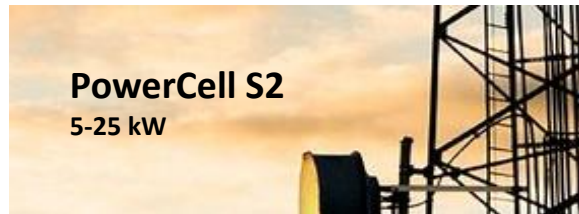


Automotive Fuel cell Stack Development at PowerCell Sweden

Dr. Thomas Tingelöf
PowerCell Sweden AB
2016



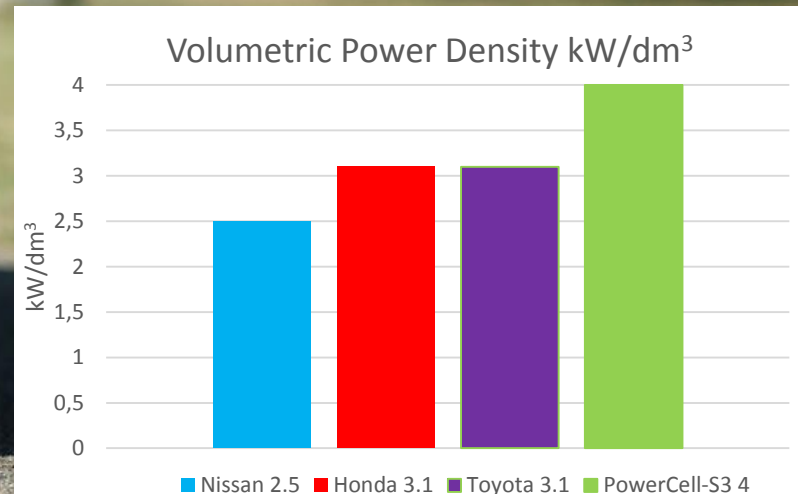
PowerCell's fuel cell stacks and systems



PowerCell S3 – Establishes Best-in-Class Power Density

- Powered by hydrogen gas
- High-quality fuel cell stack primarily for powering vehicles
- 20-100 kW power range
- Designed in accordance with automotive cost targets
- The design is exclusively based on industrial components and materials

Goal: Superior quality and performance to meet the requirements from the automotive industry!!



