

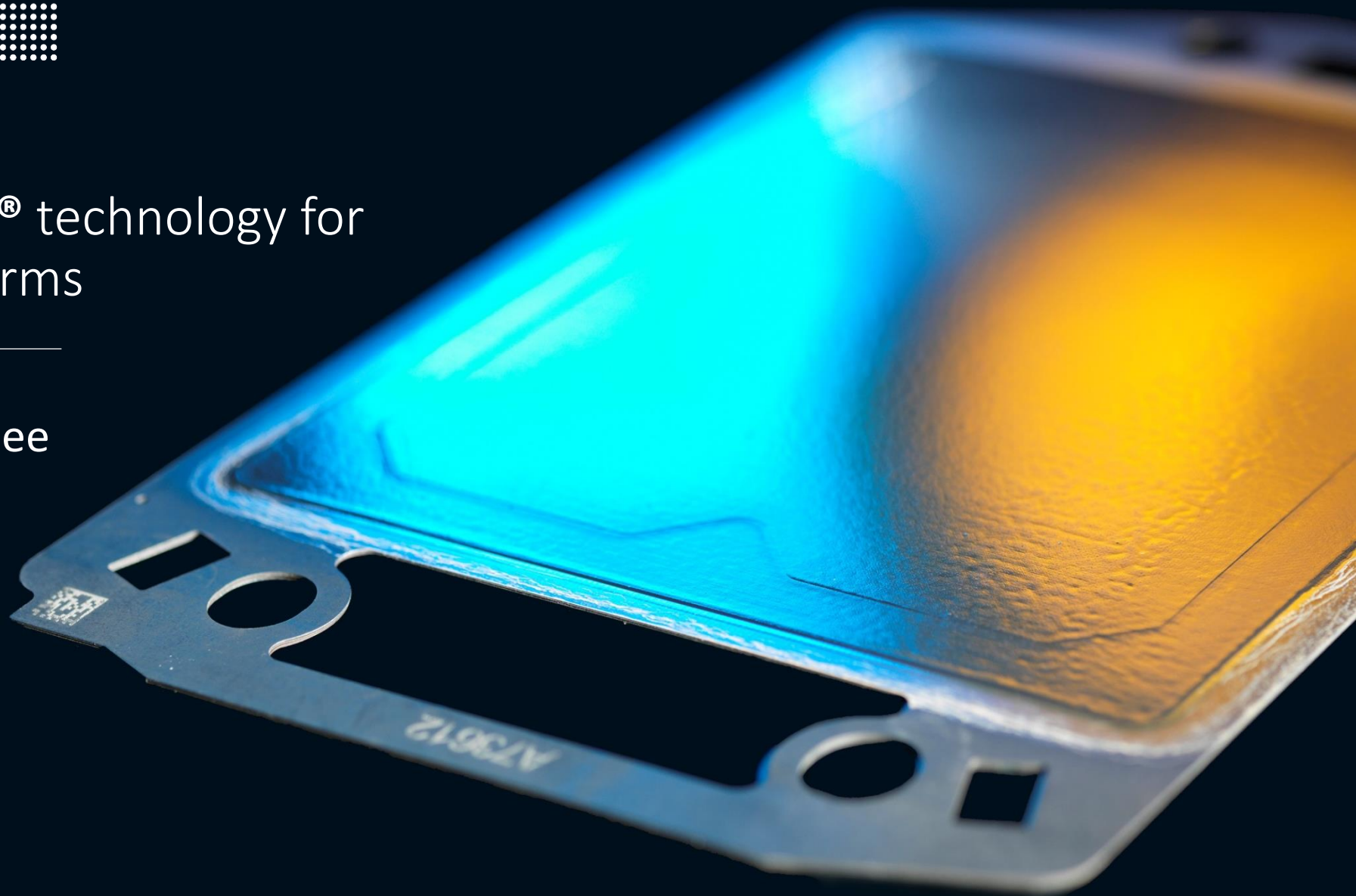


Revolutionary **SteelCell®** technology for  
multiple product platforms

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Dr. Subhasish Mukerjee  
Director of R&D

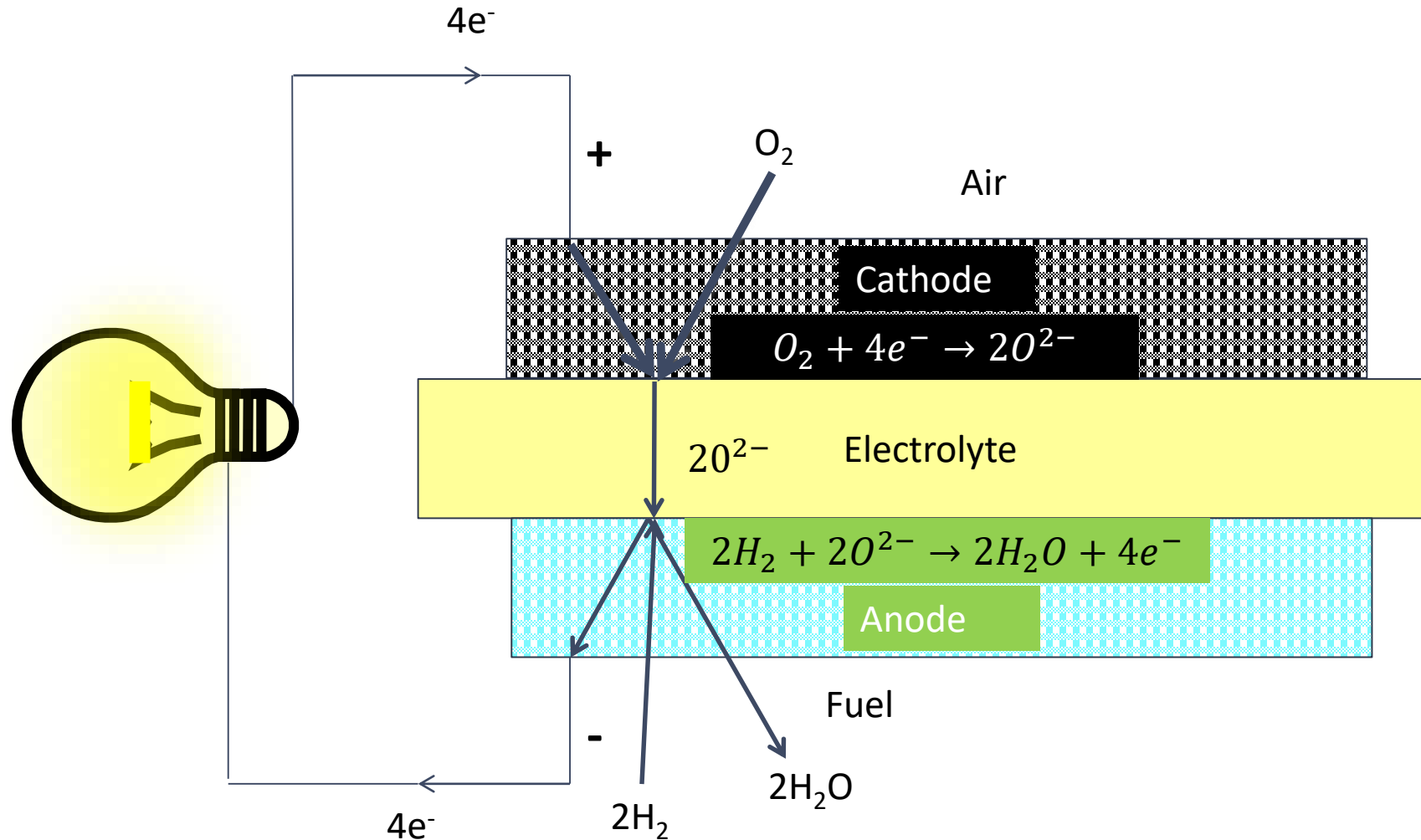
March 13, 2019



## A CHANGE OF POWER

We're a fuel cell technology and engineering company bringing cleaner and cheaper energy to every home and business.

# Solid oxide fuel cell fundamental principles



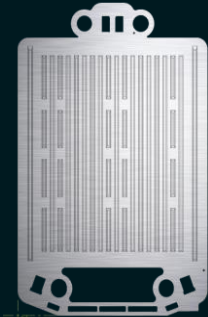
# So why is SteelCell the solution for on-site power generation?



