

## A Diesel Fuelled Fuel Cell for Seagoing Vessels



AIDA Cruises | Beluga Shipping | CMT - Center of Maritime Technologies | DNV Germany | Elsflether Zentrum für Maritime Forschung |  
EVT - Gesellschaft für Energieverfahrenstechnik | Flensburger Schiffbau-Gesellschaft | Fr. Lürssen Werft | Germanischer Lloyd | hySOLUTIONS | HAW Hamburg |  
Helmut-Schmidt Universität | Imtech Marine Germany | INVEN Engineering | MEYER WERFT | MTU Onsite Energy | Proton Motor | Reederei Rörd Braren |  
ThyssenKrupp Marine Systems | Verband für Schiffbau und Meerestechnik | ZBT Zentrum für BrennstoffzellenTechnik

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# SchIBZ

Challenges for power generation onboard seagoing vessels



# Challenges for Power Generation onboard

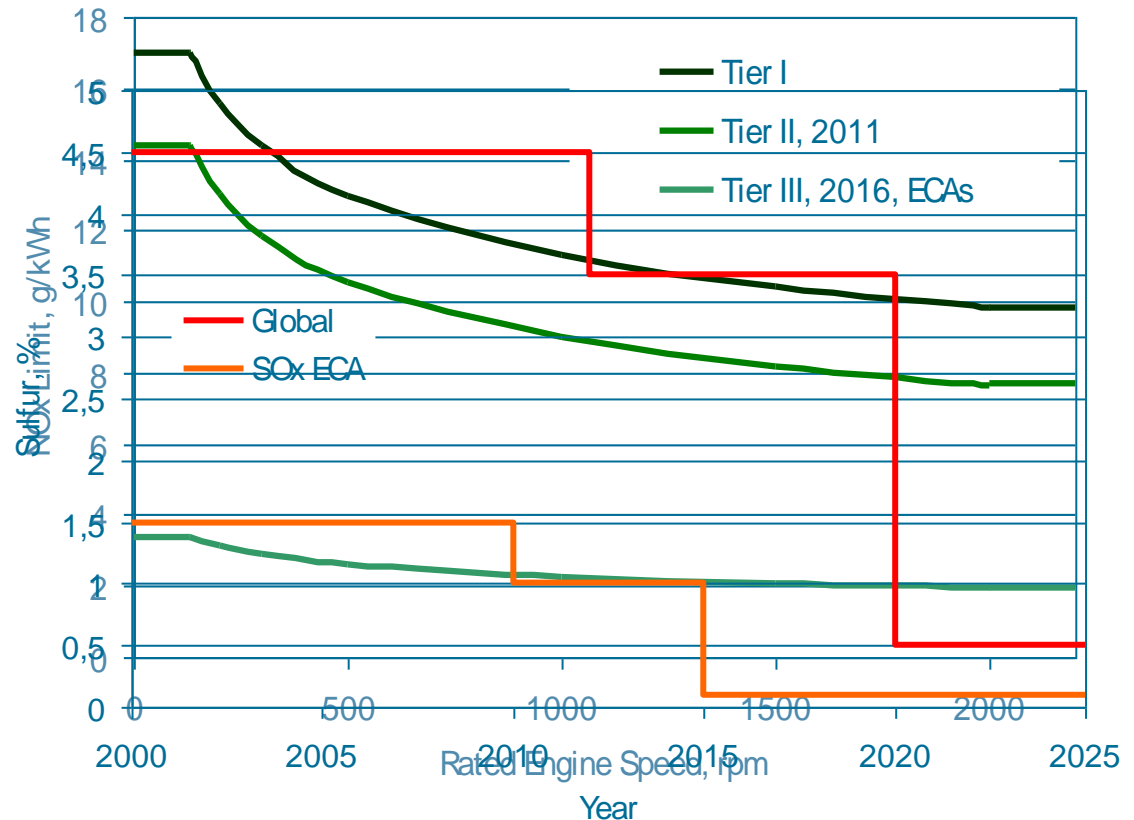
## Development of IMO emission regulations:

### ≡ NO<sub>x</sub>:

≡ ~ 2 g/kWh (IMO Tier III)

### ≡ SO<sub>x</sub>:

≡ 0.1 % in harbour (2010)



# Challenges for Power Generation onboard

## Development of IMO emission regulations:

### ≡ NO<sub>x</sub>:

≡ ~ 2 g/kWh (IMO Tier III)

### ≡ SO<sub>x</sub>:

≡ 0.1 % in harbour (2010)

### ≡ PM<sub>10</sub>:

≡ great concern in harbours

≡ US legislation < 0.5 g/kWh

### ≡ GHG:

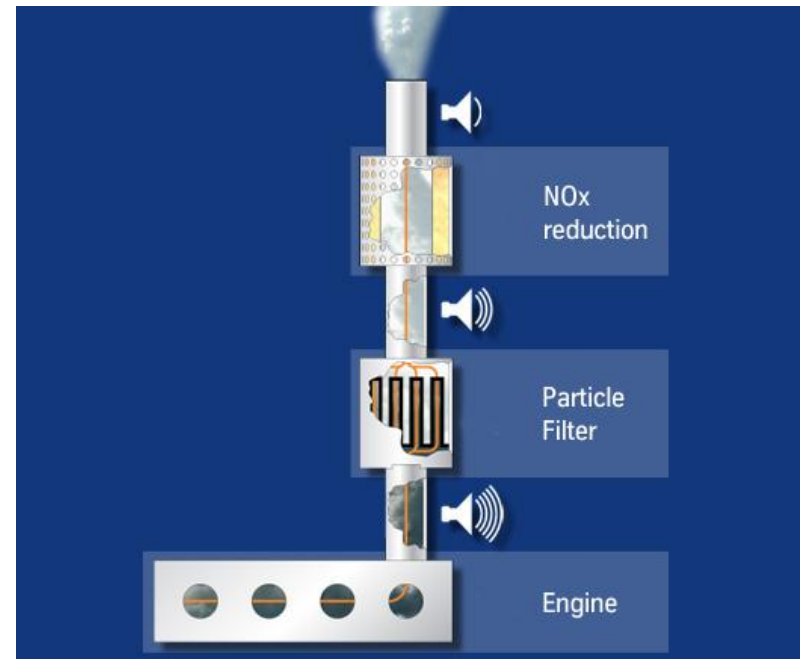
≡ especially CO<sub>2</sub>

### ≡ Noise:

≡ airborne noise

≡ waterborne noise

➔ **Lower!**





# SchIBZ

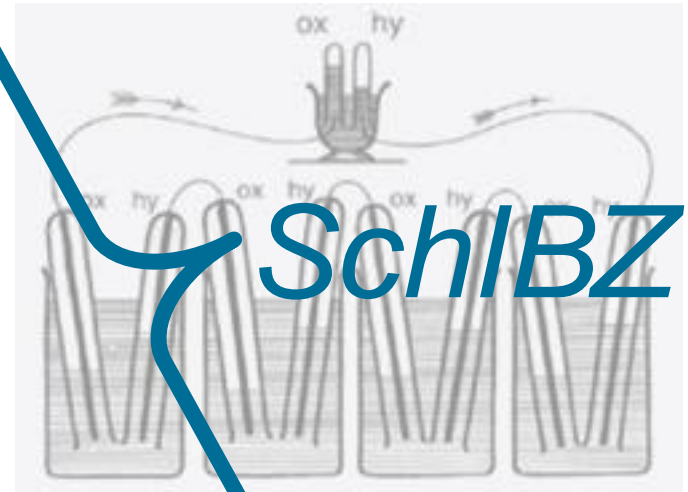
System concept



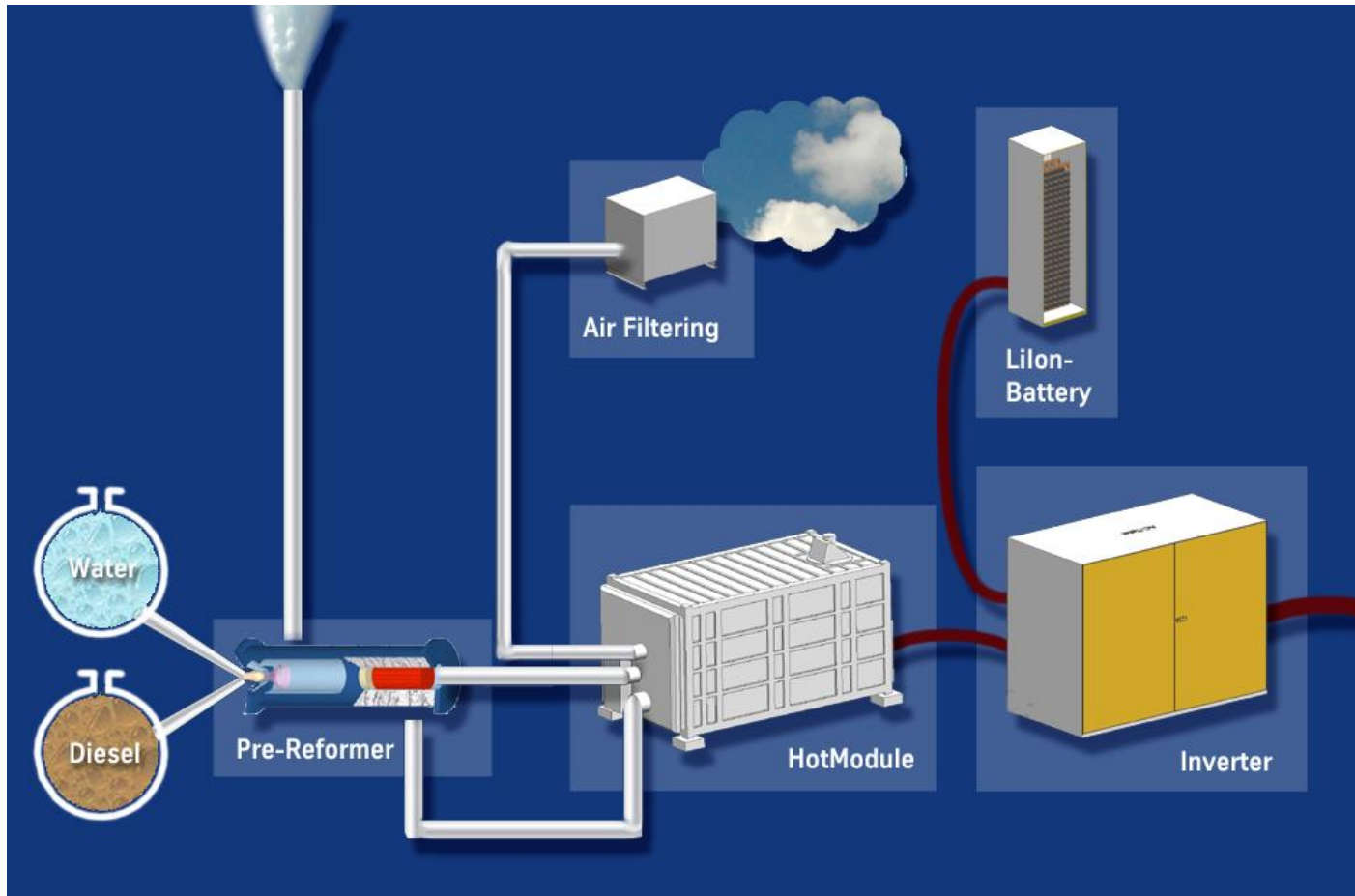
# Fuel Cell System for surface vessels – requirements

