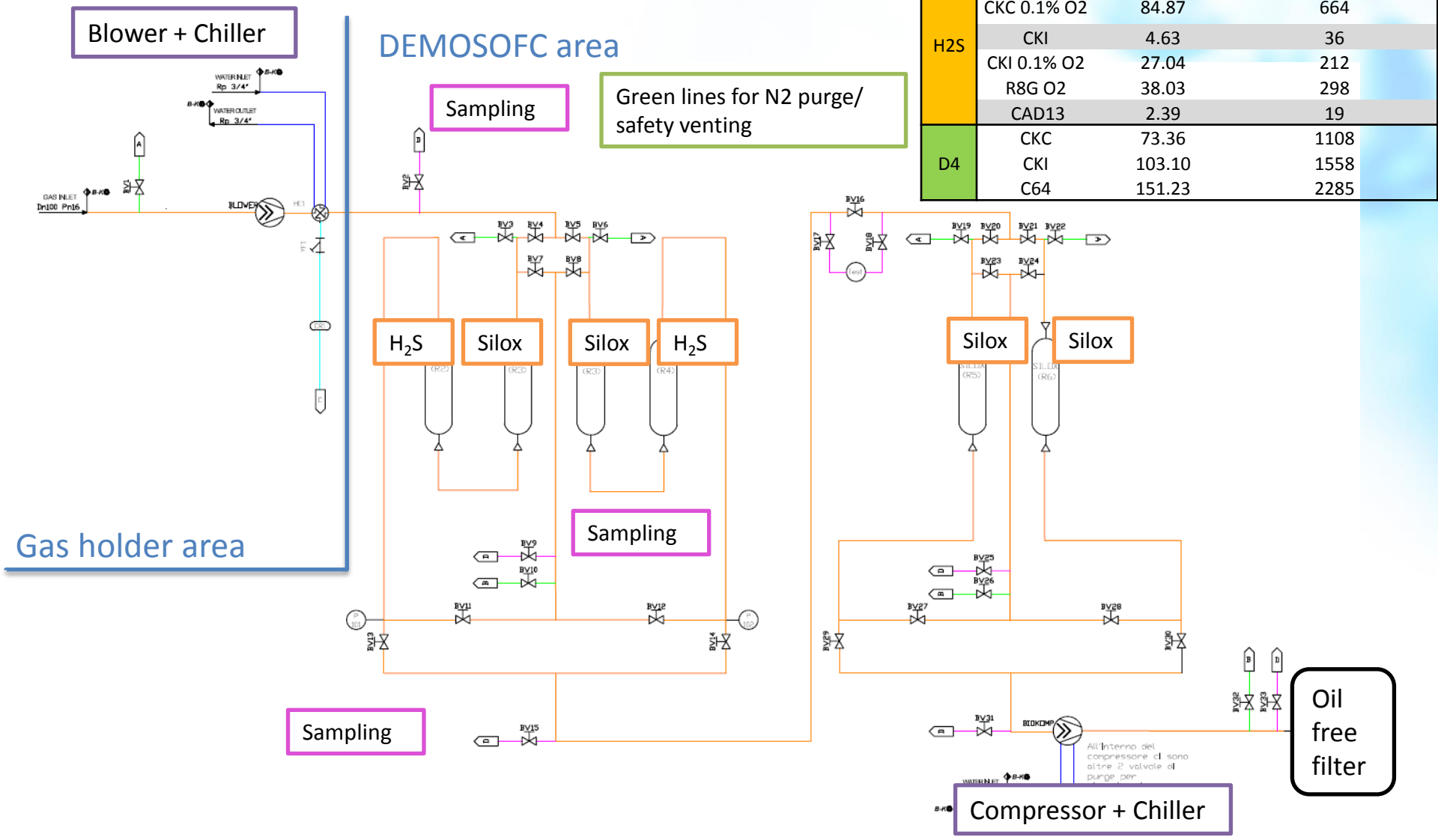
PROJECT PROGRESS/ACTIONS
Detailed engineering - Piping



