DEMCOPEM-2MW

Demonstration of a combined heat and power 2 MWe PEM fuel cell generator and integration into an existing chlorine production plant

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Project overview

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Project Information	
Call topic	SP1-JTI-FCH.2013.3.5
Grant agreement number	621256
Application area (FP7) or Pillar (Horizon 2020)	Energy
Start date	01/01/2015
End date	31/12/2018
Total budget (€)	10,524,200.40
FCH JU contribution (€)	5,466,525.00
Other contribution	n/a
Stage of implementation	46% project months elapsed vs total project duration, at date of November 1, 2016
Partners	AkzoNobel Industrial Chemicals B.V.; Nedstack Fuel Cell Technology B.V.; MTSA Technopower B.V; Johnson Matthey Fuel Cells Limited; Politecnico di Milano

Project summary

The main objective of the four years DEMCOPEM-2MW project is to design, build and operate a 2 MW power generator, with

- Full integration of heat and power with an existing chlorine production plant
- Fully automated way of operation and remote control
- High net conversion efficiency, *i.e.* > 50% electric energy on system level and > 85% for combined heat and power
- Demonstration of power and heat generation for over 2 years
- On-stream availability of > 95% for over 16,000 hours (in line with the AIP 2013)
- Over 2 years (16,000 hrs) for fuel cell stacks lifetime without any need for repair or maintenance of the membranes.
- Contribute to FCH goals with > 5 MW @ 3,000/kW in 2015 (and > 50 MW @ 1,500/kw installed)

