



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

INNO-SOFC

**Development of innovative 50 kW
SOFC system and related value chain**

INNOSOFC

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Programme Review Days 2018

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PROJECT OVERVIEW



- Call year: 2014
- Call topic: FCH-02.5-2014 Innovative fuel cell systems at intermediate power range for distributed CHP generation
- Project dates: 1.9.2015-30.4.2019
- % stage of implementation 01/11/2018: 75%
- Total project budget: 4 M€
- FCH JU max. contribution: 4 M€
- Partners: VTT, Elcogen Oy, Convion Oy, ElringKlinger AG, Forschungszentrum Jülich, ENEA, EnergyMatters BV



PROJECT SUMMARY



Main objectives

- Design, manufacture and demonstrate a SotA 50 kW SOFC system with 60% electrical efficiency and 4000 €/kW cost. (SotA: efficiency in this power level ~50%, cost in 2014 MAWP 6000 €/kW, target for 2020: 4500 €/kW)
- 3000 hours system demonstration and 10000 hours stack demonstration
- Identification and analysis of most promising end-users and applications
- The project is based on the products of industrial partners (Convion, EnergyMatters, Elcogen, and ElingKlinger) and motivated by their interest to further improve their products and consolidate an efficient value chain by collaboration.
- Research centres support these companies to further develop, experimentally validate and demonstrate their products.



