

# CUSTOM-MADE SOLUTIONS FOR HIGH- POTENTIAL FUEL CELL APPLICATIONS BASED ON MCFC

*Dr. Marc Bednarz  
Director Fuel Cell Development  
MTU Onsite Energy Fuel Cell Systems  
Ottobrunn, Germany  
October 2008*



# Introducing the Company



A Tognum Group Company

- Home base in Munich
- Fuel cell power plants for on-site energy
- Standardized building blocks for custom-made solutions
- R&D, serial production of cells and systems
- Strong base of Partners
- Appr. 100 highly qualified people
  - R&D and design crew
  - Product development
  - manufacturing and assembly

# Introducing our Products

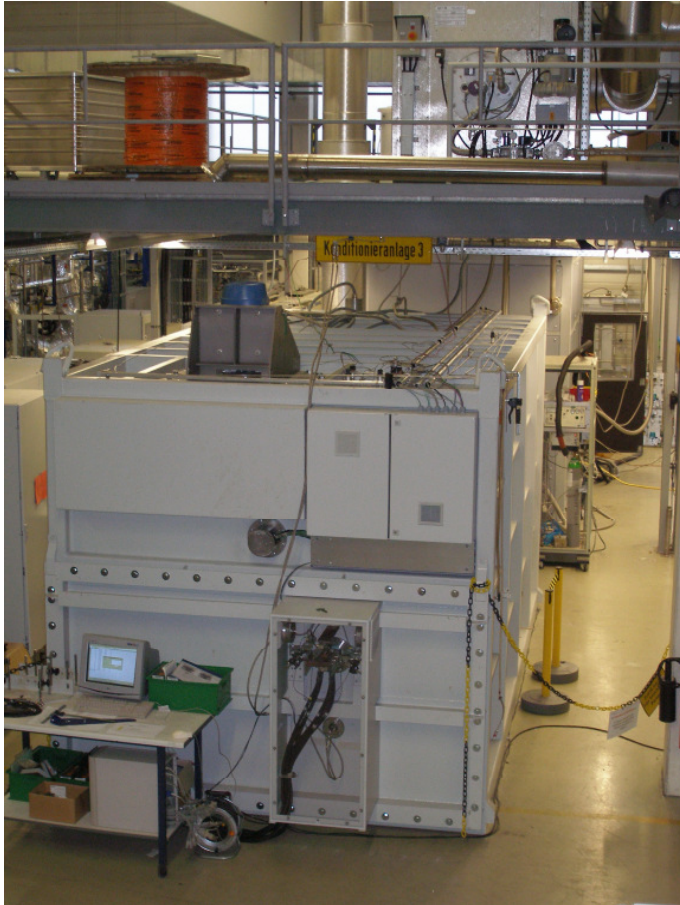


**Old HM300/310 Series:**  
From 342 to 426 cells  
Round vessel design

**Our new product line:**  
Designed for cost reduction  
HM320 Series with 500 cells ++  
Lessons learned from old series