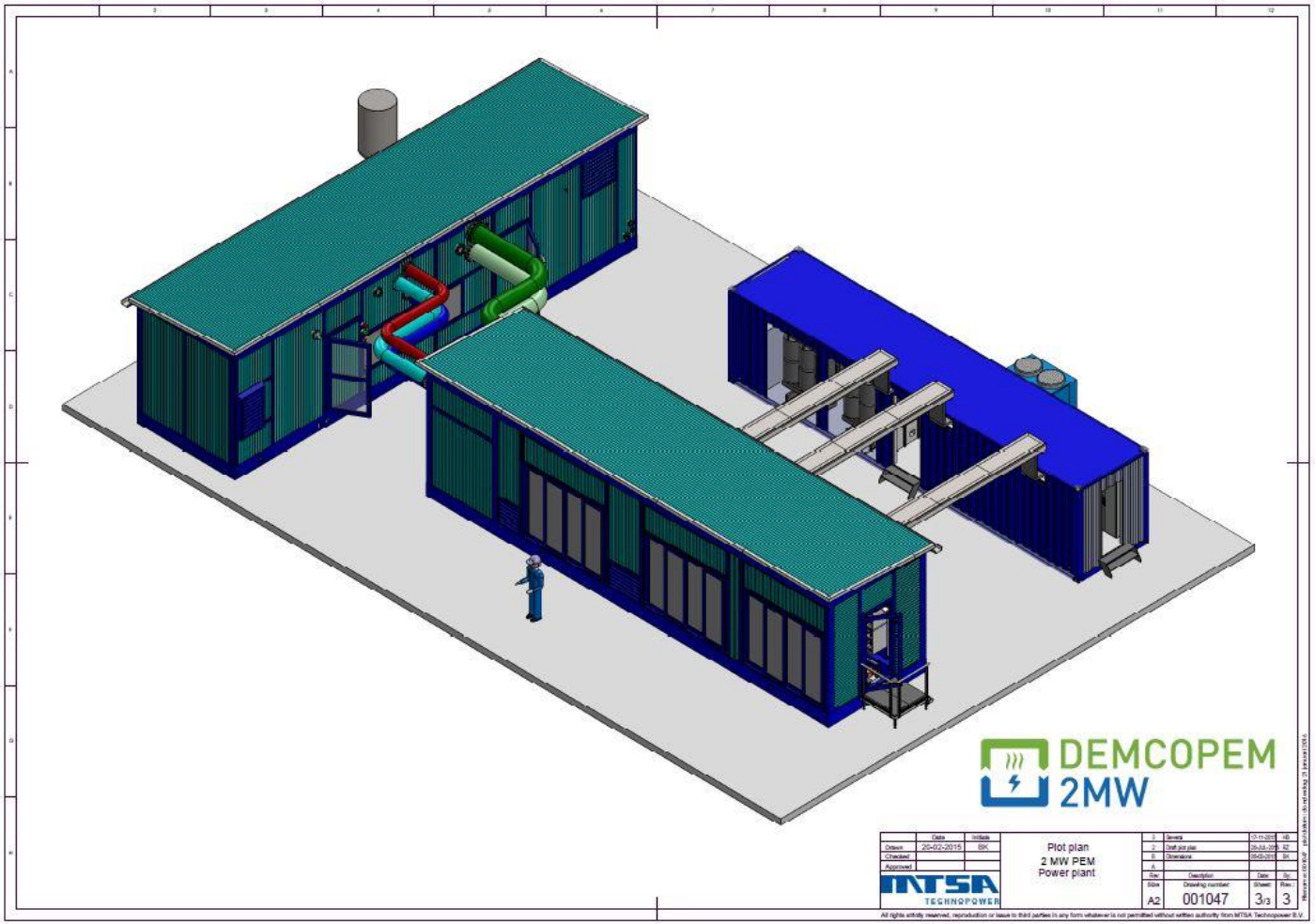
Project progress: design & construction

Ynnovate, Yingkou

(province Liaoning), China

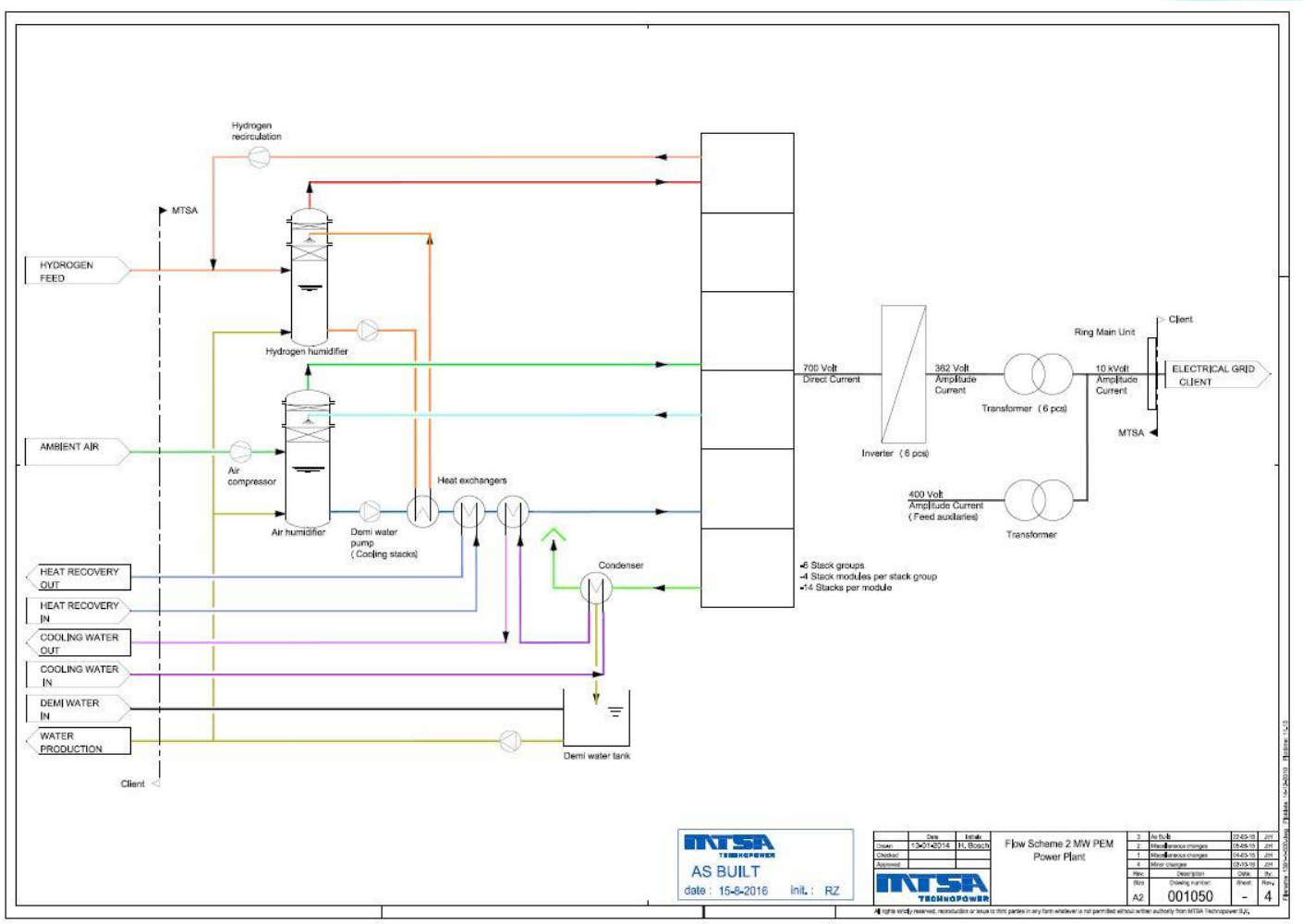
Project progress: design & construction

Lay-out



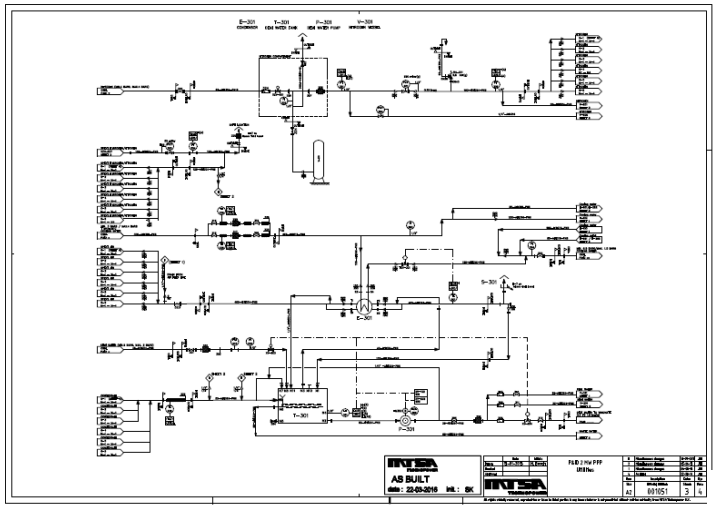
Project progress: design & construction

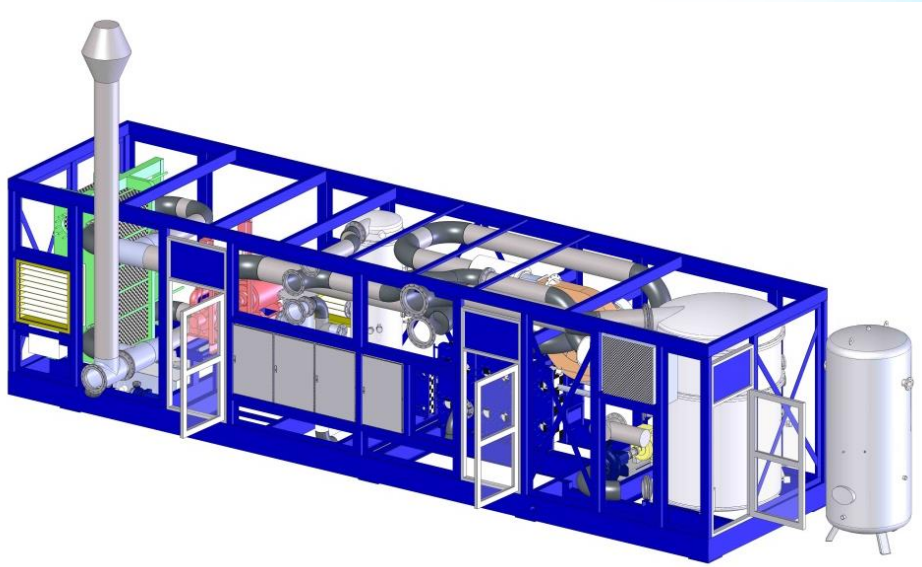