PEM cell



SOFC cell

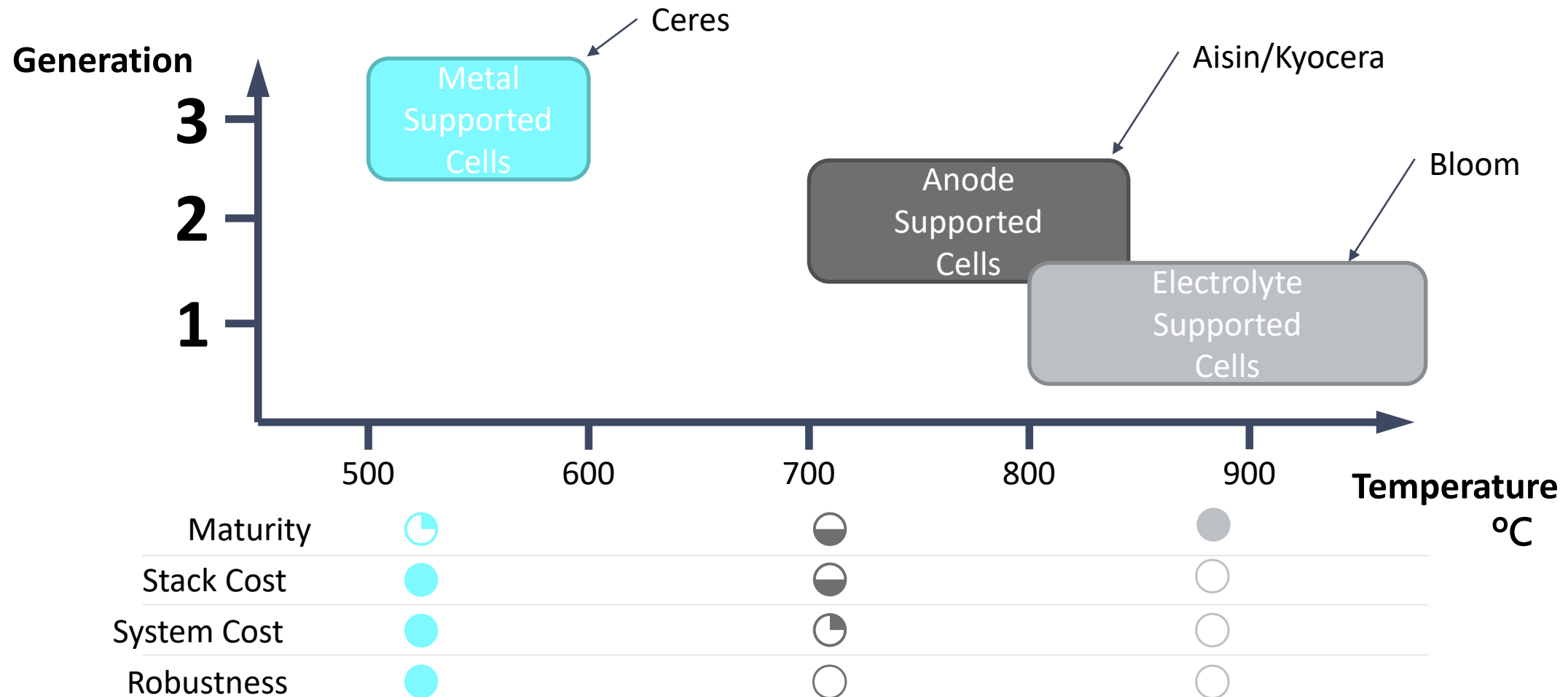


SteelCell

|                  |   |   |   |
|------------------|---|---|---|
| Cost             |   |   | ● |
| Efficiency       |   | ● | ● |
| Robustness       | ● |   | ● |
| Fuel flexibility |   | ● | ● |



# Worlds Most Robust and Lowest Cost Solid Oxide Fuel Cell Technology





# Why Steel Cell

## Robustness

- stop-start
- e-stop
- low degradation

## Efficiency

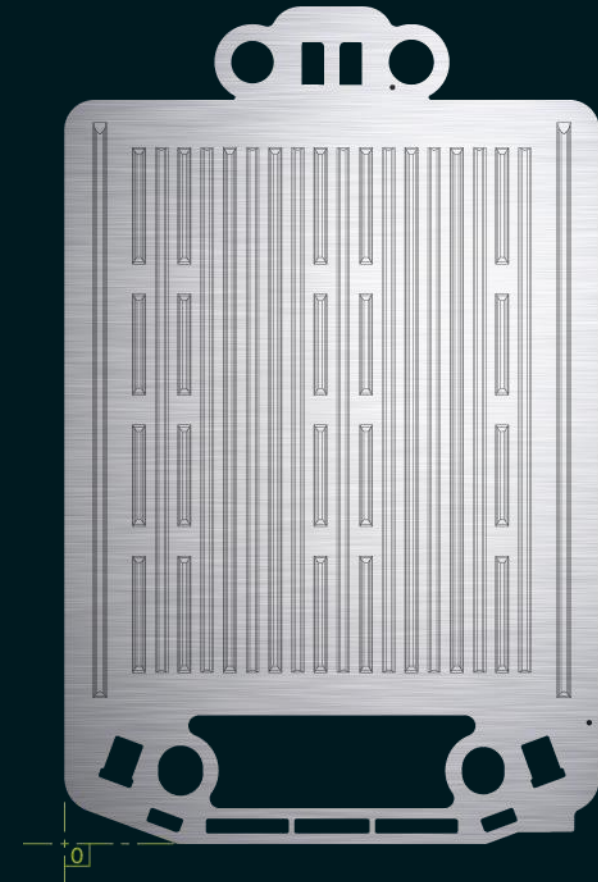
- high efficiency
- power density
- life time