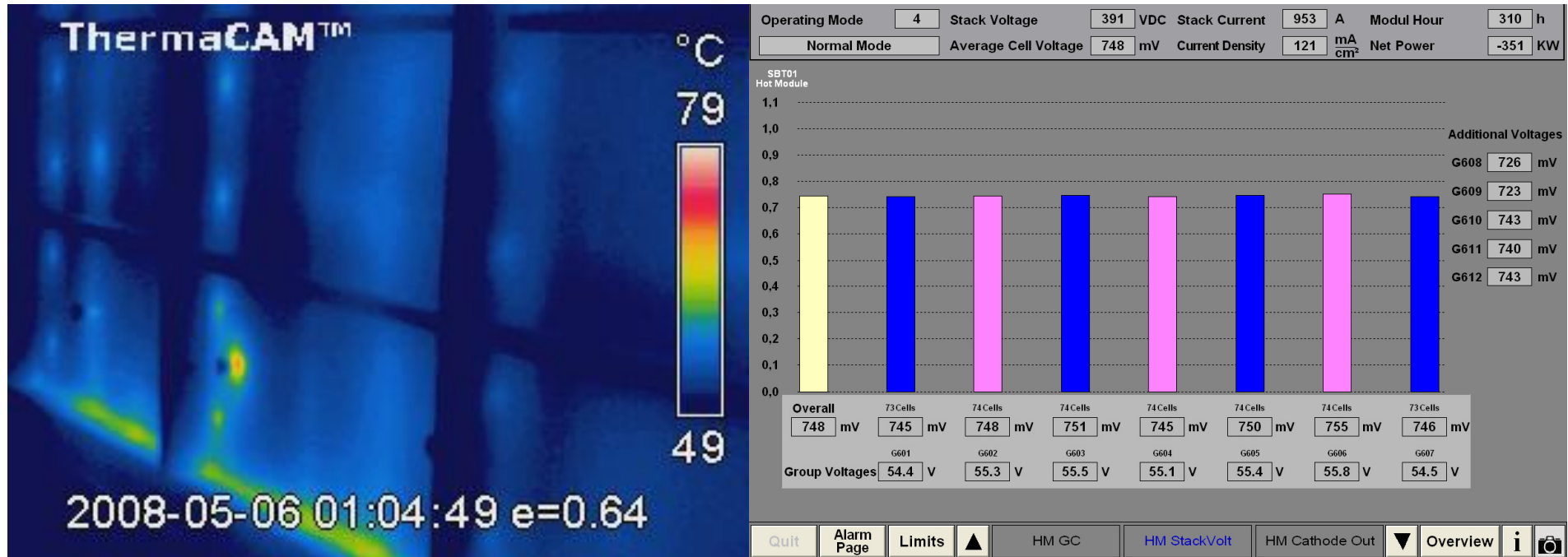


# The HM320 in operation



- Announced in San Antonio / FCS 2007
- Conditioning & test started in Q2 2008
- redesign and relocation of BOP component improved thermal situation
- 50% higher power output than HM300
- Only 25% higher cost than HM300 in the prototype state
- High further cost saving potential