Flowscheme



Project progress: design & construction

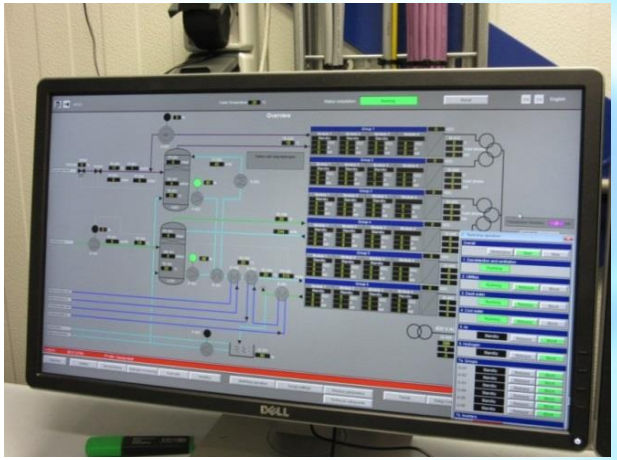
Design





Project progress: design & construction

Construction and testing at MTSA
Arnhem, The Netherlands



Project progress: design & construction

Transport

Project progress: design & construction

Connection on local utilities and testing

Project progress: design & construction

Commissioning and start-up, September 2016
Operation period started

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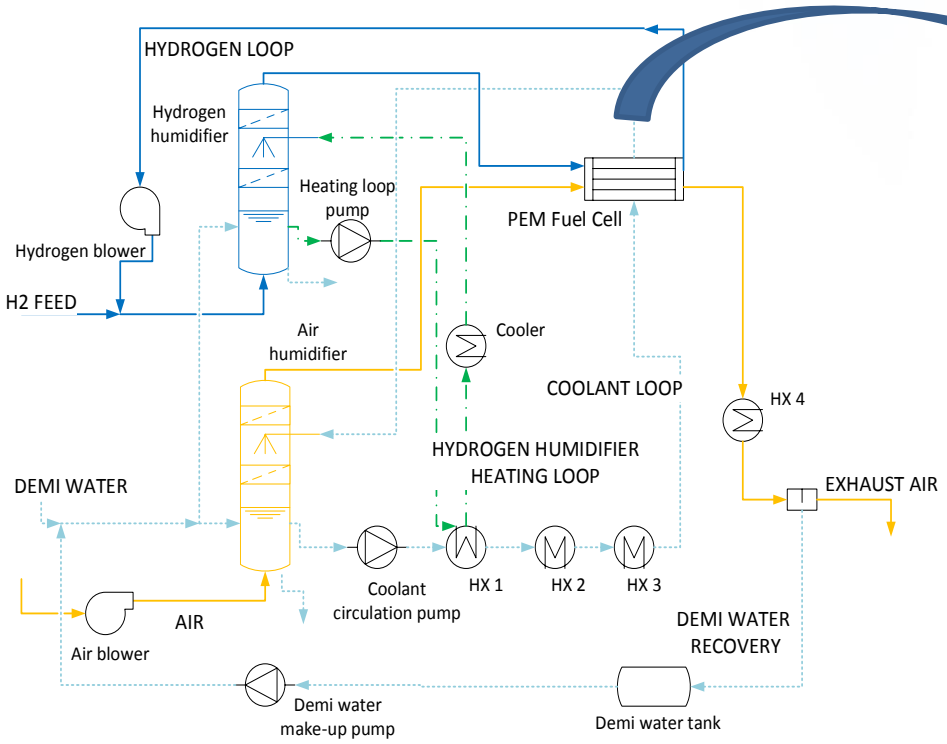
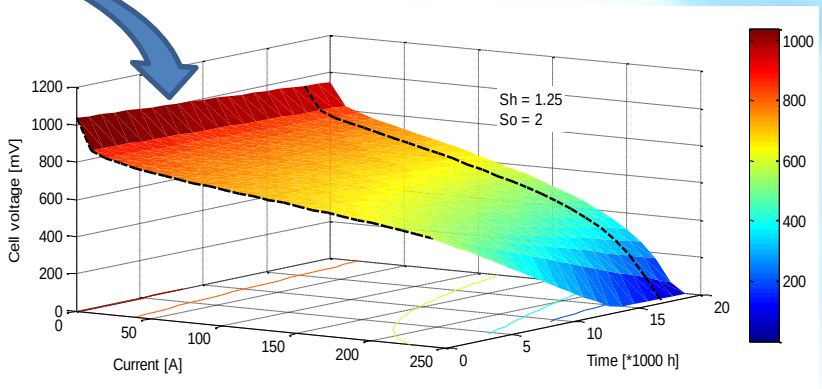
Project progress: modelling of process