## Costs

- cell and manufacturing cost
- system cost

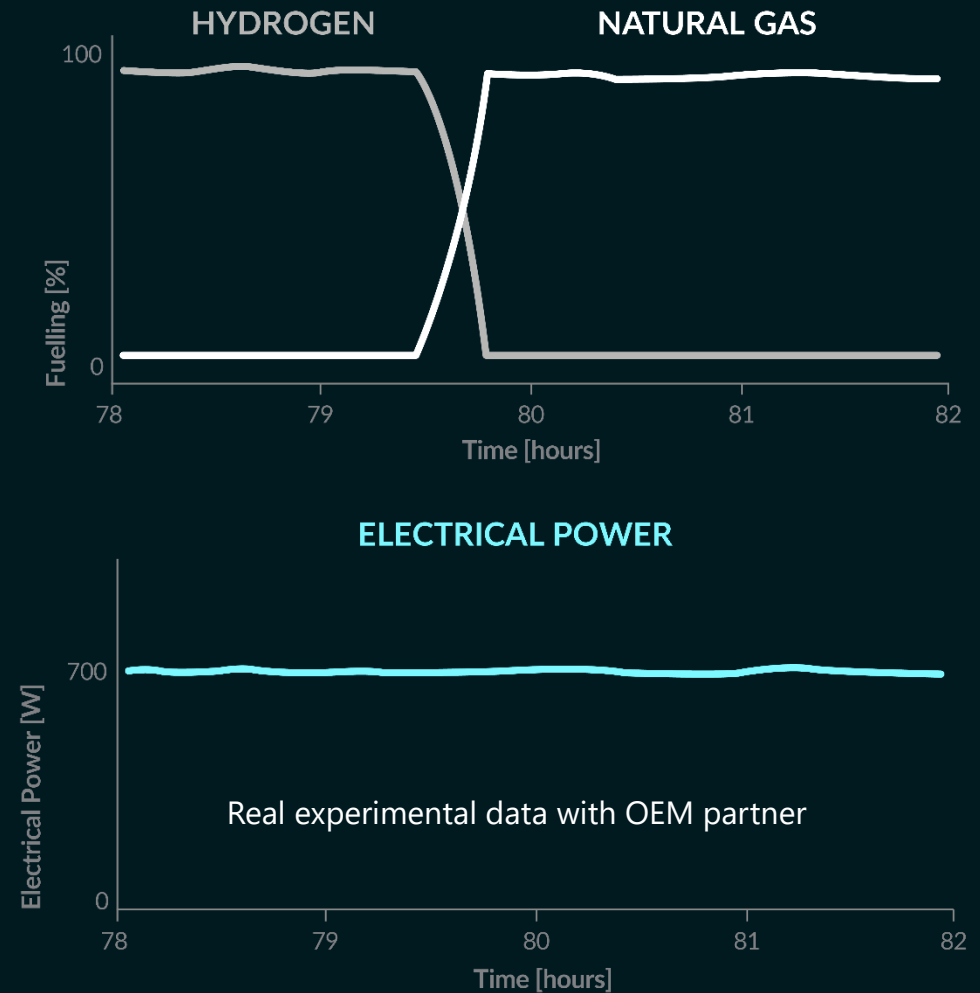
## Flexibility

- Fuel flexibility
- System responsive

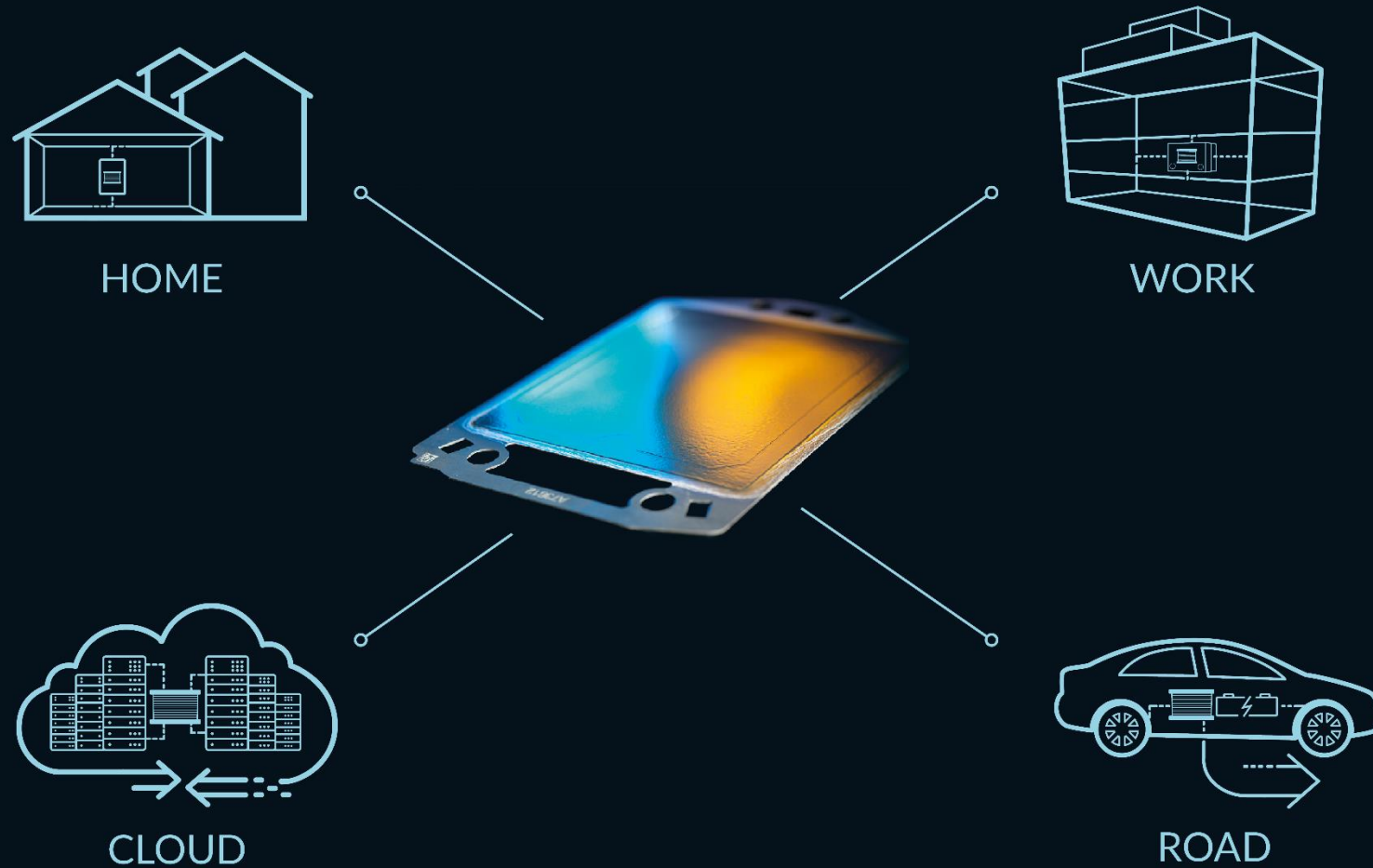


# Fuel Flexibility enables many energy futures

SteelCell has been extensively demonstrated on Natural Gas and Hydrogen



# APPLICATIONS FOR THE SteelCell®





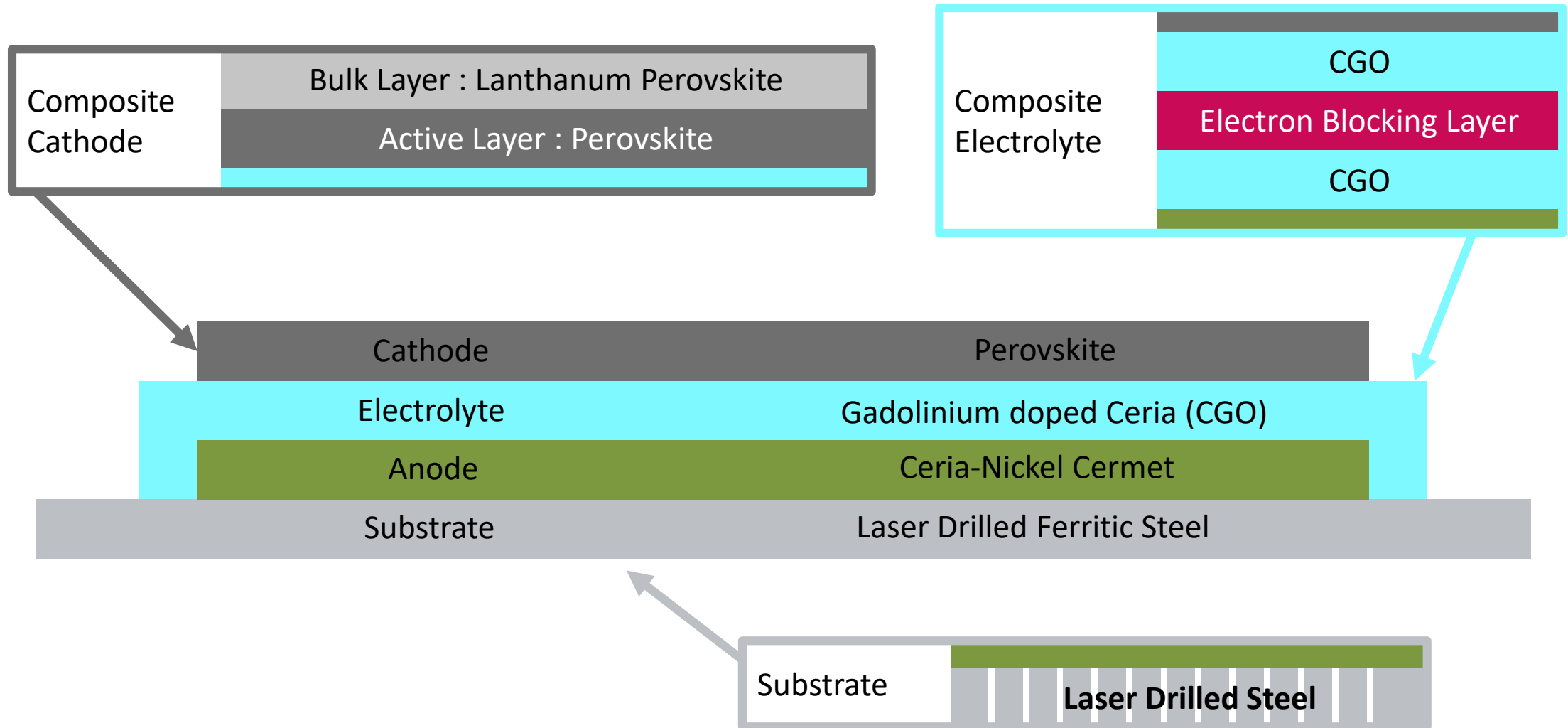
# MULTIPLE DEVELOPMENT PARTNERS for MULTIPLE APPLICATIONS



