



Nedstack fuel cell technology

Jorg Coolegem
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We are dedicated to
designing and producing
the best value for money
PEM fuel cell stacks in
the market.



Company Profile

- Founded in 1999
- Based in The Netherlands
- Independent fuel cell stack manufacturer
 - Supplier to system integrators, serving world-wide markets
 - Installed base in Europe, US, Africa, Asia
 - Extensive system integration know-how
- Member of a Dutch-based group with over 40 years worldwide experience in prime power, power generation and UPS-solutions





Unique features of the Nedstack PEM fuel cell stack



Unique features

- Product range allows for fit for purpose choice:
 - Power range: 2-10 kW per stack
 - HP for low cost and back-up: > 4,000 hr & > 1250 start-stops
 - XXL for long life : > 20,000 hr
- Liquid cooled
- High power density
- High fuel efficiency
- Low parasitic losses
- Easy to integrate, reliable and robust

	HP High Performance	XXL eXtended Life
FCS 2	 <p>Backup power for Telecom, Rail, Utility substation</p>	 <p>Baseload power for Telecom</p>
FCS 5		
FCS 8		
FCS 10 (stackable to 1 MW and higher)	 <p>Large scale Backup</p>	 <p>City Transport, material handling Chlorine power plants</p>

Nedstack system integration track record



Over 700 telecom back-up stations since 2007



5 kW off-grid telecom power supply



14 kW off grid power supply demonstration unit FC with ethanol reformer



70kW demonstration power plant running >50,000 hrs since 2007



1MW plant at Solvay chlorine plant



Nedstack's commercial focus

Telecom power supply



Grid equipment back-up and P2P



Transport



Industrial CHP



Nedstack business model



Description

- | | | | |
|---|--|---|--|
| <ul style="list-style-type: none">• Carbon• Membrane Electrode Assemblies• Aluminum parts | <ul style="list-style-type: none">• Produce cell plates• Assemble fuel cell stacks• Provide system integration know-how• Create market pull from end user | <ul style="list-style-type: none">• Design fuel cell system (application)• Assemble systems• Sell and install systems• Service systems• (Run fuel supply chain) | <ul style="list-style-type: none">• Run the system |
|---|--|---|--|

Nedstack in transport initiatives

To be sure.



E-trucks Europe



First Chinese car (chery SUV)



HyMove bus with:



30 kWe range extender

70 kW PEM demonstration Power Plant

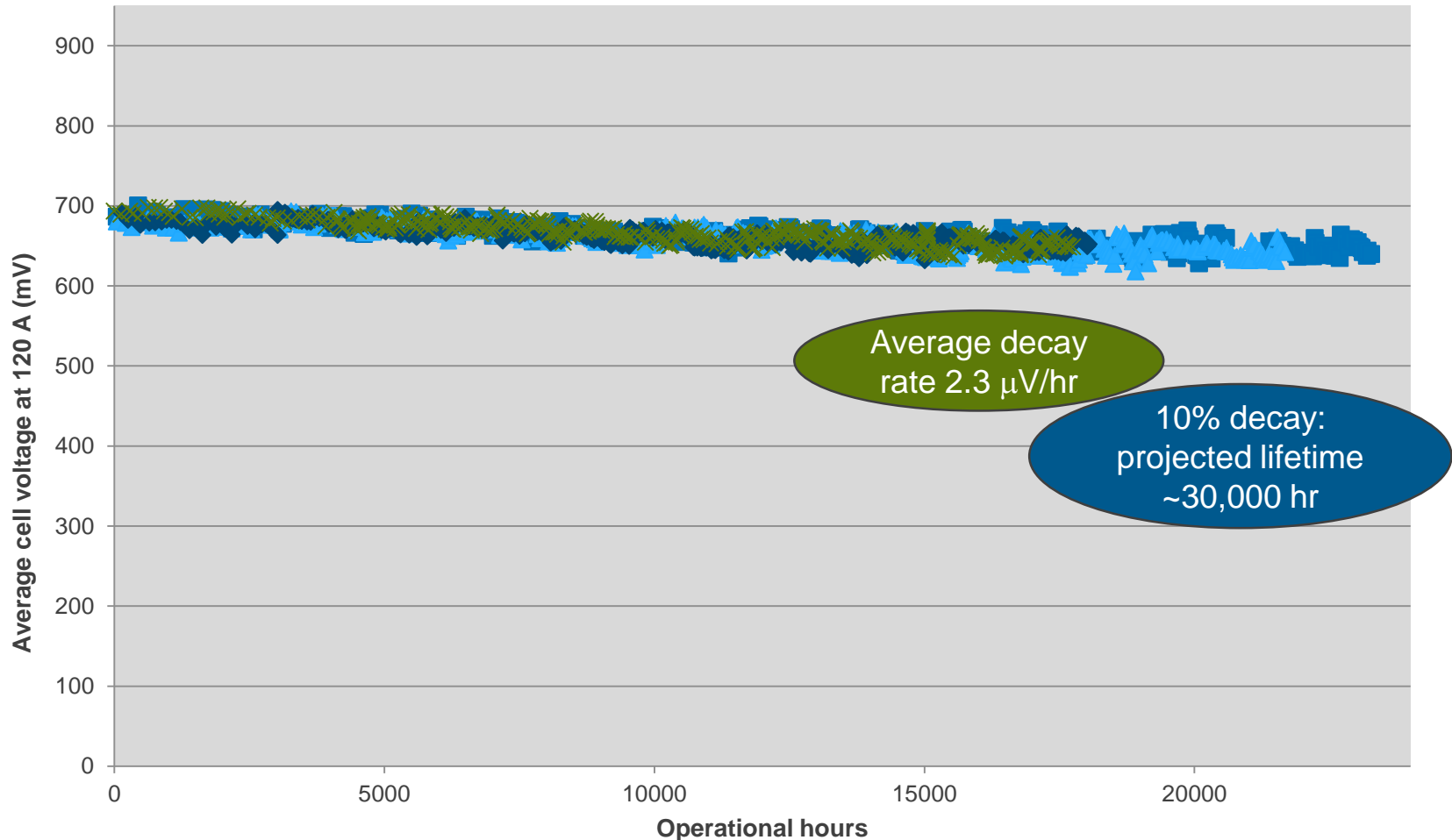
At AkzoNobel's Delfzijl chlorine plant



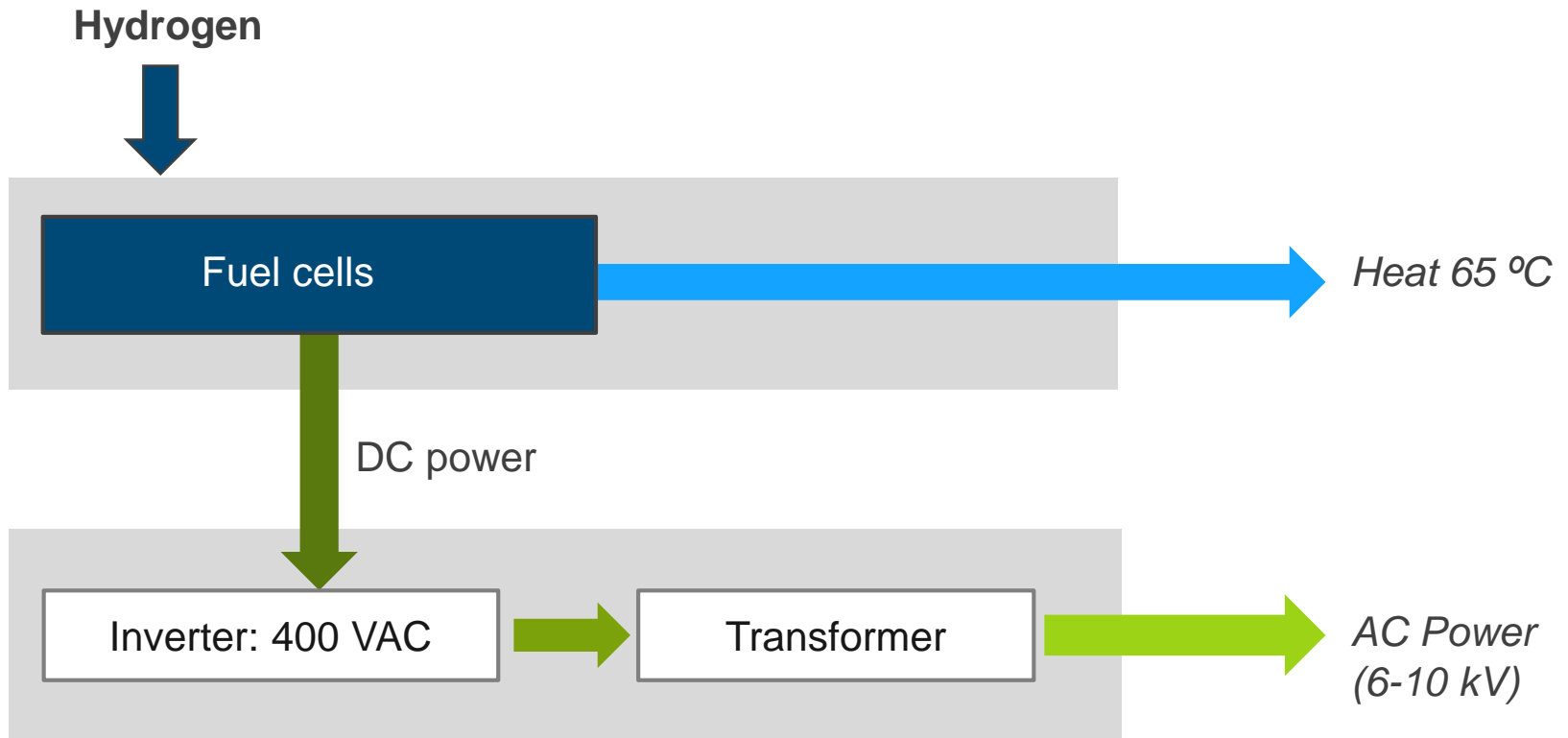
- > 50,000 hours on grid
- Stack life in field conditions over 23,000 hours
- Reliable operation, low maintenance costs
- Fully automated, remote monitoring
- Mobile set-up

FCS-XXL stacks: stable performance, long life

- Unique stack performance and lifetime under real, industrial conditions (Delfzijl)