# Results in factory test



350 kW grid power – largest monoblock fuel cell stack worldwide

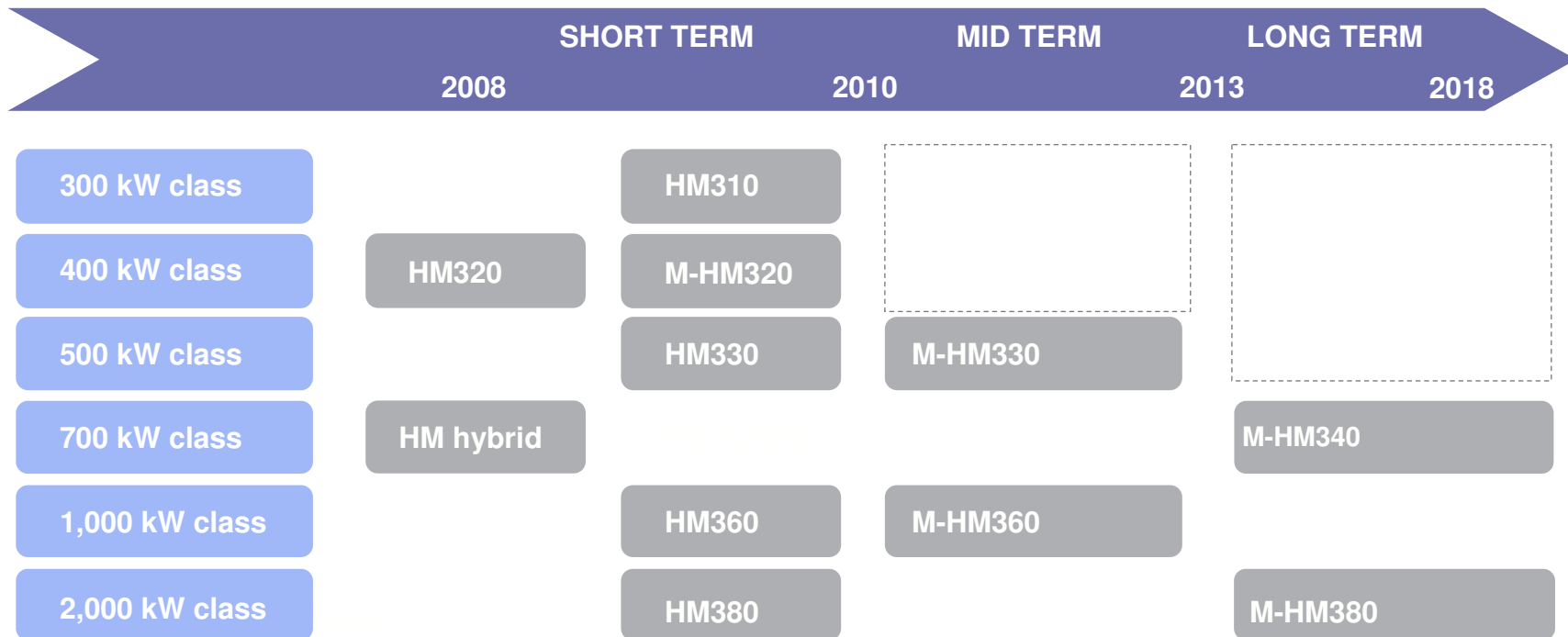
Within field test no signs of limitation in stack length

Installation at customers site in Q1-09

(Biogas application in Germany)



# Product Portfolio based on new (HM320) design



# Introducing the Value Proposition

## **hot**module

### Efficiency

- electrical efficiency 49 percent
- thermal efficiency up to 40 percent
- part load independent efficiency
- cogen, trigen