PROJECT PROGRESS/ACTIONS

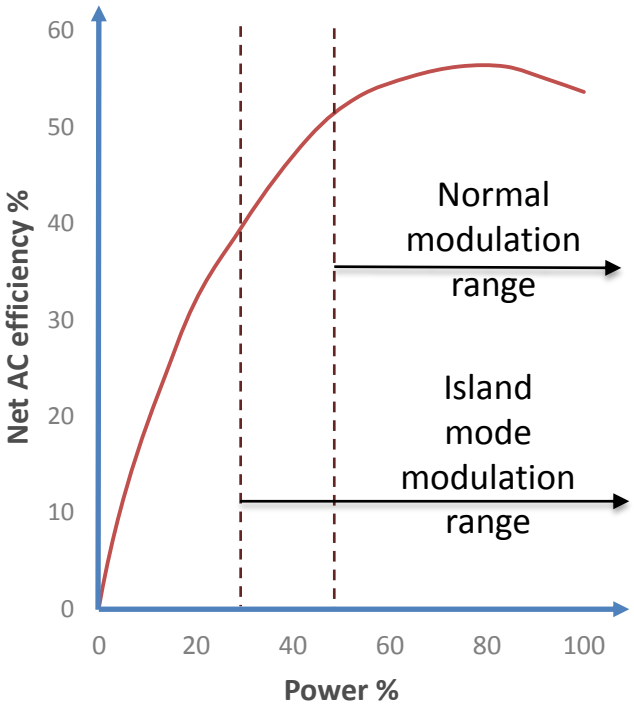
Detailed engineering - Biogas clean-up module

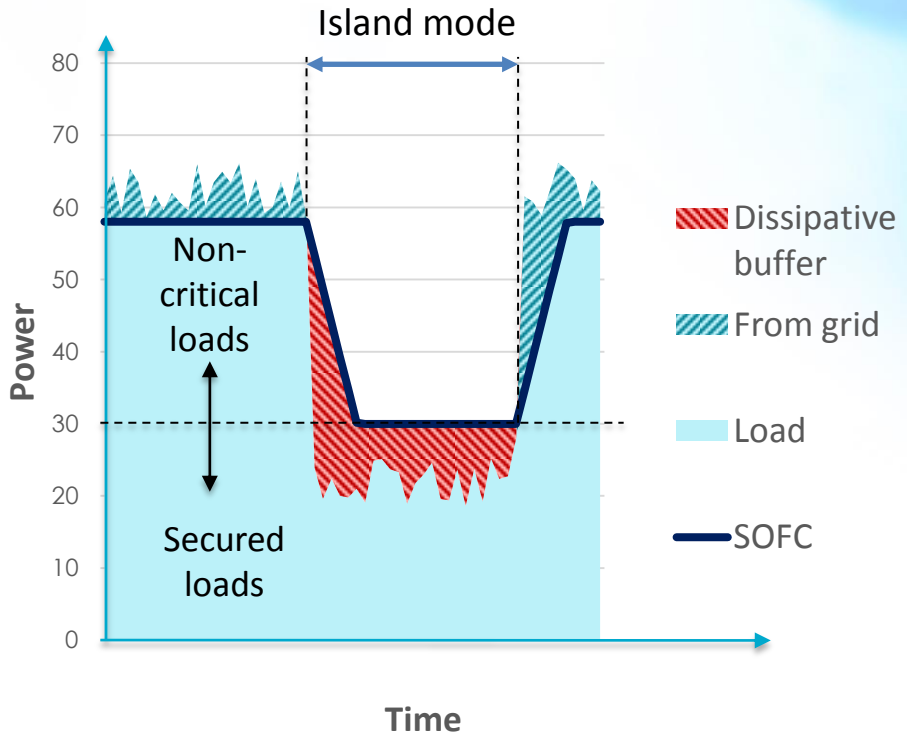
		Adsorption capacity [mg/g]	Reactor breakthrough time [days]
H2S	CKC	3.91	31
	CKC 0.1% O2	84.87	664
	CKI	4.63	36
	CKI 0.1% O2	27.04	212
	R8G O2	38.03	298
	CAD13	2.39	19
D4	CKC	73.36	1108
	CKI	103.10	1558
	C64	151.23	2285