Setup of a plant model (Aspen Plus®) with custom PEMFC model based on stack measurements

Validation against real data 1 MW plant





Polarization curves as function of current and time at fixed stoichiometry

Model of components based on P&ID

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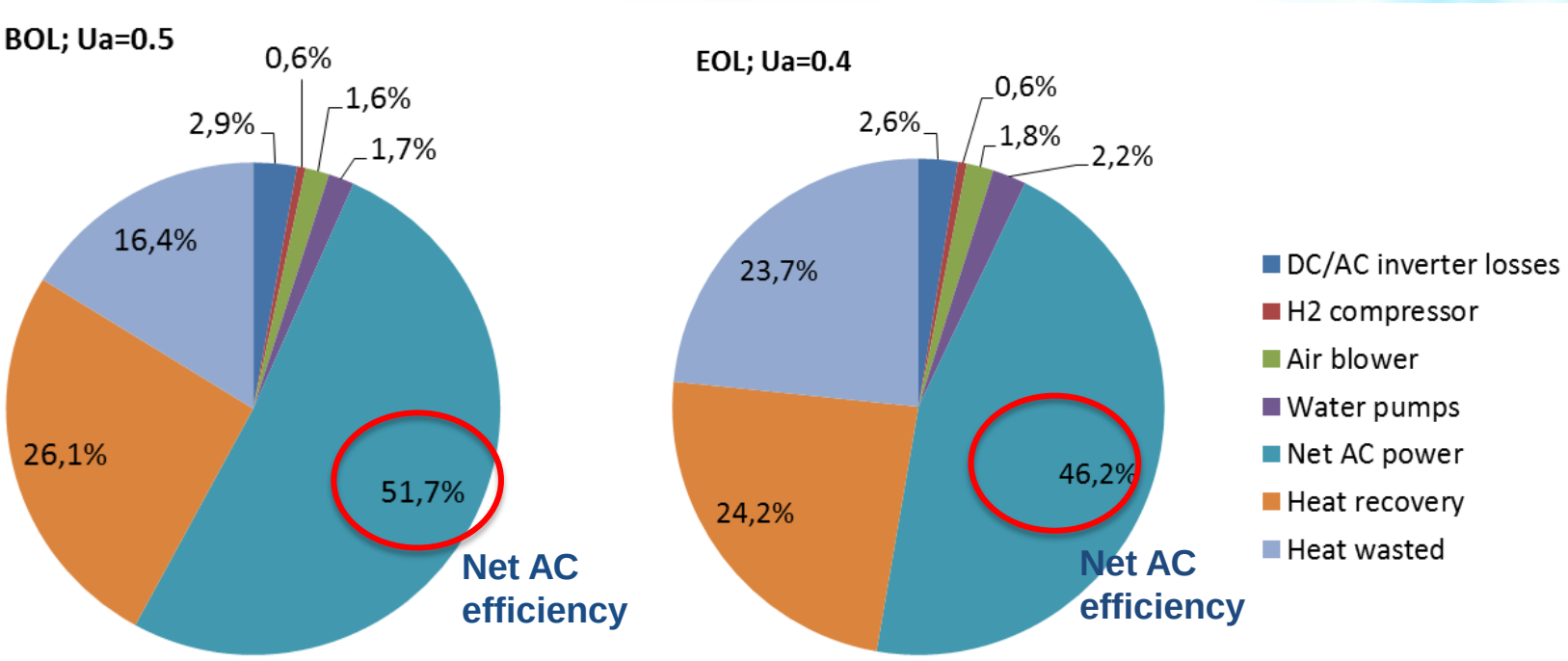
Project progress: modelling of process