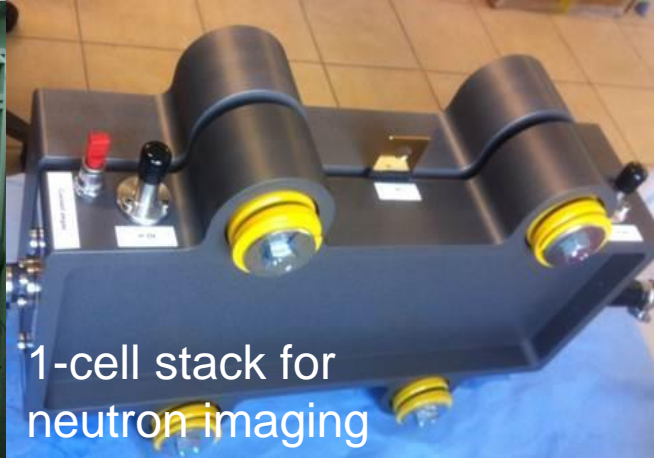
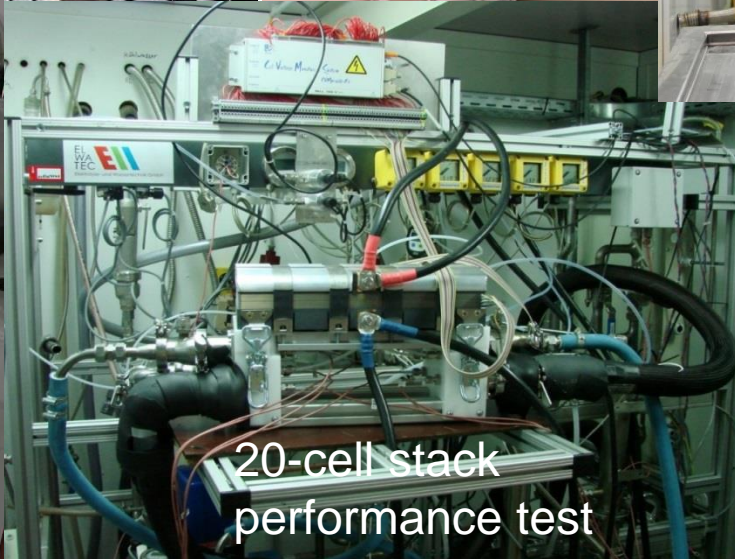
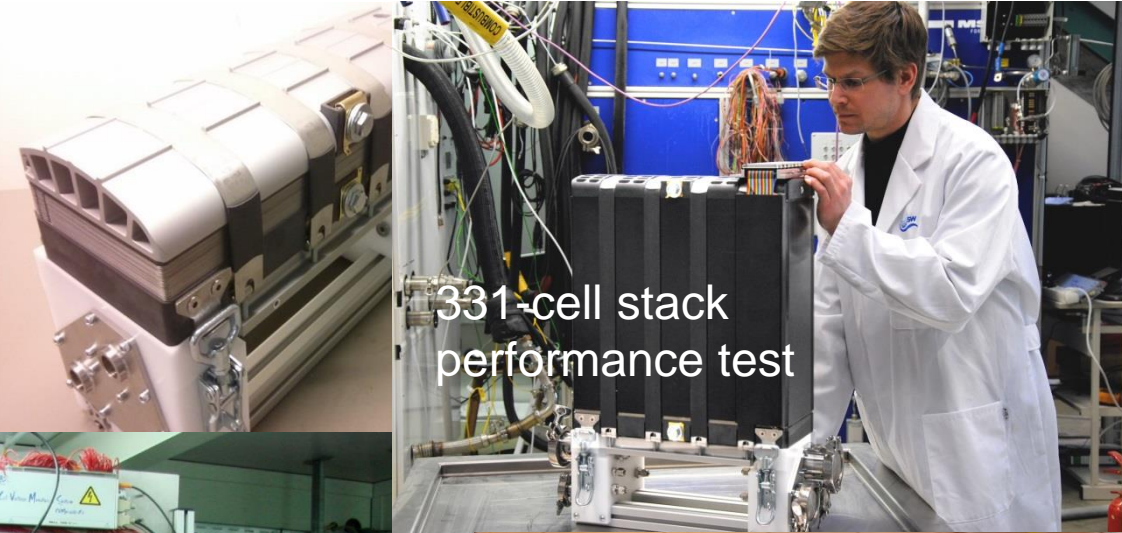
Industrial & Research Partners Join Forces in World-Class Project

- The project addresses a critical gap in the European value chain.
- The objective is to develop best-in-class automotive stack technology.
- The stack platform concept enables additional vehicle and stationary applications.
- The design is exclusively based on industrial components and materials.
- The target is automotive stack production in Europe starting 2018/19