**CONFIDENTIAL PARTNER 1**

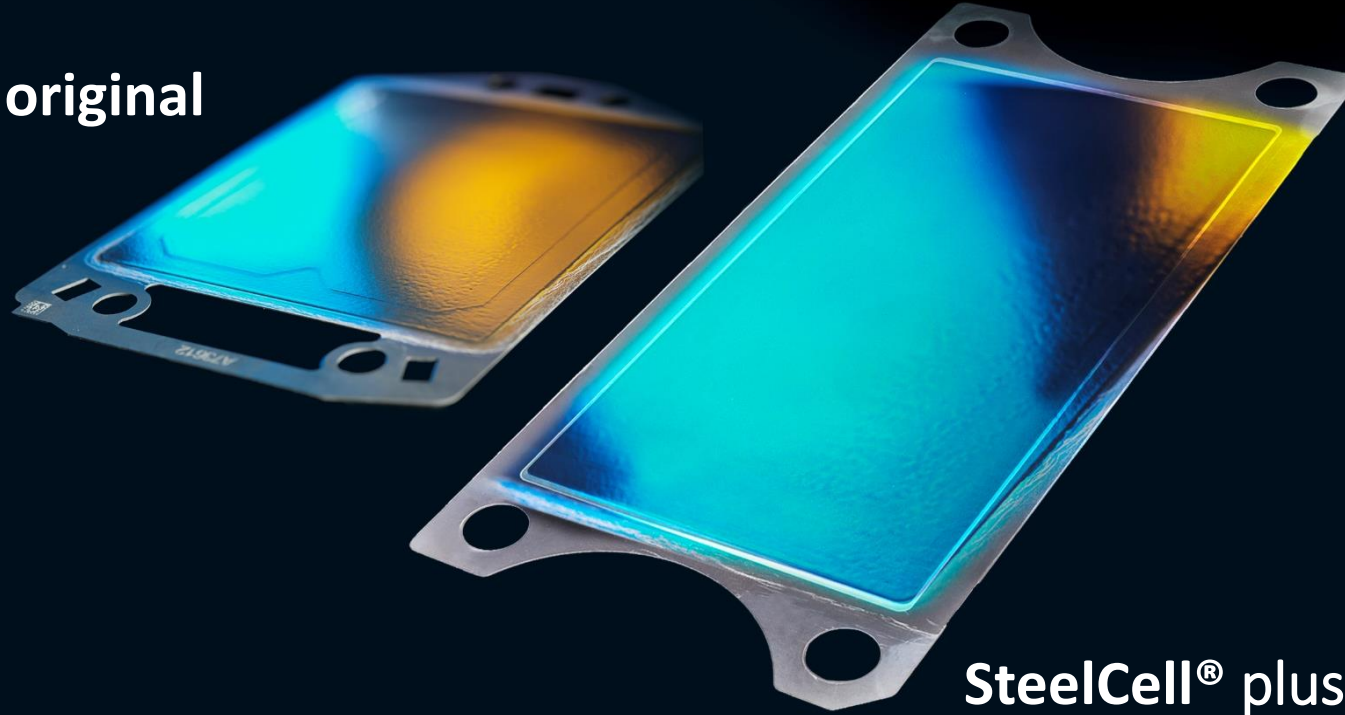
- European-based Global OEM co-developing multi-kW prototype for multiple applications
- Strategic collaboration – buses and other China markets - targeting equity investment and JV
- Honda Power Systems – several applications
- SOFC Stack to Extend Range of Electric Vehicles
- Data Centre & Commercial Scale Opportunity
- Commercial Scale CHP Development with aim to market launch

## Detailed Ceramics Structure



Increasing demand for increasing power.

SteelCell® original



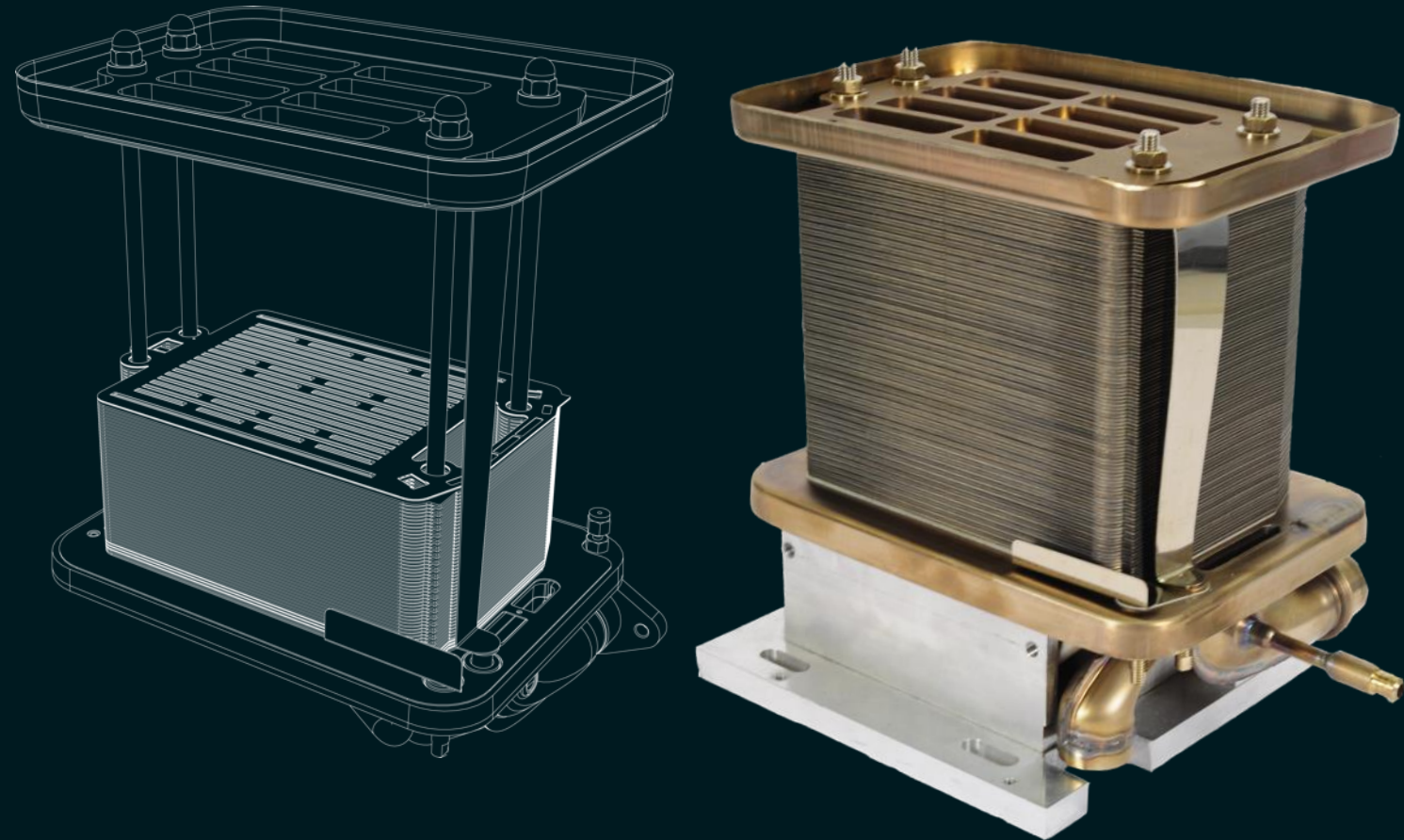
SteelCell® plus

Larger footprint cell under development

## Mature Steel Cell Stack Module developed for uCHP and small distributed generation applications

### Specification

- Weight 11 kg
- Volume 5 l
- Cells ~100/stk
- Dimensions:
  - W 190mm
  - D 140mm
  - H 180mm
- Sealing by welding and compressive gaskets
- Ease of assembly for mass manufacture