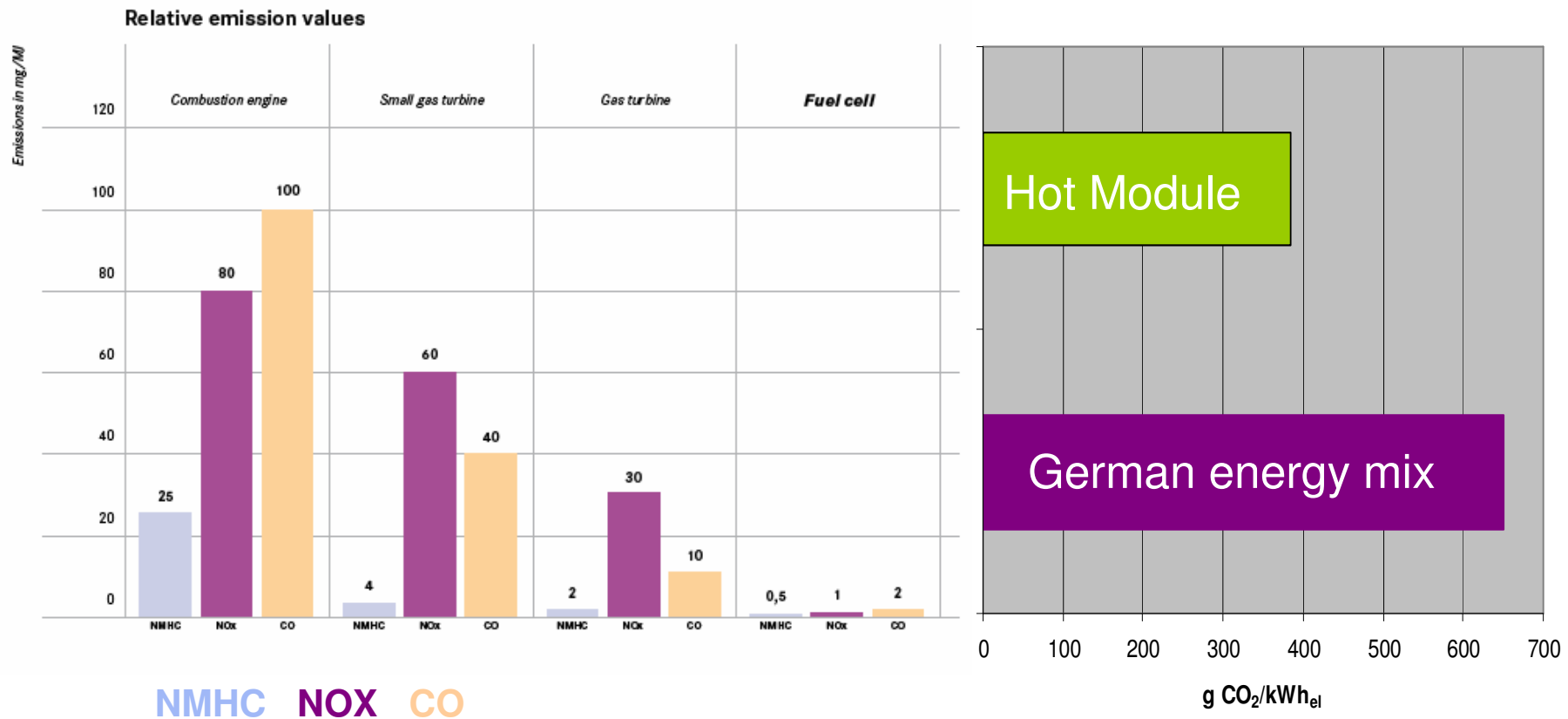
### Quality

- premium power
- 400°C usable heat
- no pollutants
- no vibrations

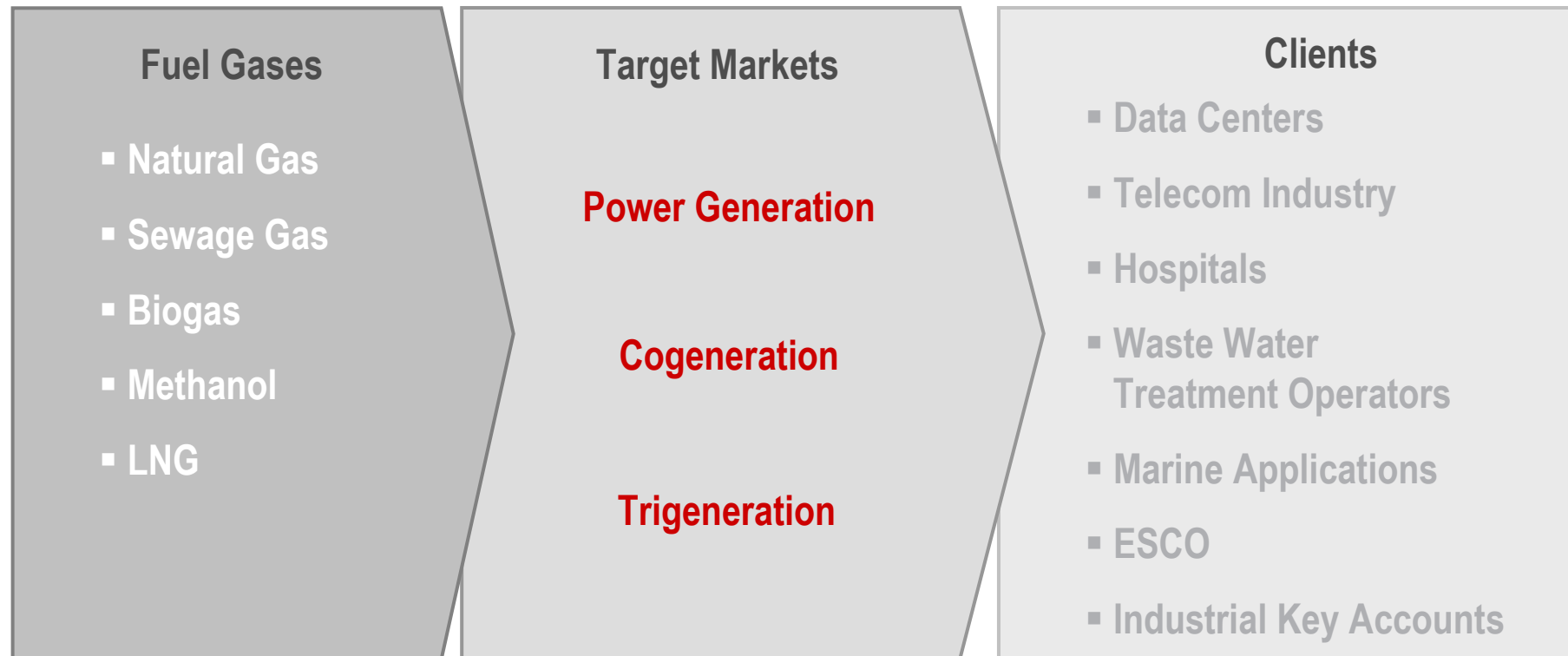
### Security

- on-site energy
- fuel flexibility
- grid independence