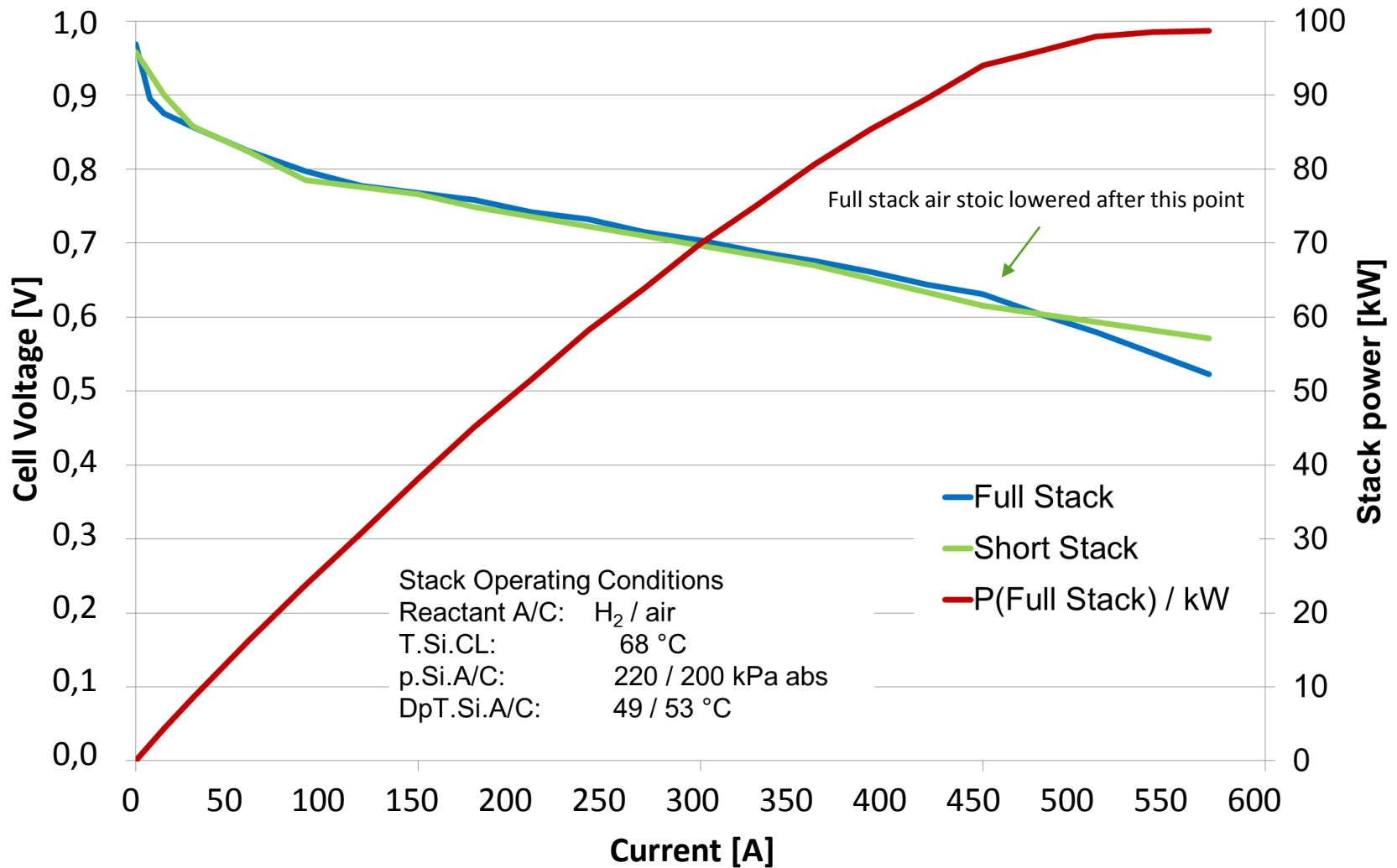
AutoStack Core Consortium



Extensive automotive stack test program provides design validation

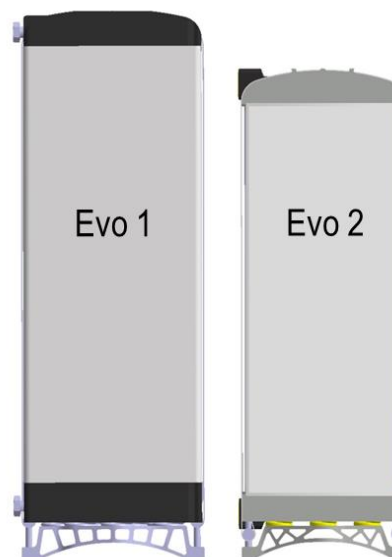


Evo1 short and full size stacks deliver almost identical performance



Main changes between Evo1 and Evo2

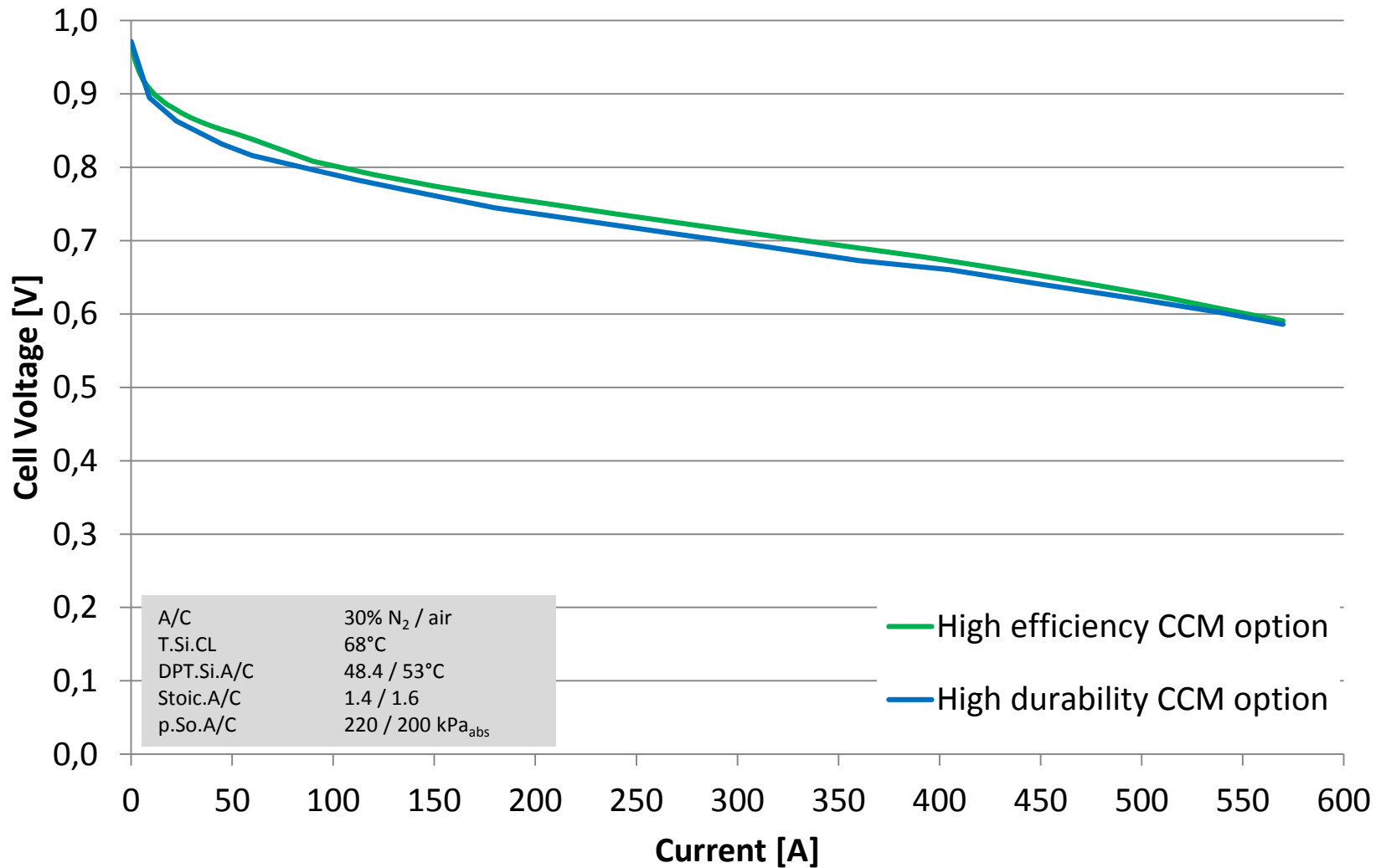
- Improved active to passive ratio
- Lower cell pitch
- Improved material usage
- Lower cost materials
- More rugged design
- CVM integrated in stack housing
- Prototype tooling for housing components



Change Evo 1 vs. Evo 2
 Active/passive ratio +13%
 Cell pitch mm -17%

Specifications	Unit	Target	EVO1	EVO2
Outer dimensions (length x width x height)	dm	6.5x4.3x1.8	5x4.14x1.656	4.46x4.19x1.49
Volume of the stack exterior	dm ³	<55	34.3	27.8
Weight without fluids an fully humidified membranes (net weight)	kg	<44	46.3	33.1
Power density at nominal load	kW/dm ³		2.7	3.55
Power density at peak load	kW/dm ³		2.8	4.05

Evo2 short stack polcurves with different CCMs under standard conditions



Hardware status summary

- *Power density:* Best in class due to due to thin and lightweight components
- *Degradation rate:* DLC tests on Evo2 started (Evo1 ~ 4000 h @ 26 μ V/h on FC-DLC)
- *Production capacity:* Fast ramp up possible due to mature industrial components at automotive sub-suppliers with high production capacity



EVO1



EVO2-A



EVO2-C

Way forward

- ASC project will be closed down 2017 after test program finalization
- Project preparation for stack commercialization ongoing
- Vehicle / system integration ongoing with several partners
- S3 100 kW prototypes currently available for sale



Integrated CVM unit in 100 kW stack

Example car integration projects S2 & S3



- Range extender
 - PowerCell S2 (20kW)
 - Installed in XC90
- Full power fuel cell system
 - PowerCell S3 (100kW)
 - Consortium in contract negotiations

Example truck integration project S3

- Coop Switzerland launches the first fuel cell distribution truck (34 ton) with trailer
- Reduces the weight with more than 1 ton while increasing operational range



Example boat integration projects S3

- Solar powered ship
 - 2 x PowerCell S3
 - Installed by partner company Swiss Hydrogen
- Maranda: Consortium with among others ABB
 - System based on PowerCell S3 for marine environment
 - Consortium in contract negotiations



Foto: Joel Hatfield



PowerCell, the Nordic leading fuel cell company

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