PROJECT PROGRESS/ACTIONS – Stack development and manufacturing



Achievement to-date

Stack degradation <0.3%/1000 h
24 stacks delivered for Convion



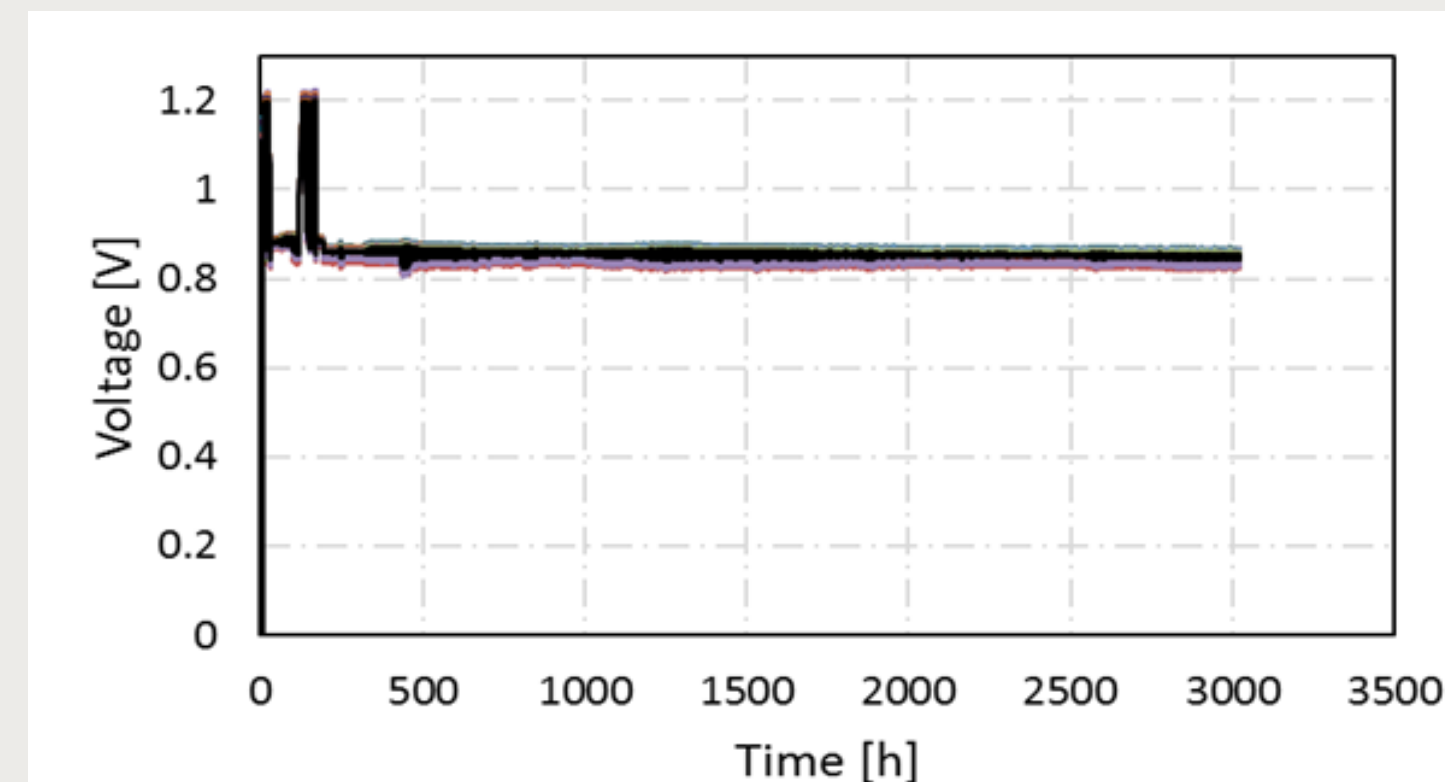
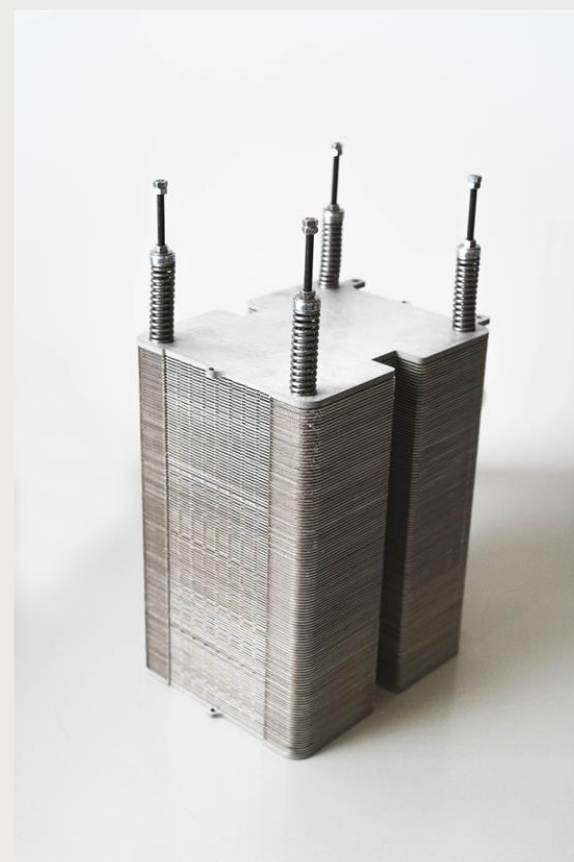
0.3% / 1000 h, 3500 hours
12 stacks delivered