# Ultraclean and low greenhouse gas emissions



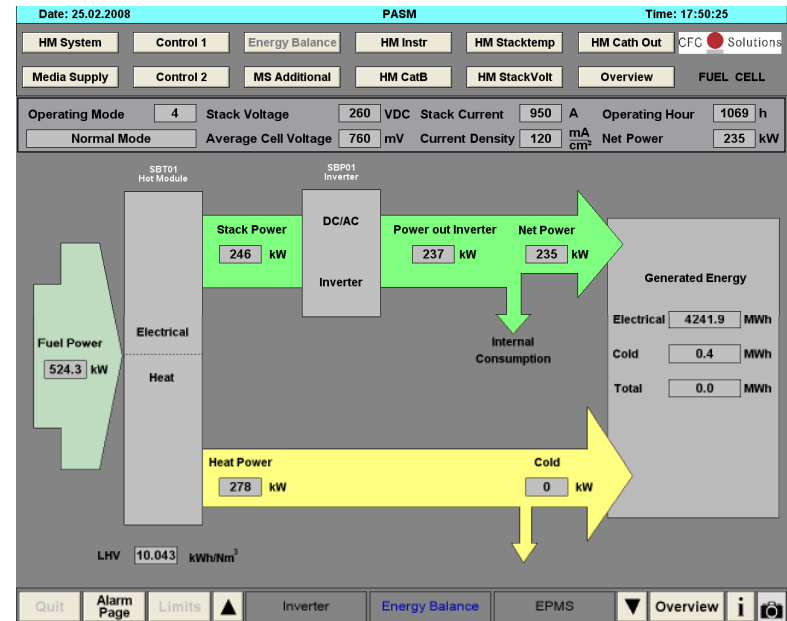
# Fuels, Target Markets, Clients



# T-Systems Data Center Munich



- Trigeneration application
- Fuel: biomethane
- Hours of operation: 4,950 h
- Power output: 950 MWh

