



**NELLHI**

**New all-european high-performace stack:  
design for mass production**

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***Programme Review Days 2016  
Brussels, 21-22 November***

# PROJECT OVERVIEW



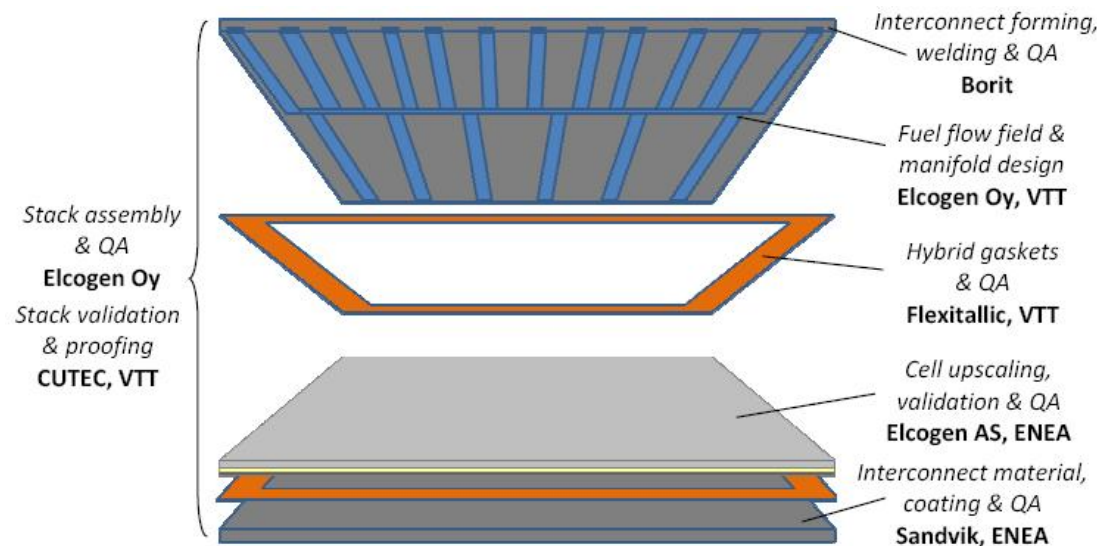
Project Information	
Call topic	SP1-JTI-FCH.2013.3.2
Grant agreement number	621227
Application area (FP7) or Pillar (Horizon 2020)	Stationary power and CHP
Start date	01/05/2014
End date	30/04/2017
Total budget (€)	2,858,447.20
FCH JU contribution (€)	1,633,895.00
Other contribution (€, source)	
Stage of implementation	83%
Partners	ENEA (IT), Elcogen AS (ET), Elcogen Oy (SF), VTT (SF), Flexitallic (UK), Borit (BE), Sandvik (SE), CUTEC (DE)

# PROJECT SUMMARY

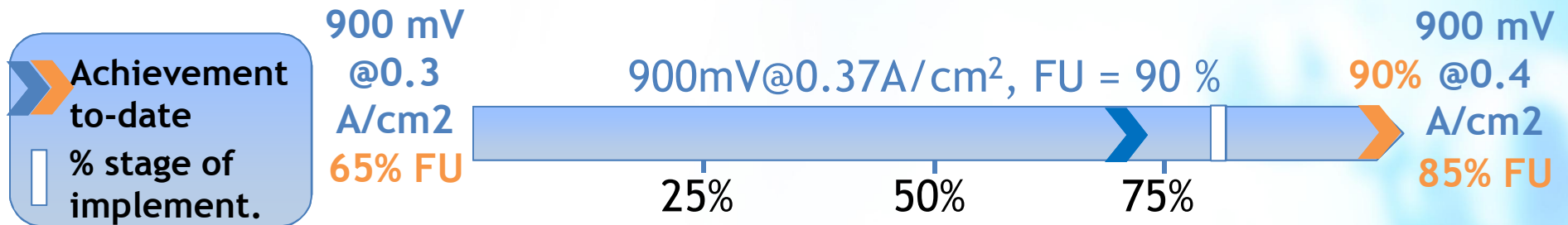


NELLHI is an all-European technology assembly for a high-performance, low-cost, mass-manufacturable SOFC stack

- High performance: Elcogen AS Cells @ 650° C
- Low-cost materials: cells, seals and interconnect steel
- Mass manufacturing: Flexitallic casting, Borit hydroforming, Sandvik roll-to-roll precoating, Elcogen Oy automated assembly
- 1000 €/kW stack, 0.2%/kh degradation, 900 mV @ 0.4 A/cm<sup>2</sup>
- Natural-gas fed applications for CHP at all scales (1 - xxx kW)