PROJECT PROGRESS/ACTIONS
Detailed engineering - Operation

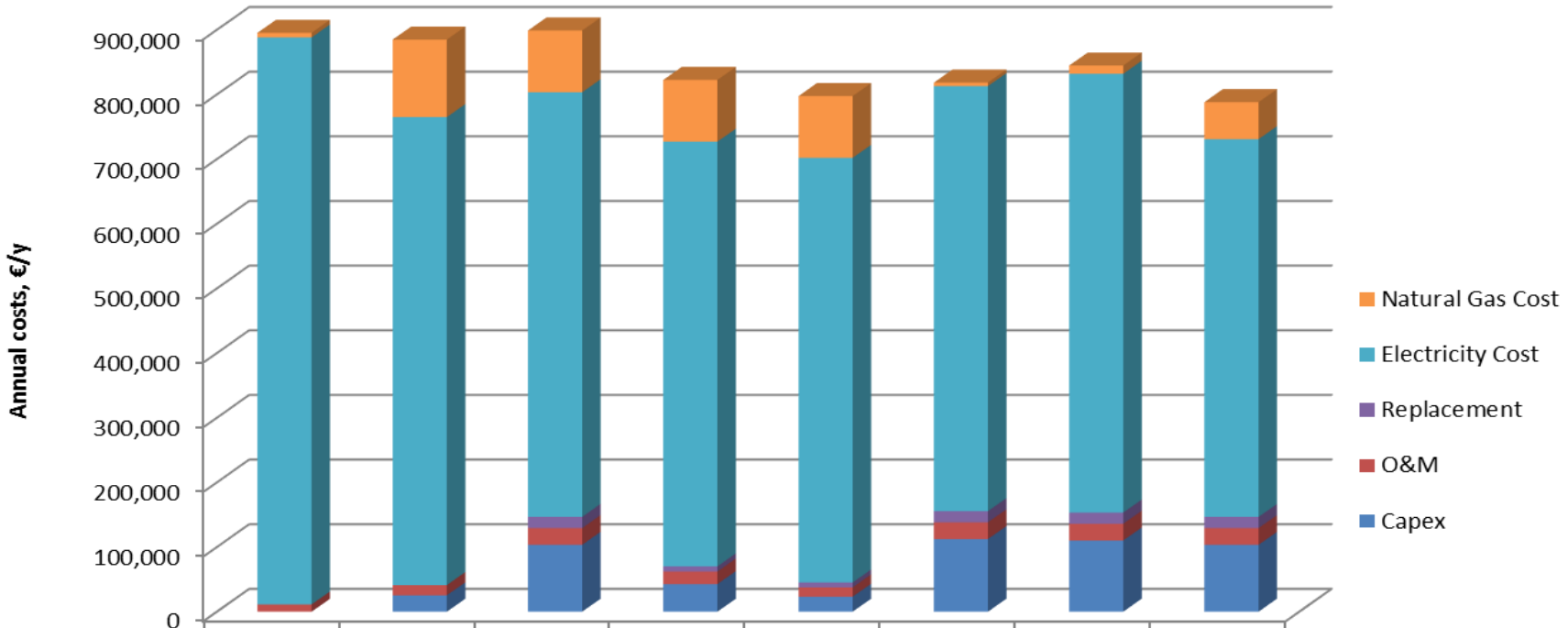
- In **grid-tied mode**, SOFC can be modulated from **100% to 50%** with little compromise in efficiency.
- In an event of power grid failure, SOFC system with built-in dissipative means can form an **islanding grid** and supply dynamic loads with power at a little sacrifice in electrical efficiency.