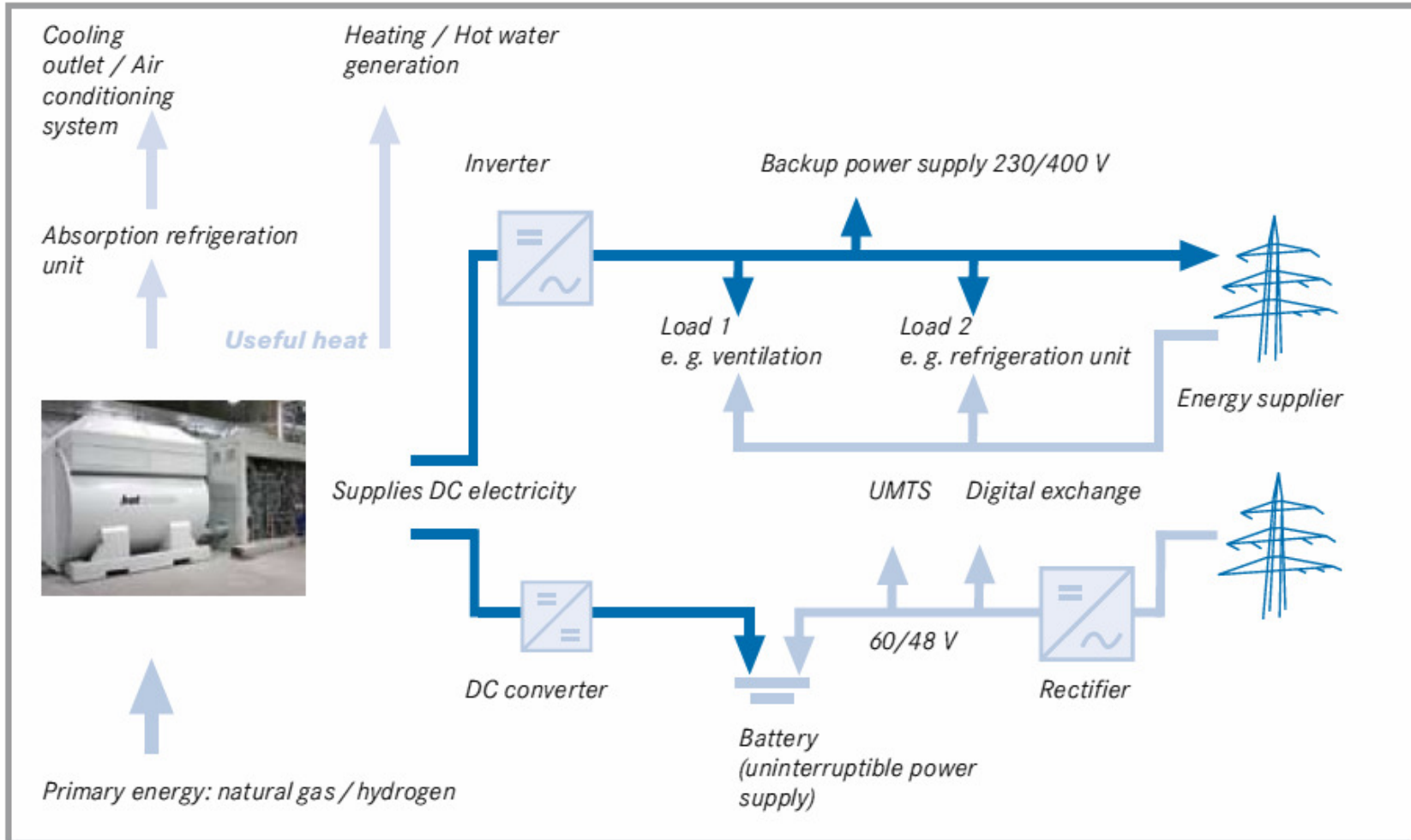


# DeTeImmobilien Munich



- Trigeneration application
- Fuel: natural gas
- Hours of operation: 25,480 h
- Power output: 3,660 MWh