25%

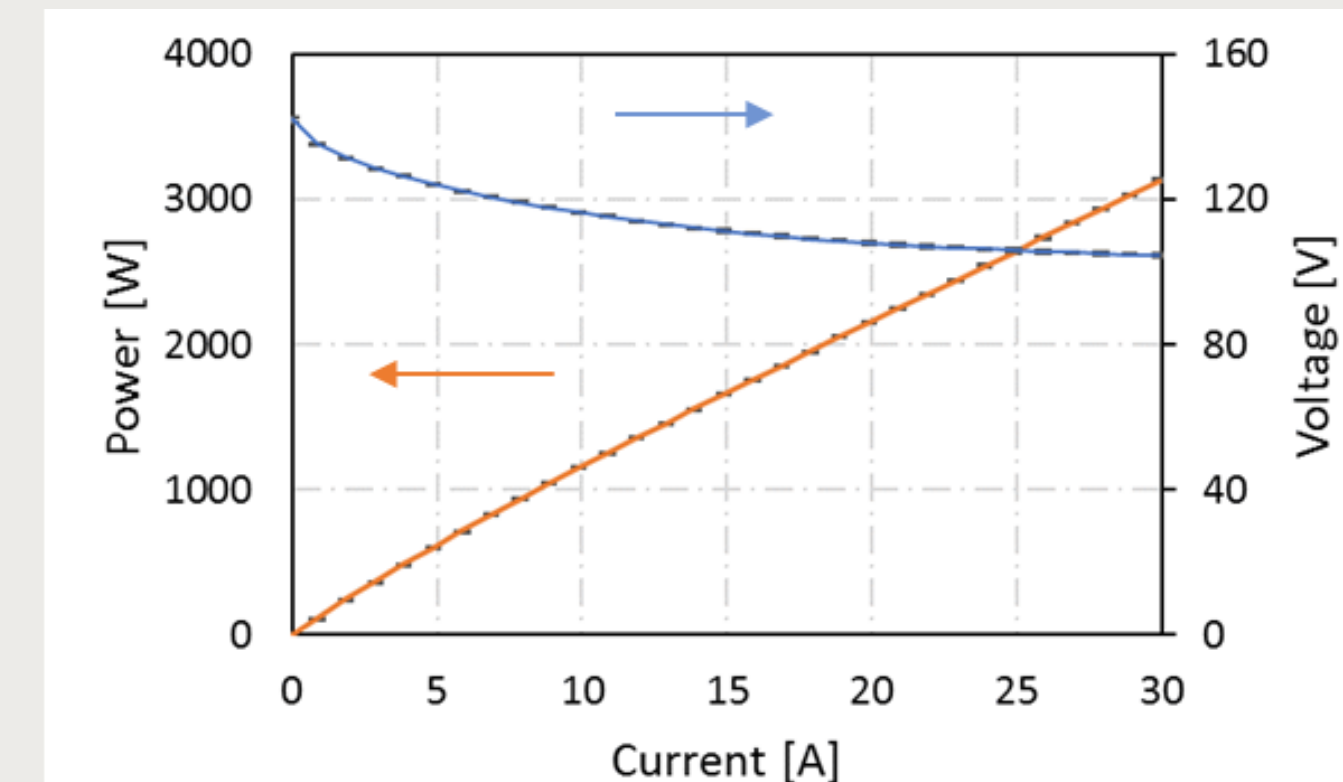
50%

75%

- Optimize Elcogen’s E3000 stack design for INNO-SOFC system: **done** (air manifolding, pressure losses, stack-system interface)
- Validate stack life-time in 10000 hours test: **0.3% / 1000 hours degradation in on-going test.**
- Manufacture and deliver 24 stacks for INNO-SOFC system assembly: **all components received, 12 stacks manufactured. Very small variation between stacks.**



E3000 stack with NG reformat



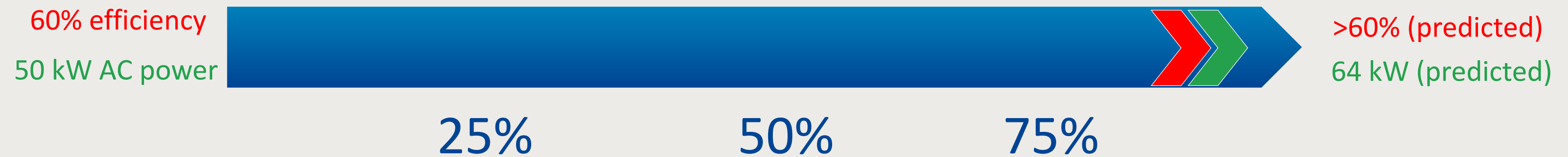
Mean stack power and voltage with standard deviations