Simulation of different air flowrate control strategies for efficiency optimization vs. lifetime (Beginning Of Life, BOL – End of Life, EOL)



Ongoing activity: validation against field measurements

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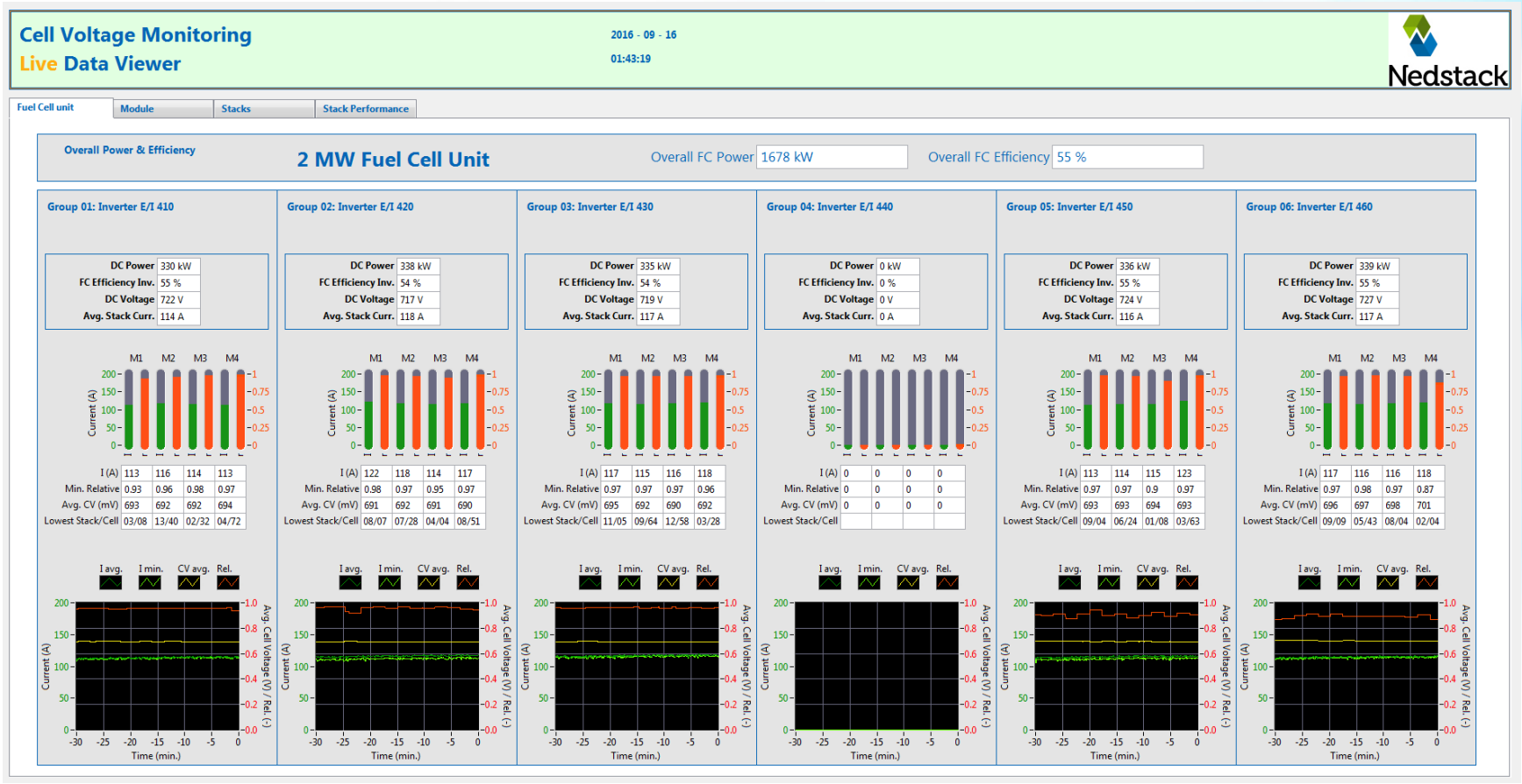
Project progress: stack performance data