# Integrating the fuel cell into the infrastructure of the telecommunication industry

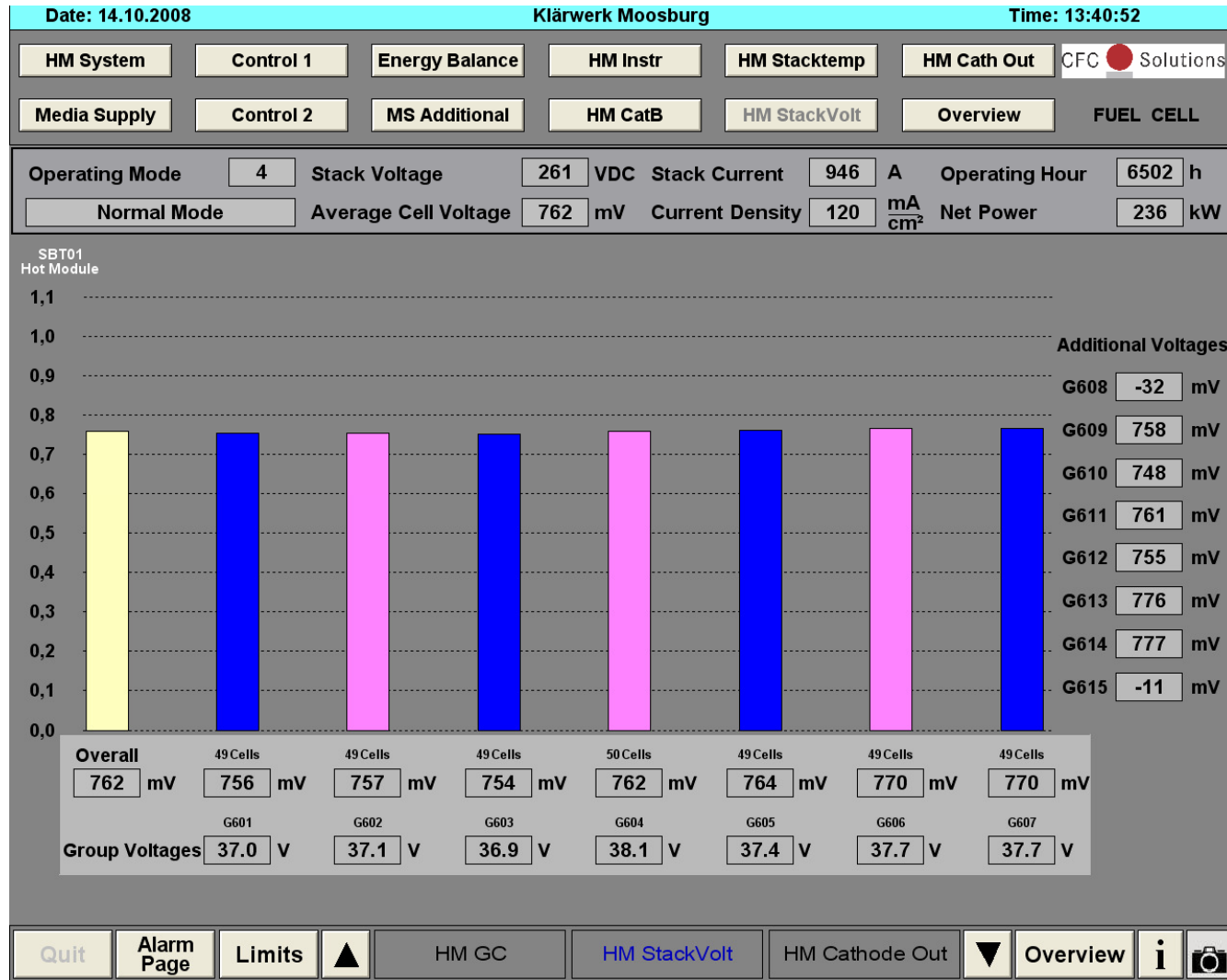


# Example Biogas: Municipal Sewage Gas Plant Moosburg



- Cogeneration application
- Sewage gas from municipal waste water
- Heat utilization for fermenter and sludge treatment
- Hours of operation: 6,500 h (2008-10-14)
- Full load operation ongoing