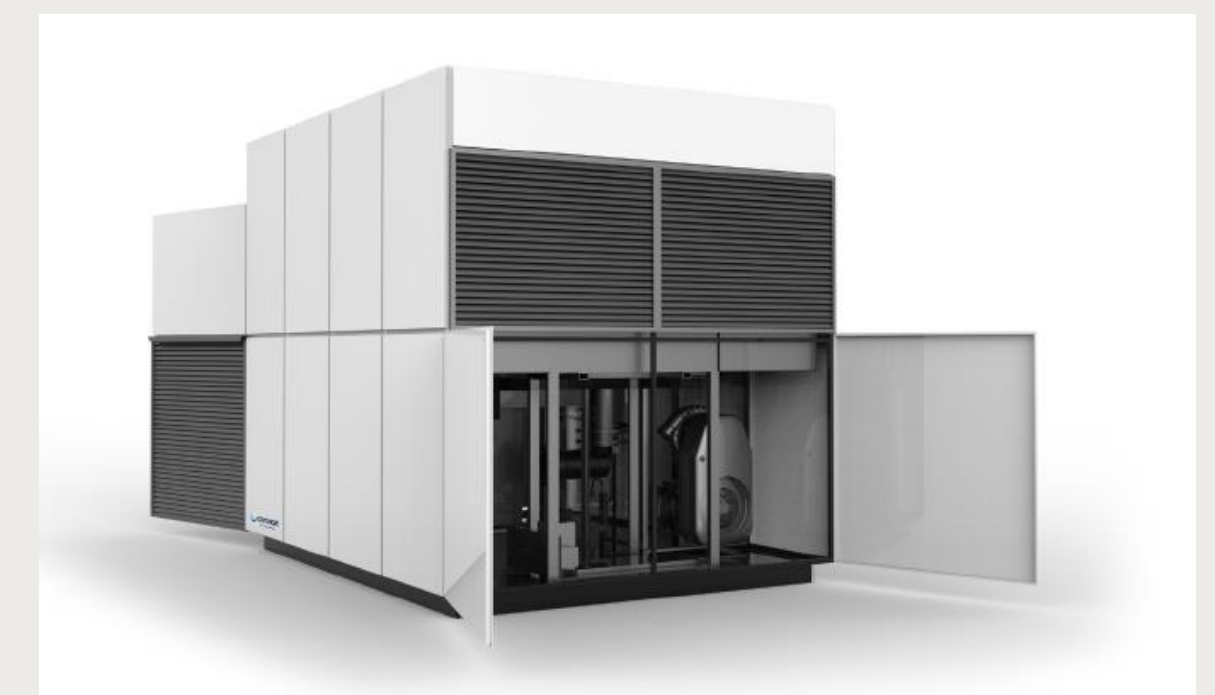
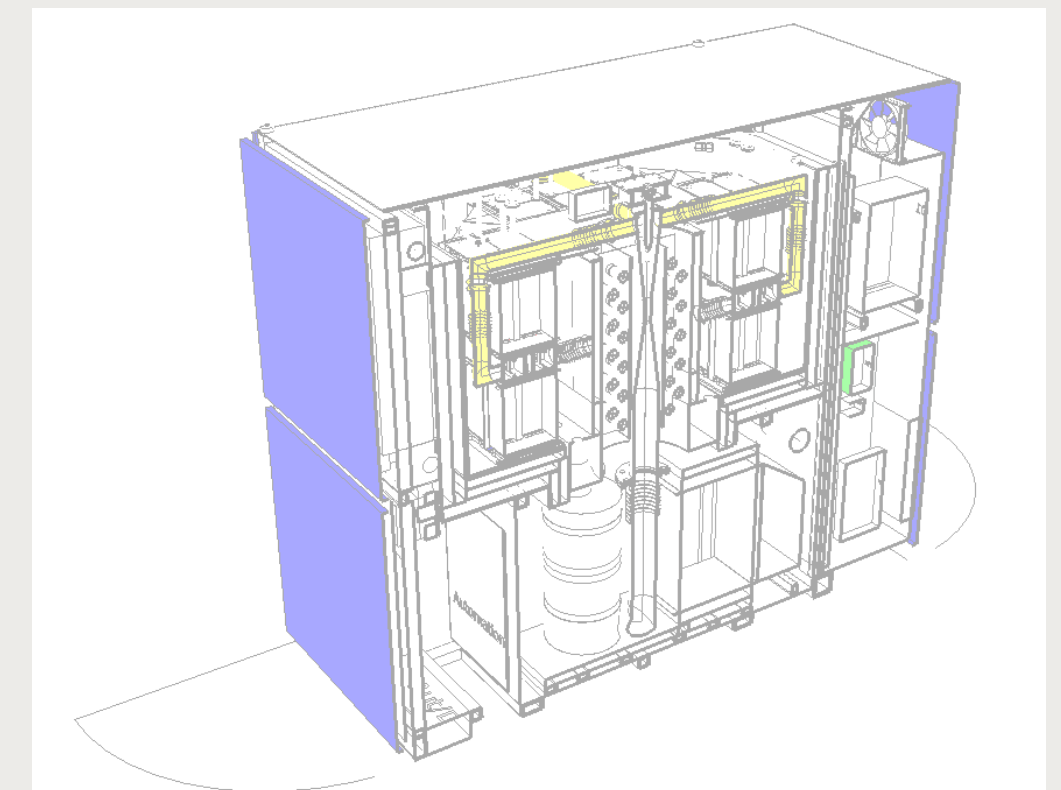
PROJECT PROGRESS/ACTIONS – System design and manufacturing