# PROJECT PROGRESS/ACTIONS - Performance



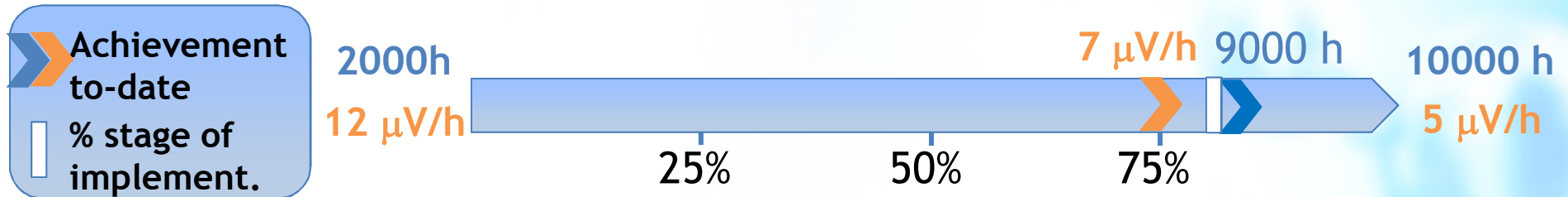
Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Performance	Max Power density @650°C	mW/cm <sup>2</sup>	333 *)	n.a.	n.a.	n.a.
	Fuel utilization	%	90 *)	n.a.	n.a.	n.a.

## Future steps:

*Unit cell cathode side optimization*

\*) Elcogen values = SoA

# PROJECT PROGRESS/ACTIONS - Durability



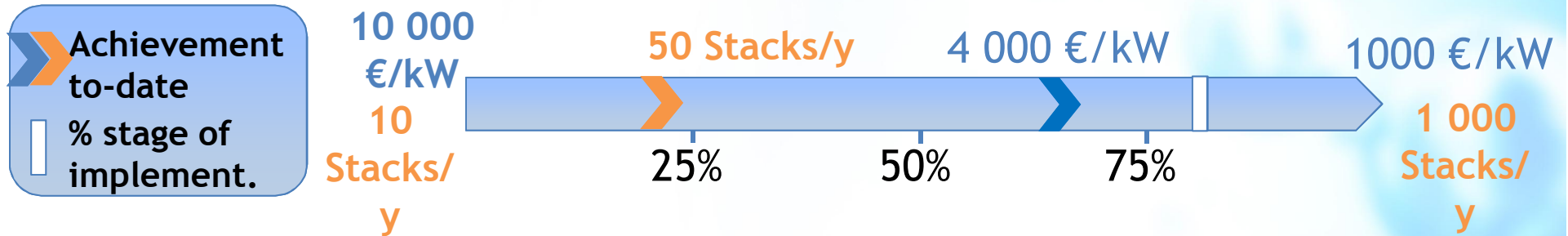
Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Durability	Stack Lifetime	h	20 000 *)	n.a.	12 y (syst)	13 y (syst)
	Degradation rate	μV/h	10 *)	n.a.	n.a.	n.a.

## Future steps:

*Introduction of new protective coating*

\*) Market values

# PROJECT PROGRESS/ACTIONS - Cost & capacity



Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
COST	Specific stack cost	€/kW	5 000	n.a.	14000 (syst)	12000 (syst)
	Stack production capacity / year	Stacks /y	500 *)	n.a.	n.a.	n.a.

## Future steps:

*Further component design optimizations, robotic stack assembly, increased stack conditioning speed*

\*) Stack production in Europe

# SYNERGIES WITH OTHER PROJECTS AND PROGRAMMES



## Interactions with projects funded under EU programmes

<i>SCORED 2.0</i>	Synergies on interconnect coating processes, exchanges on characterization techniques and outcomes
<i>INNOSOFC</i>	Exchange of NELLHI stack design specs and characterization data
<i>HELTSTACK</i>	Exchange of stack performance characterization for promotion
<i>DIAMOND</i>	Design of multi-kW module and control diagnostics for large-scale replication
<i>BALANCE</i>	Utilization of single-cell set-up designed in NELLHI

## Interactions with national and international-level projects and initiatives

<i>IEA AFC Annex 32</i>	Promotion of NELLHI stack and consortium as example of mass manufacturing
<i>STEP</i>	Optimization of stack design and manufacturing processes
<i>ELPaSO</i>	Integration of Flexitallic gaskets in stacks

## Public deliverables

- D2.1 Report on cell performance validation
- D4.4 Summary of steel pre-coating materials, characterization and coating/manufacturing
- D6.4 Workshop for dissemination to industrial stakeholders
- D6.6 Final Layman's project report

## Conferences/Workshops

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

## Publications: 6

- M. Rautanen et al., J. Power Sources (284, 15) 2015
- D. Pumiglia et al., J. Power Sources (in press) 2016

## Patents: 1

- 1614946.0 (UK) - *Thermiculite CL87* by Flexitallic Ltd.



## Exploitation

5 industries: Enhanced co-operation, alignment and solidity within SOFC-stack value chain

3 R&D centres: Qualification and correlation of cell & stack performance tests, including in-cell process identification, cycling, long term operation

## Impact

Higher quality, more cost-effective products for customers

Higher quality data, real interaction and close collaboration with industry advancing development

**Thank You!**

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