- Live CVM viewer – plant overview
- 1,7 MWe fuel cell power (5/6 groups operational)

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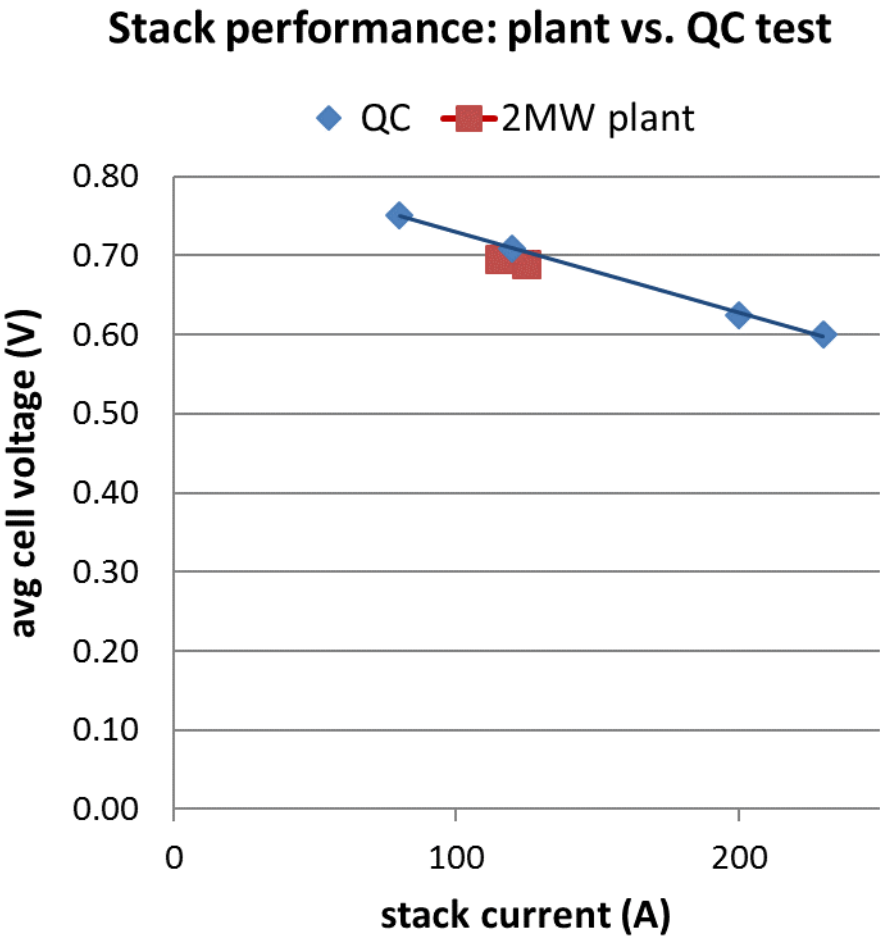
Project progress: performance data