PROJECT PROGRESS/ACTIONS

Detailed engineering - First cost analysis



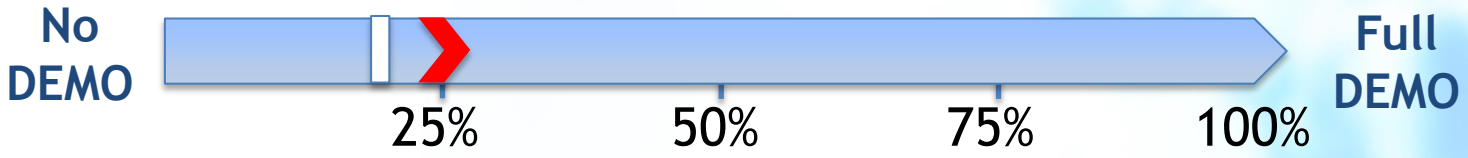
	A	B	C	C.s	C.t	D	E	F
Natural Gas Cost	7,216	119,977	95,477	95,477	95,477	5,419	12,736	57,272
Electricity Cost	876,824	723,769	656,865	656,865	656,865	657,446	678,618	584,303
Replacement	0	0	17,276	8,079	7,612	17,276	17,276	17,276
O&M	11,308	15,817	25,885	19,414	14,342	25,885	25,885	25,885
Capex	0	25,365	103,442	42,690	23,303	112,378	110,212	103,442

A: boiler - **B**: mGT - **C**: SOFC (C: current scenario, C.s: short term scenario, C.t: target scenario) - **D**: SOFC with centrifugal pre-thickening - **E**: SOFC with dynamic pre-thickening - **F**: SOFC (UK)

PROJECT PROGRESS/ACTIONS
Installation

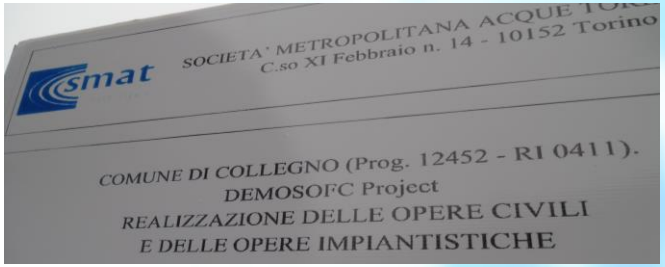
Achievement to-date

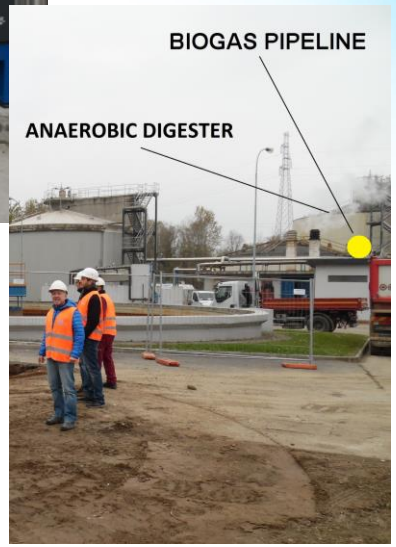
% stage of implement.



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





DEMOSOFC site preparation video

PROJECT PROGRESS/ACTIONS
Dissemination

Cross Workshop in Stuttgart (DE) on January 30th, 2017

Title: SUPERSofc

HELISTAK- Marie Curie project	NEL HI
INNOSOFC	DEMOSOFC FCH2-JU PROJECT

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

- Deliverable D2.1 Energy planning of the DEMO: DONE at M3 (November 2015)
- Deliverable D2.2 Optimization of the DEMO: DONE at M4 (December 2015)
- Deliverable D2.3 Detailed engineering of the DEMO: DONE at M6 (February 2016)
- Deliverable D2.4 Cost/benefit analysis of the system: DONE at M6 (February 2016)
- Deliverable D7.1 Plan for the dissemination of the results: DONE at M3 (November 2015)

Conferences/Workshops

- 1 organised by the project
- 8 in which the project has participated (but not organised)

Social media

Publications: 5

- Papurello D., Lanzini A., Drago D., Leone P., Santarelli M., Limiting factors for planar solid oxide fuel cells under different trace compound concentrations, Energy, Vol. 95, pp. 67-78, 2016 ISSN: 03605442
- Giarola S., Forte O., Lanzini A., Gandiglio M., Santarelli M., Hawkes A.,Techno-economic assessment of a wastewater treatment plant retrofited with a sub-MW SOFC CHP system (submitted)

Patents: 0

Thank You!

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