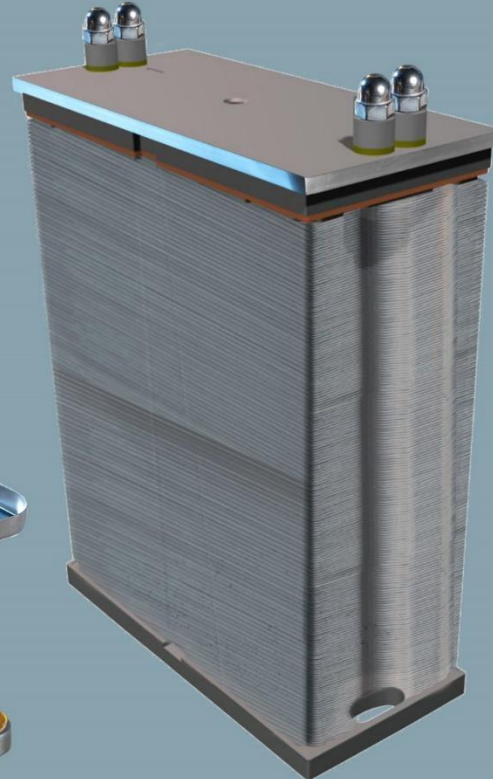


## 5 kW class Stack Development enables higher power applications

*1kW-class stack  
for Stationary  
Application*



*5kW-class stack  
under development  
14.5 L volume*





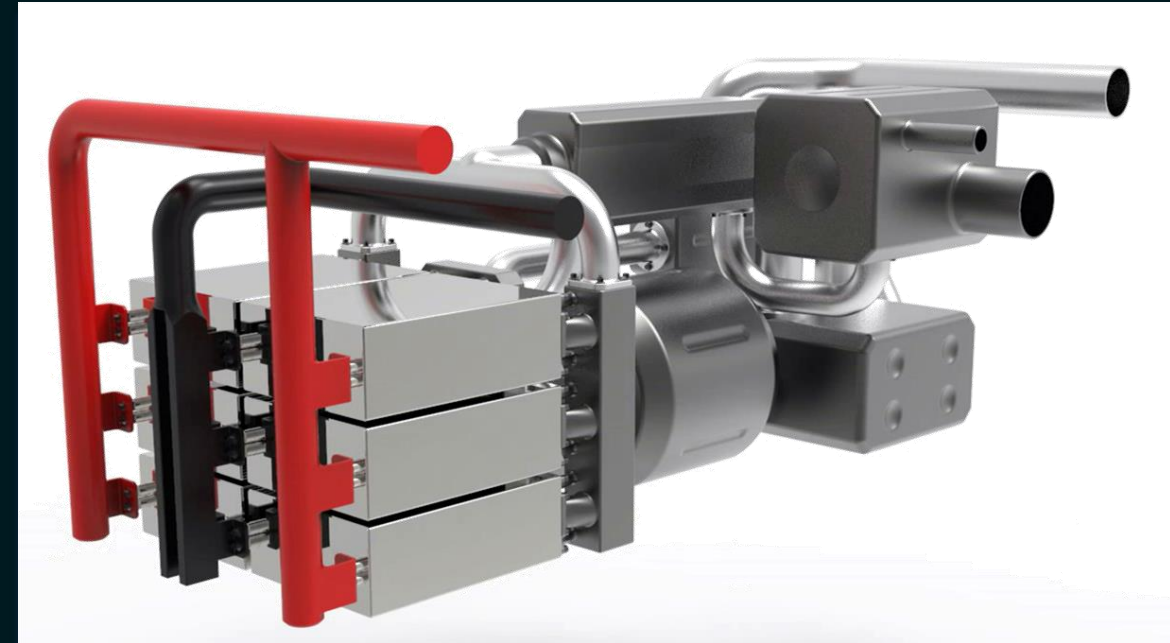
# Steel Cell technology product platforms