Plant performance

Nominal fuel cell output:	2000 kW
Fuel cell efficiency (LHV):	55%
Auxiliary consumption:	120 kW
BOP efficiency:	90%
Electrical efficiency:	50%
Available heat @ 60° C:	950 kW
Total efficiency:	77%

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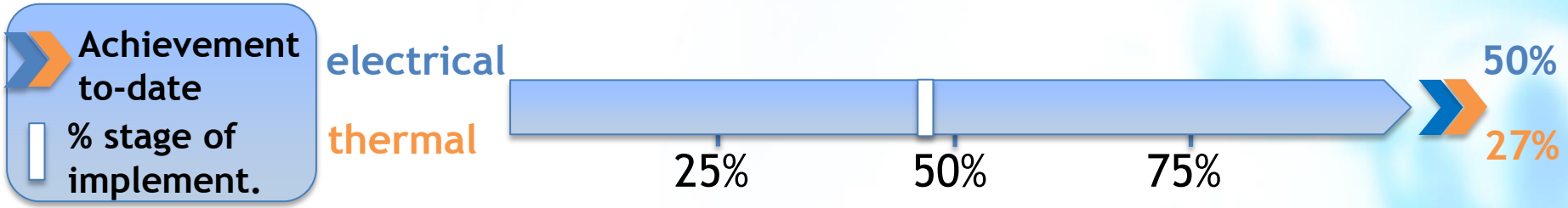
Project progress - efficiency (BOL)



Aspect addressed	Parameter (KPI)	Unit	SoA 2012	FCH JU Targets[1]		
				Project[2]	2017	2020
Efficiency	Electrical	%LHV	45	**50**	45	45
	Thermal	%LHV	20	**27[3]**	20	22
Emissions	NOx, SOx, CO_2	mg/kWh	<5 <0.05 <5k	**0** **0** **0**	<5 <0.05 <5k	<5 <0.05 <5k

1) from MAWP 2014-2020
2) based on BOL data
3) available heat, not implemented by customer yet

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Project progress: MEA's

- From manual built to automated Membrane-Electrode Assembly (MEA) manufacturing
  - JMFC shifted to volume production using automated, roll-to-roll manufacturing equipment
  - Ability to produce MEAs for the 2MWe PEM power plant at far higher rate than in previous designs
- Analytical and diagnostic capability allow analysis of failures and inform how to improve the MEA design
- Production prototypes of improved MEAs by JMFC with:
  - Stabilized catalyst layers
  - Improved membranes for longer lifetime
  - New seals and membrane architecture for ease of volume manufacture
  - Potentially lower cost long-lifetime electro catalysts

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Dissimination activities

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Public deliverables

- **D8.5-D8.6 Workshops (M30/M42)**

Workshops

- Official launching ceremony of the PEM power plant, 14th Oct
- Dedicated panel during the ICAE 2016 conference in Beijing

Newsletters/Social media

- 2 newsletters prepared and distributed
- Articles in National newspapers (NL, China)
- LinkedIn, videos (dissemination at partners)

Publications & Conference Proceedings

- "Modeling of 2-MW co-generative PEM fuel cell for hydrogen recovery from Chlorine industry" WHEC2016, Zaragoza (G. Guandalini, S. Foresti, S. Campanari, J. Coolegem, J. ten Have)
- "Simulation of a 2 MW PEM fuel cell plant for hydrogen recovery from chlor-alkali industry", ICAE2016, Beijing
- International Chlor-Alkali and Vinyls Conference and Chlor-Alkali Tech Summit APAC (2015)
- 3rd annual FCH2 Technical Conference (Birmingham, 2016)
- Fuel Cells Science and Technology (Glasgow, 2016)

Thank You!

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