Achievement to-date



- AC output > 50kW: **On track, predicted 64 kW beginning of life**
- Electrical efficiency >60%: **On track, predicted >60% from 50-100% load**
- Total efficiency >85%: **Achievable with low temperature HRU**
- Part count reduction: **On track, -70% reduction from 1st generation (DEMOSOFC)**
- Cost reduction: **On track, 3600 €/kW projected for 10 MW annual volume**
- Reduced footprint: **On track, 2.0 x 2.5 x 2.3 m for system including all auxiliaries**
- **Manufacturing will start in December 2018.**
- **Two “INNO-SOFC” systems will be delivered to an industrial customer in Q2/2019.**



Example of INNO-SOFC exploitation: Smart grid system in Lempäälä, Finland



Lempäälän Energia Oy and Convion Oy have signed an agreement regarding a delivery of two Convion C50 fuel cell systems to Lempäälä industrial district.

Lempäälä smart grid system will combine 4 MW PV panels, battery storage, gas engines, and two Convion C50 to provide electricity and heat. Elcogen E3000 stacks will be used in these C50 systems.

“This project is based upon the good results of EU’s Horizon2020 / Fuel Cells and Hydrogen Joint Undertaking project INNO-SOFC (671403).”



Risks and Challenges



System design has taken more time than expected for several reasons:

- Redesign of the frame. Frame structure was changed from a separate pipe frame to a self-supported sheet structure, which was needed to reach cost target.
- Implementation of learnings from DEMOSOFC project.
- Bridge financing of Convion

Three new persons employed + 3 external designers working on INNO-SOFC since 03/2018 to speed up the process.

Project duration was extended by 14 months



Dissemination and Communication Activities



- 18 presentations in workshops and conferences
- Three press releases (Elcogen and Convion)
- Two workshops organized, presentations in 8 conferences
- Five scientific articles
- INNO-SOFC newsletter distributed to 200 professionals
- Nine public deliverables
- Promotional and educational video, together with qSOFC and DEMOSOFC projects:
<https://www.youtube.com/watch?v=KK-sjnnEcuo>



SYNERGIES WITH OTHER PROJECTS AND PROGRAMMES



Interactions with projects funded under EU programmes

- FCH JU NELLHI: single cell and stack development, joint workshop
- FCH JU DEMOSOFC: system design, manufacturing, operational experience, joint workshop
- FCH JU qSOFC: quality assurance of stacks and stack components
- Marie-Curie HELTSTACK: single cell and stack development, joint workshop

Interactions with national and international-level projects and initiatives

- Finnish-German bilateral project STEP: stack development and characterization, joint workshop
- IEA Annex 32 (SOFC): information exchange
- EERA: information exchange