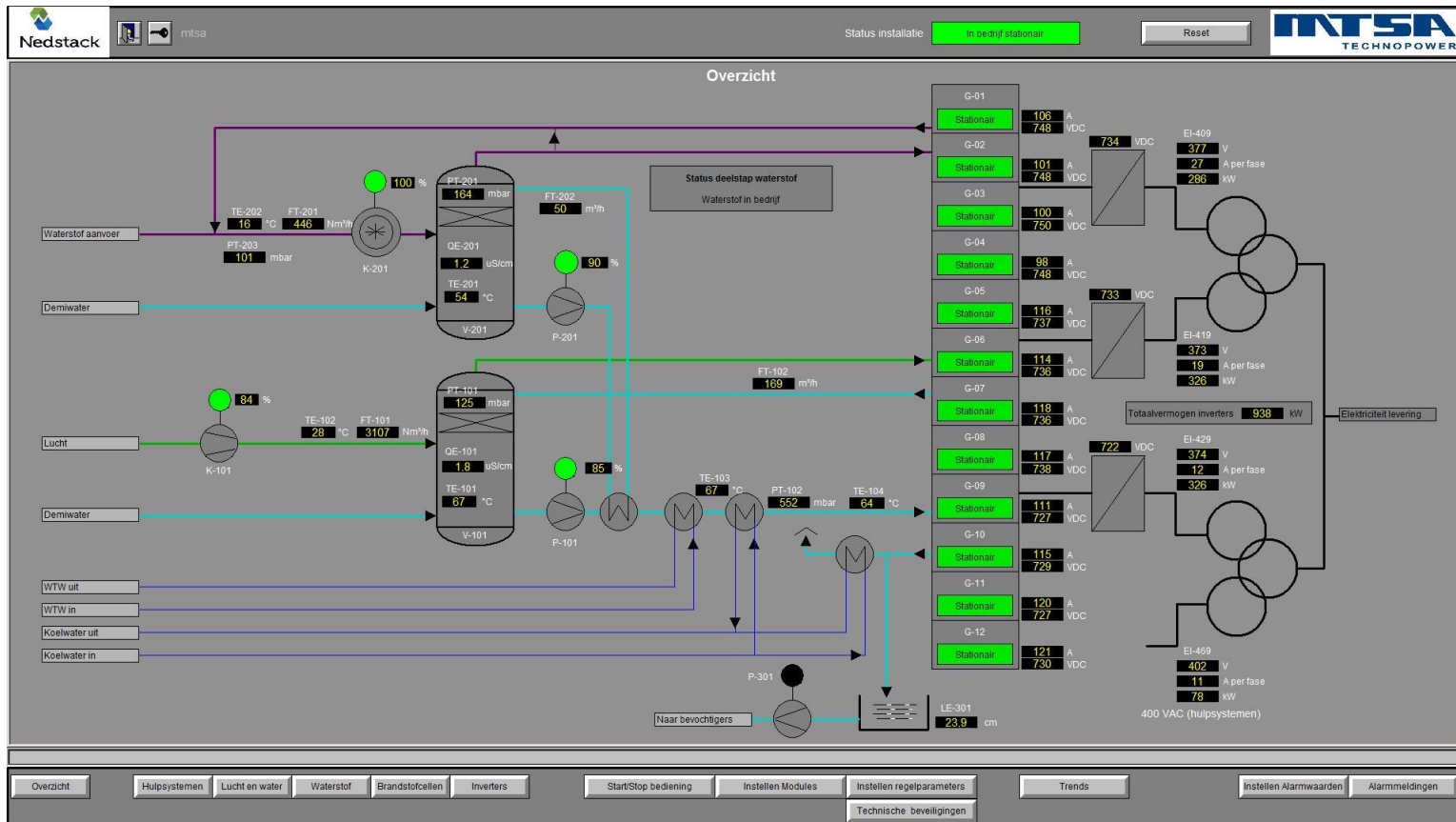


Cogeneration of AC-power and heat



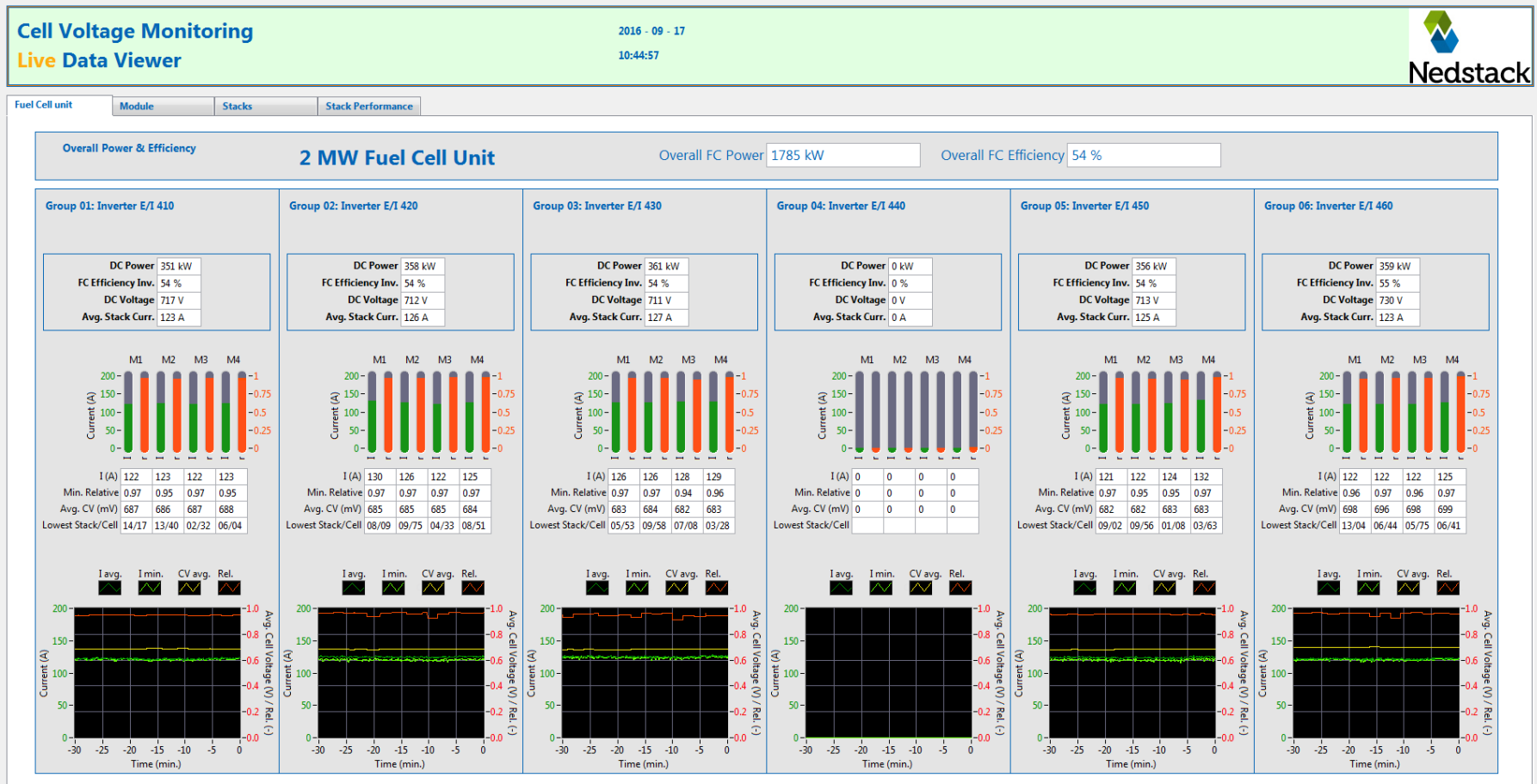
System overview

- System can be remotely monitored and operated



Monitoring of stack performance

- All stacks in the plant can be individually monitored:

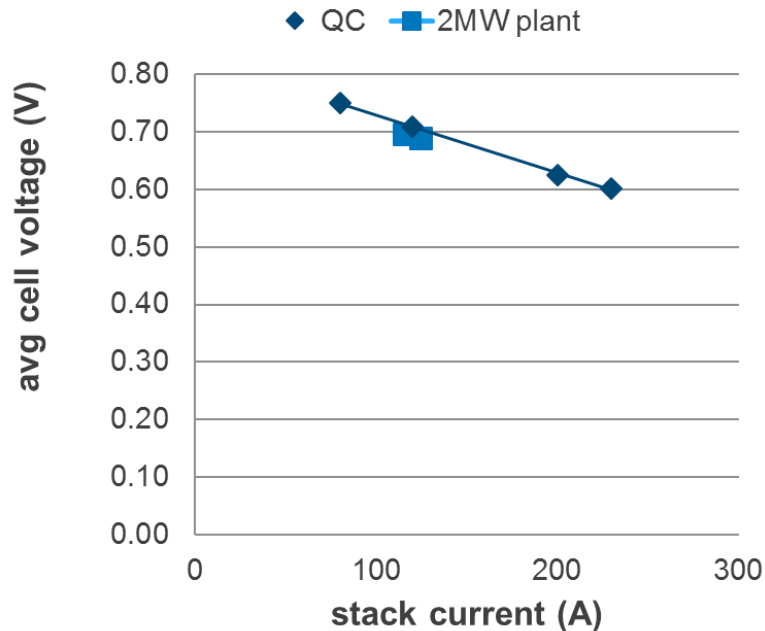


2 MWe PEM Power Plant - China



Preliminary performance data

Stack performance: plant vs. QC test

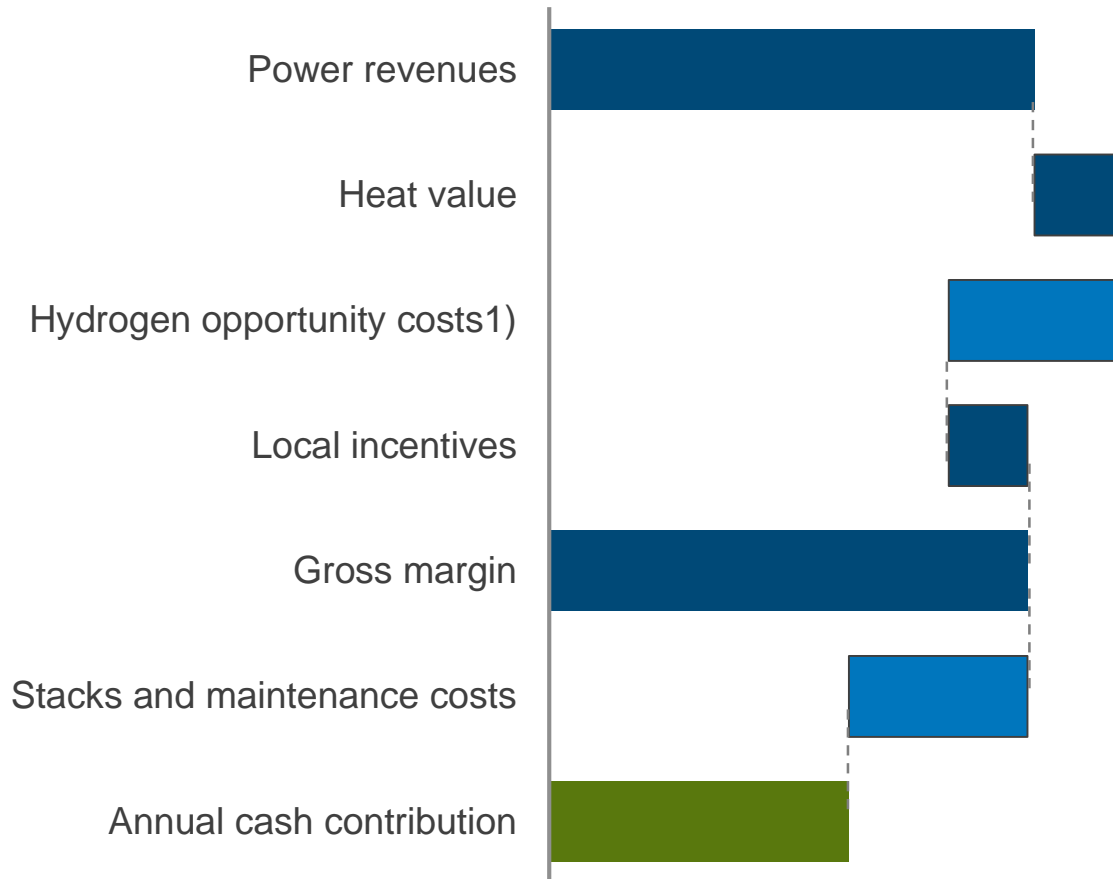


Plant performance

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

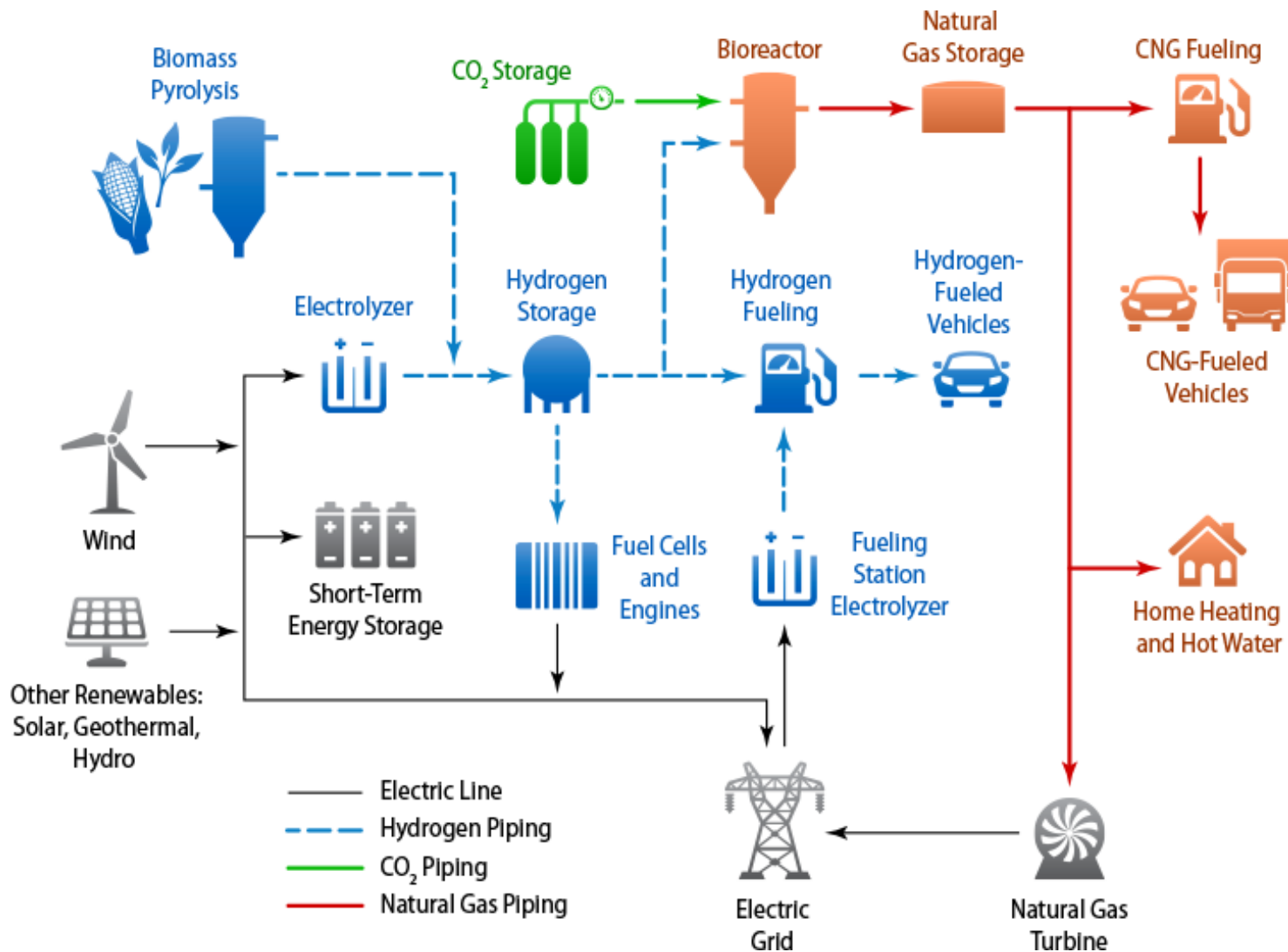
Business case for a MW PEM Power Plant

Depends largely on local situation



1) Assuming hydrogen would otherwise be burnt and now will have to be substituted by natural gas

Hydrogen Market Overview



Thank you

謝謝

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