~10kW system for Data Centres

~1kW micro CHP

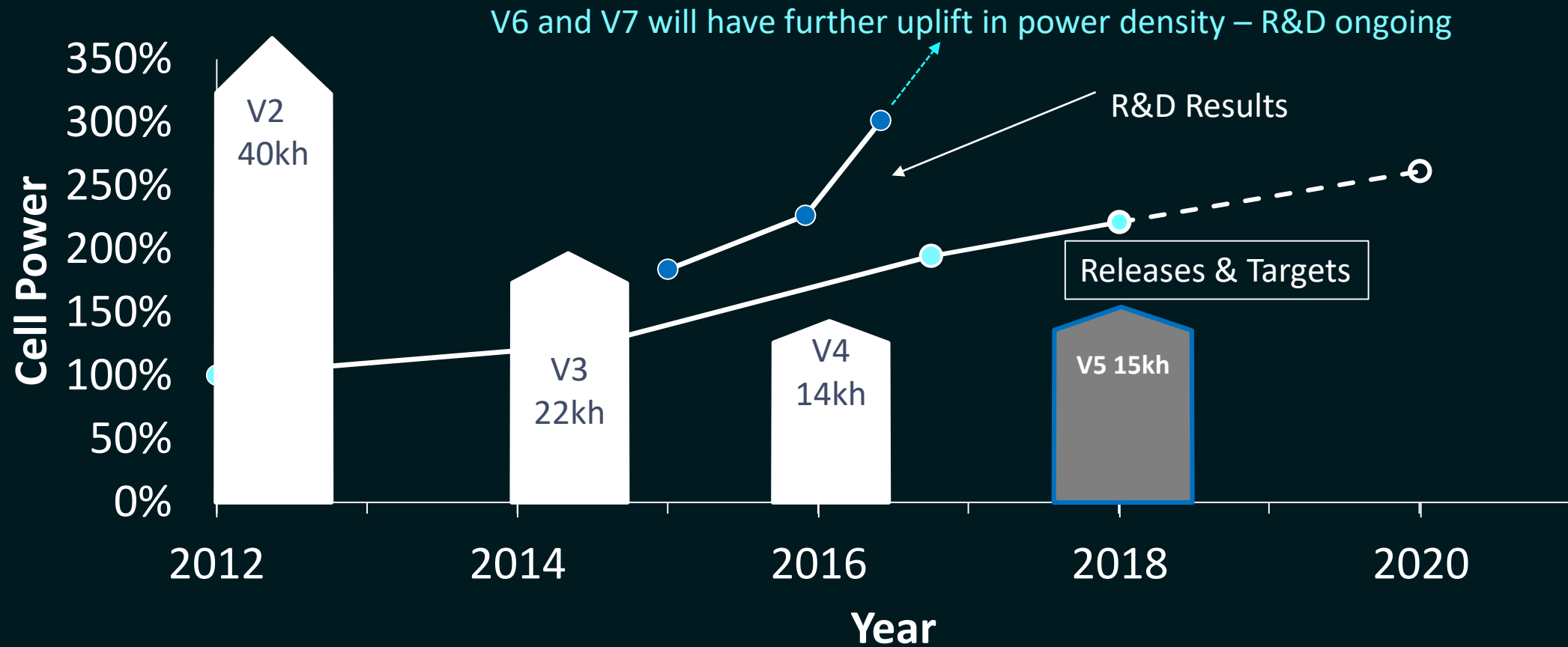


~30kW system for Battery Electric Buses

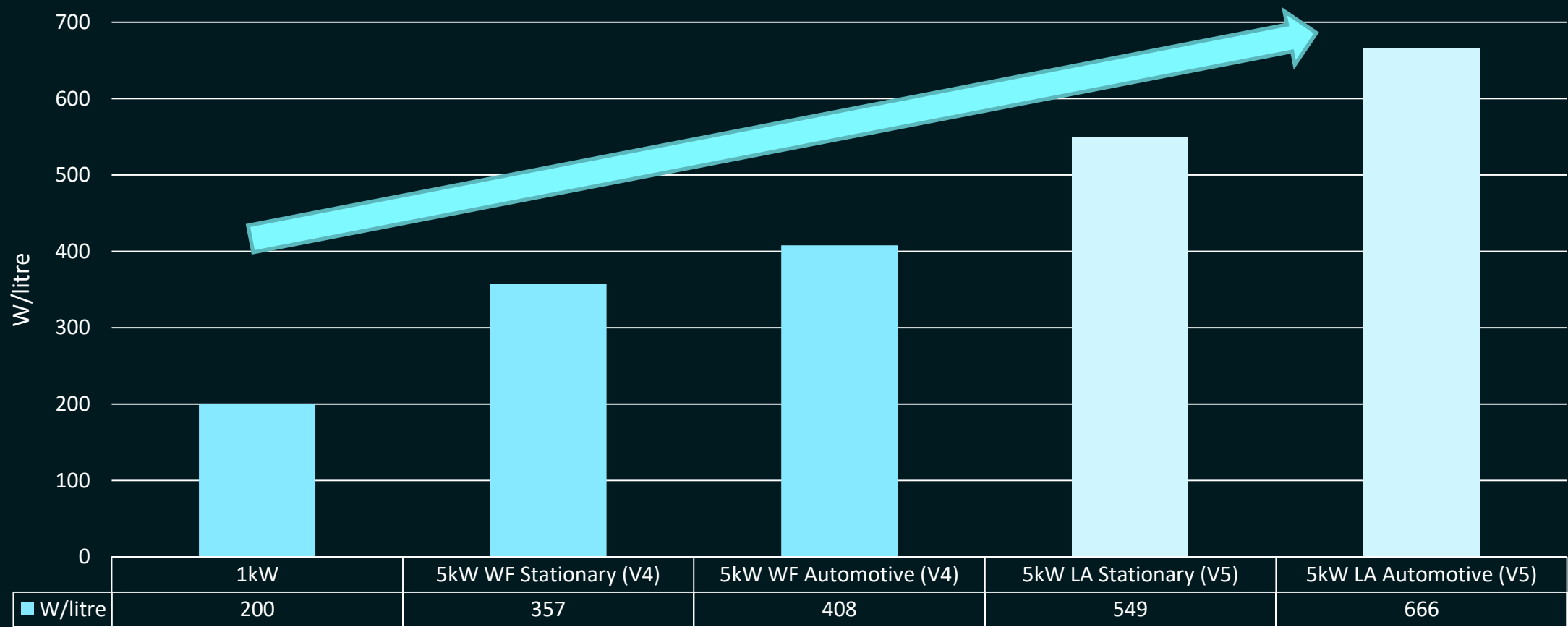




## Continued improvement of power density and maturity of technology

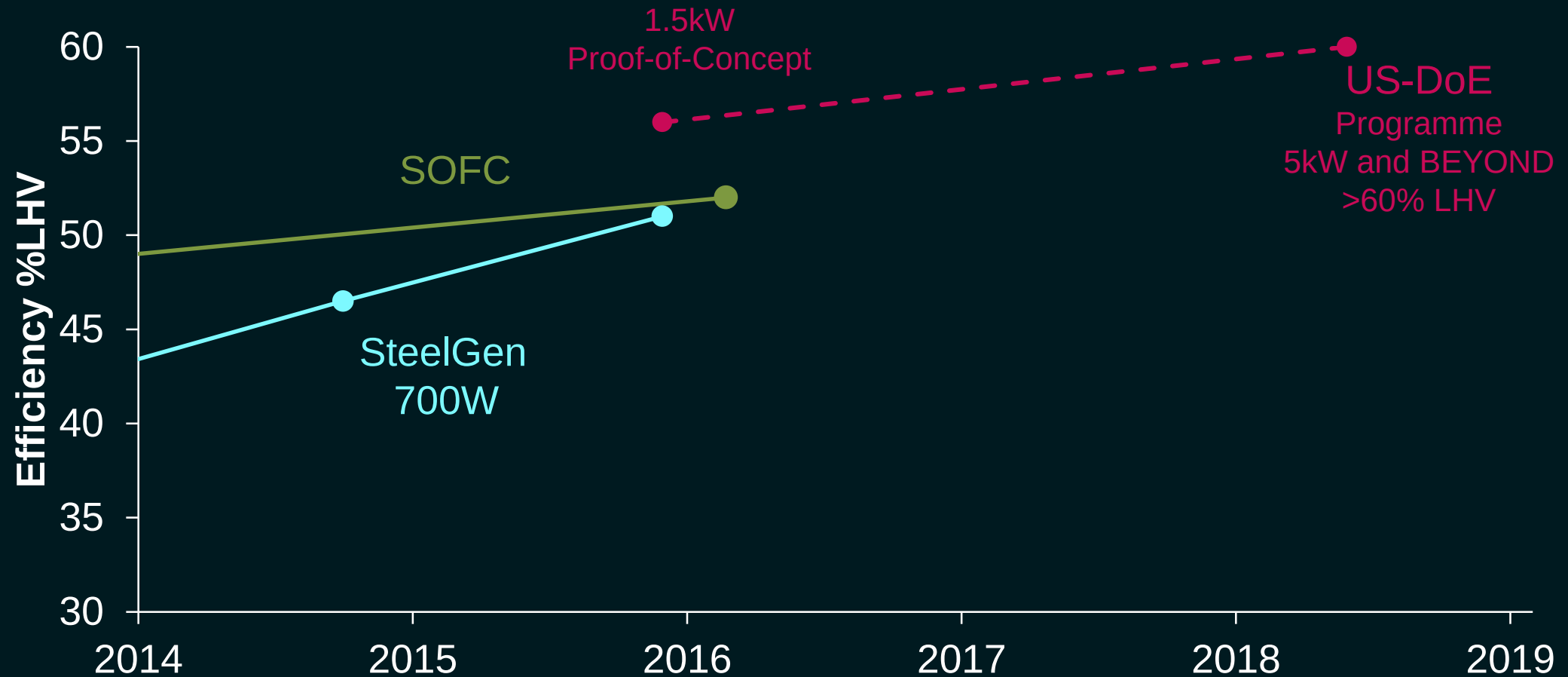


# Stack Volumetric Power Density Projections

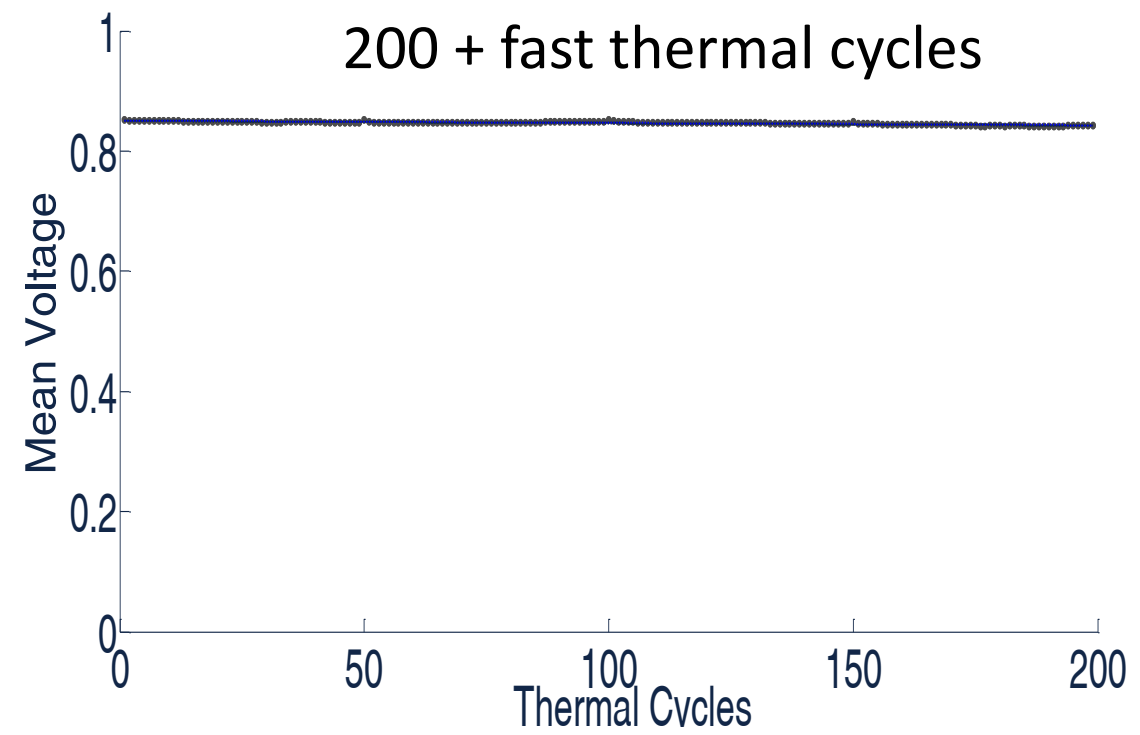
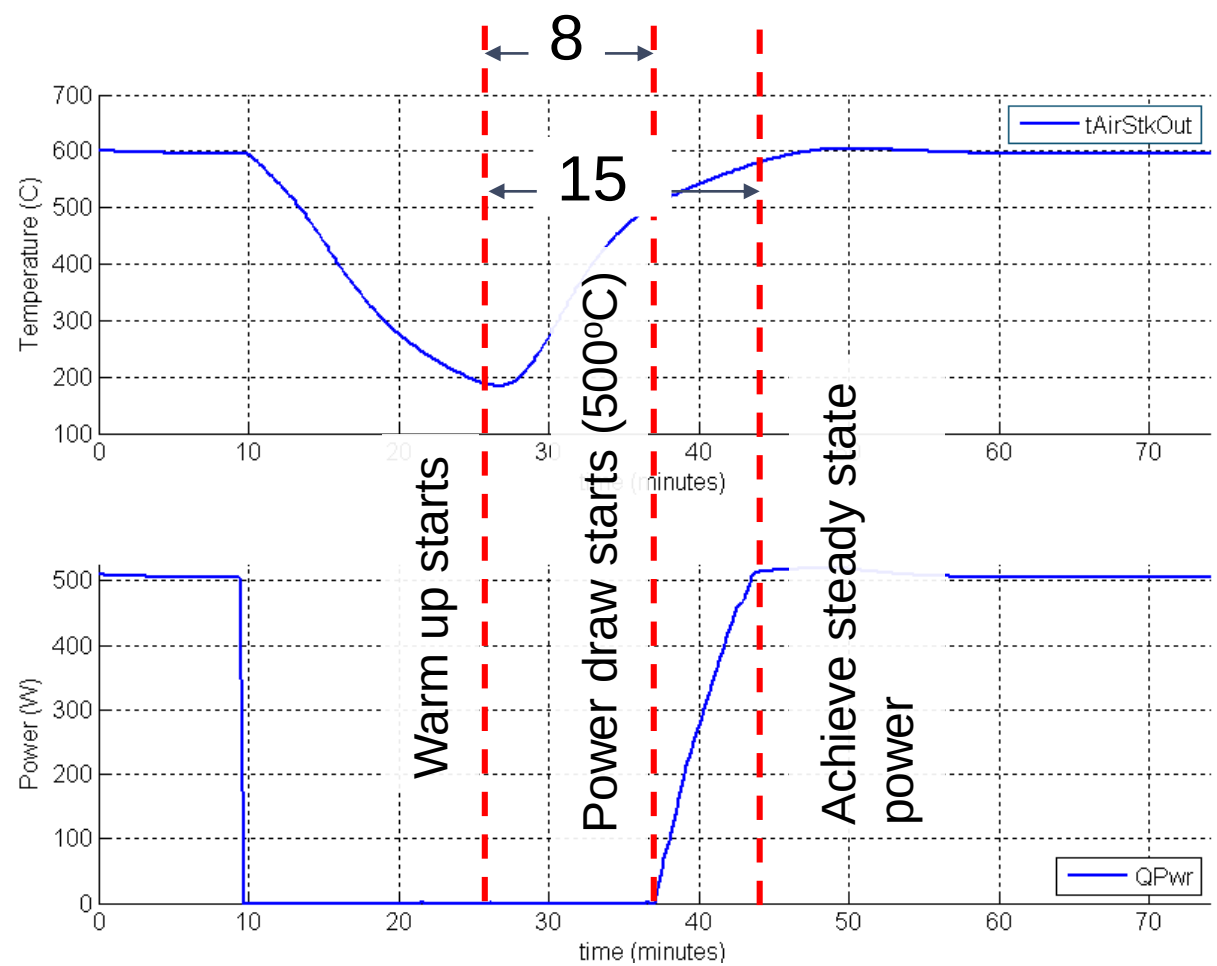