# Voltages in biogas operation (40%CO2)

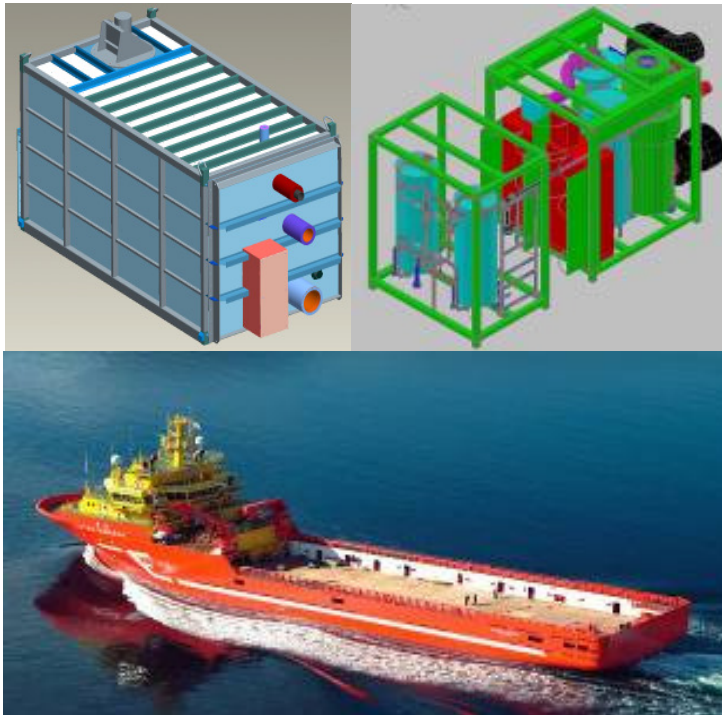


# Challenges in biogas operation: Impurities



- Hydrothermal fermentation
- Catalytical desulfurization KI-charcoal
- Charcoal bed for contaminant removal
- Hours of operation: 5.500 h
  
- “Sudden stack death”
- Strong thermal shifts in stack & system
- Halogene compound slipped through
- Corrosion totally destroyed the anode current collectors

# Fellowship



„Viking Lady“

- HotModule for low emission ships
- Partner: DNV, Wärtsilä, Eidesvik, Vik-Sandvik
- 400 kW baseload power for shipboard power supply system
- LNG
- Offshore test on Viking Lady as of May 2009
  
- Intensive mechanical testing and modeling in preparation of the stack and manifold situation

# Hospital Bad Berka



- Trigeneration application
- Fuel: natural gas
- Stack replacement in 2007
- Hours of operation: 35,400 h
- Power output: 6,220 MWh

# Vattenfall Berlin



- Cogeneration application
- Dual fuel mode (natural gas, methanol)
- Hours of operation: 21,900 h
- Power output: 3,770 MWh

# Scorecard

- Pathbreaking system design  
→ HotModule®
- Unique cell technology  
→ Eurocell®
- Unmatched field experience  
→ Operating hours  
→ large monoblock stacks  
→ application variety

**MTU Onsite Energy  
Fuel Cell Systems**

**European technology  
leader aiming at a top  
ranking in the global  
market for stationary  
fuel cell power plants**

# Manufacturing & Assembling



Eurocell electrode coating line  
Fast & automated inline process  
Flexible in cell area dimensions



Stacking facility –  
Flexible in stack length  
Up to 700 or 800 cells possible

# Conclusions

MTU sees a clear way to commercial applications:

- highly automated Eurocell serial manufacturing
- MW-System design with cogen/ trigen, turbine as long term option
- stacks with highest possible dimensions and power output
- MCFC lifetime will exceed 40 kh by corrosion protection and T-management

Large scale modules will be profitable without funding.

Exceeding a certain production rate is essential for meeting the cost structure.

To overcome that „critical mass“, funding programmes like NIP are required.

# Thank you for your attention!



Dr. Marc Bednarz  
+ 49 89 20 30 42 640  
[marc.bednarz@mtu-online.com](mailto:marc.bednarz@mtu-online.com)