WF: Window Frame LA: Large Area

# Fuel Cell Power System – Multi-kW Prime Power



# Steel cell stacks capable of <10min start-up for transportation applications





Cost potential



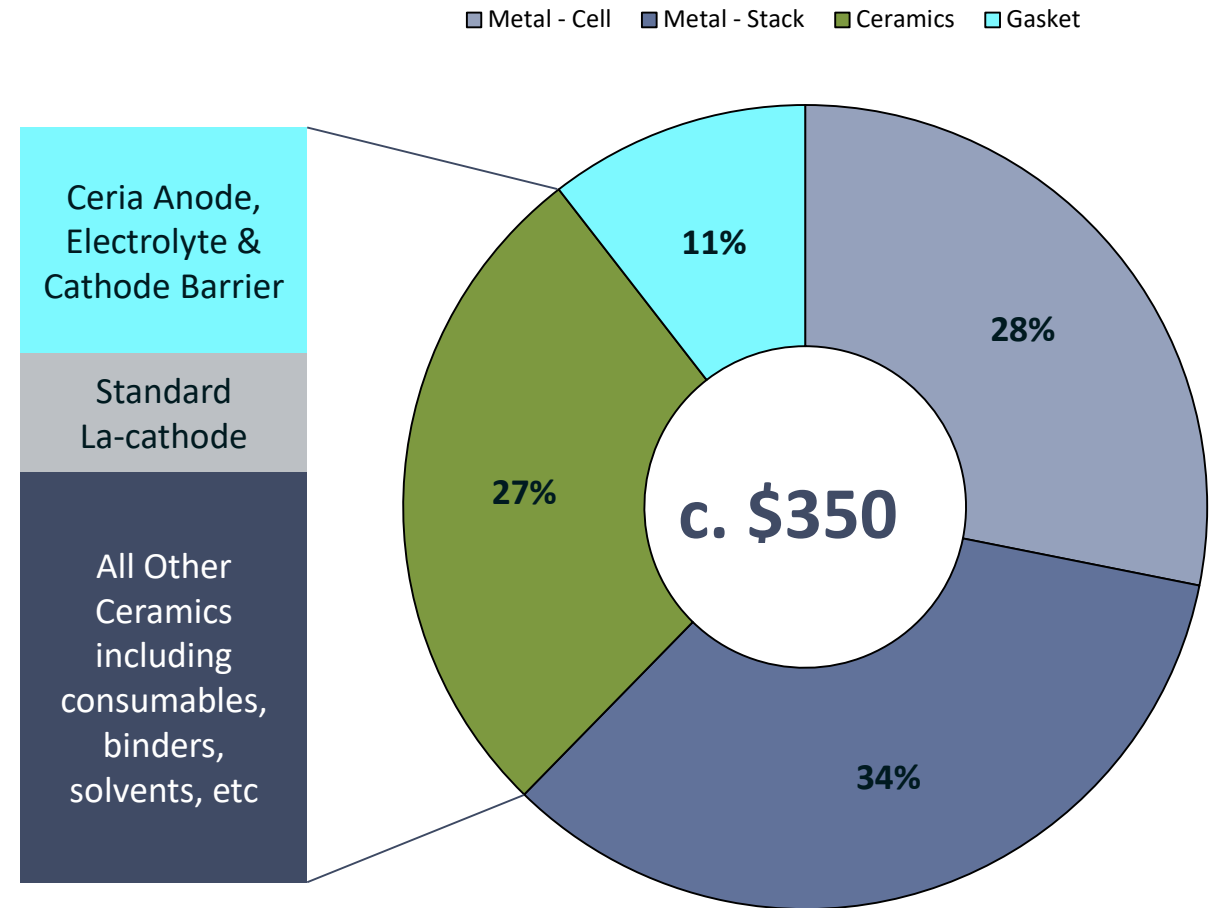
# Ceres Stack Cost Breakdown 700W $\mu$ CHP Class

At 100k 1kW units per year  
material cost c.350US\$

All ceramics purchased from  
global suppliers.

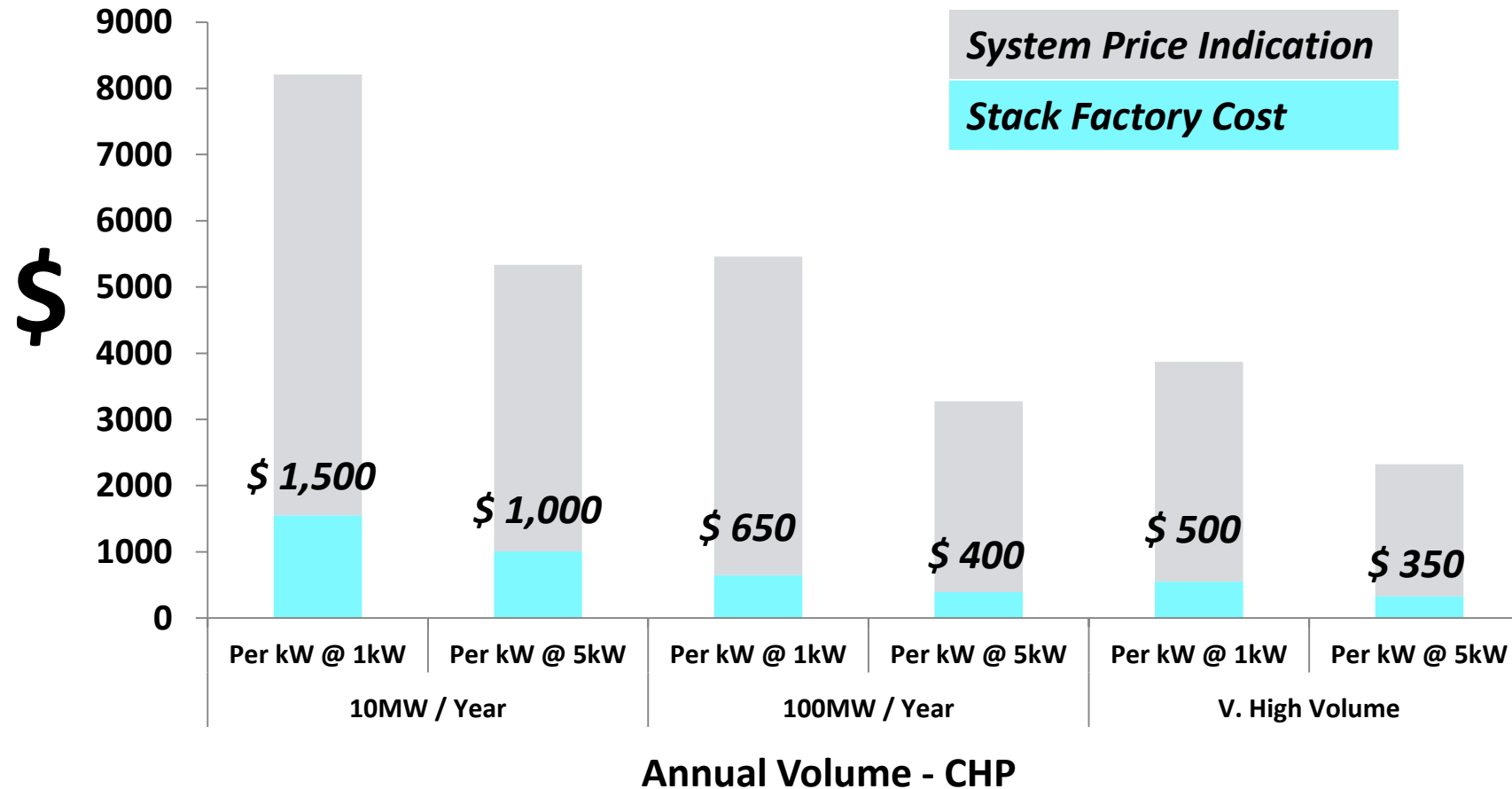
No exotic or hard to source  
rare earth metals are used.

Ceres has never experienced  
supply interruptions, costs of  
all Ceres rare earth  
components have dropped in  
the last 5 years



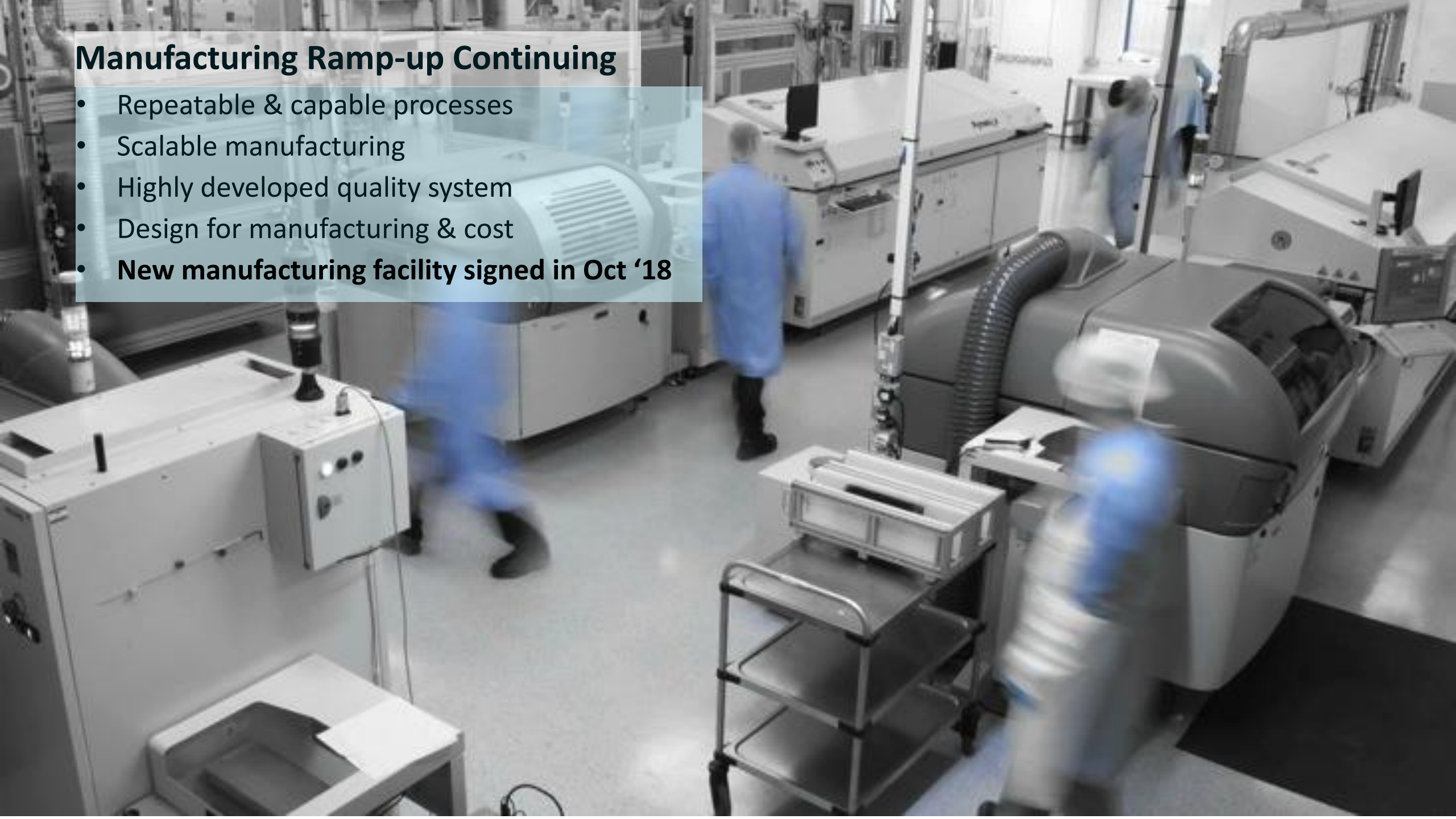
>60% Steel in Ceres Steel Cell Stack = Low Cost

# Costs per kW for 1kW and larger power products meets market needs



## Manufacturing Ramp-up Continuing

- Repeatable & capable processes
- Scalable manufacturing
- Highly developed quality system
- Design for manufacturing & cost
- **New manufacturing facility signed in Oct '18**



Steel Cell is ready and being commercialised

World class technology - still getting better

Multiple go-to-market partners in key market sectors – and growing

WE THANK HTC FOR THEIR SUPPORT TO MAKE THIS FUTURE POSSIBLE !!!!



Thank you

S. Mukerjee

Director of Fuel Cell  
Development

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