## Properties a ship borne power plant should have:

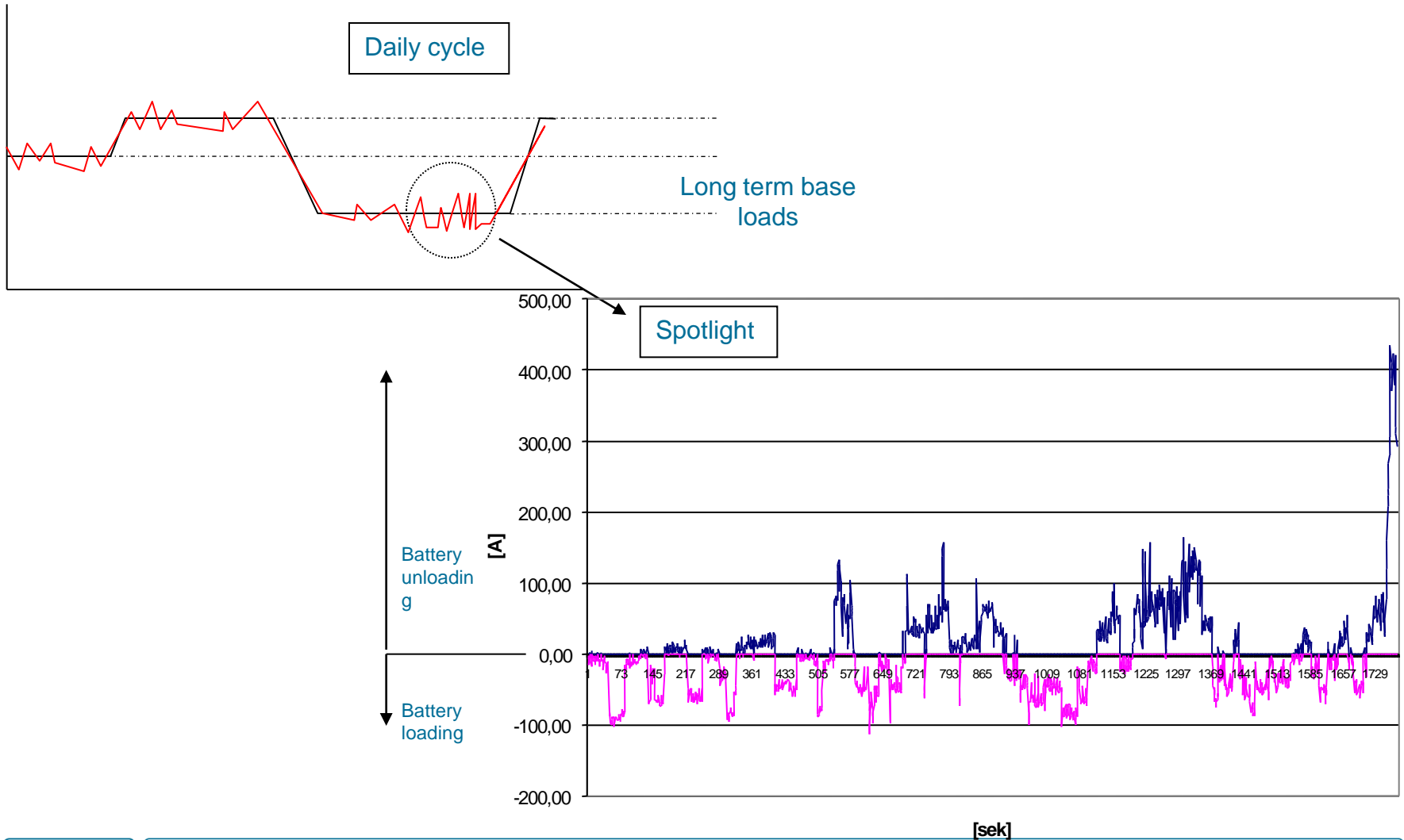
- ≡ **familiar fuel**
  - ≡ no additional safety requirements
  - ≡ suitable for existing equipment
- ≡ **full automation**
  - ≡ no continuous supervision required
- ≡ **modules**
  - ≡ components logically grouped in frames
  - ≡ frames flexible installable
  - ≡ very compact arrangement
- ≡ **operational flexibility**
  - ≡ capable of isle mode
  - ≡ capable of parallel operation with power sources
- ≡ **minimum of 500 kW**



# Fuel Cell System for surface vessels – system concept



# Fuel Cell System for surface vessels - Power buffering



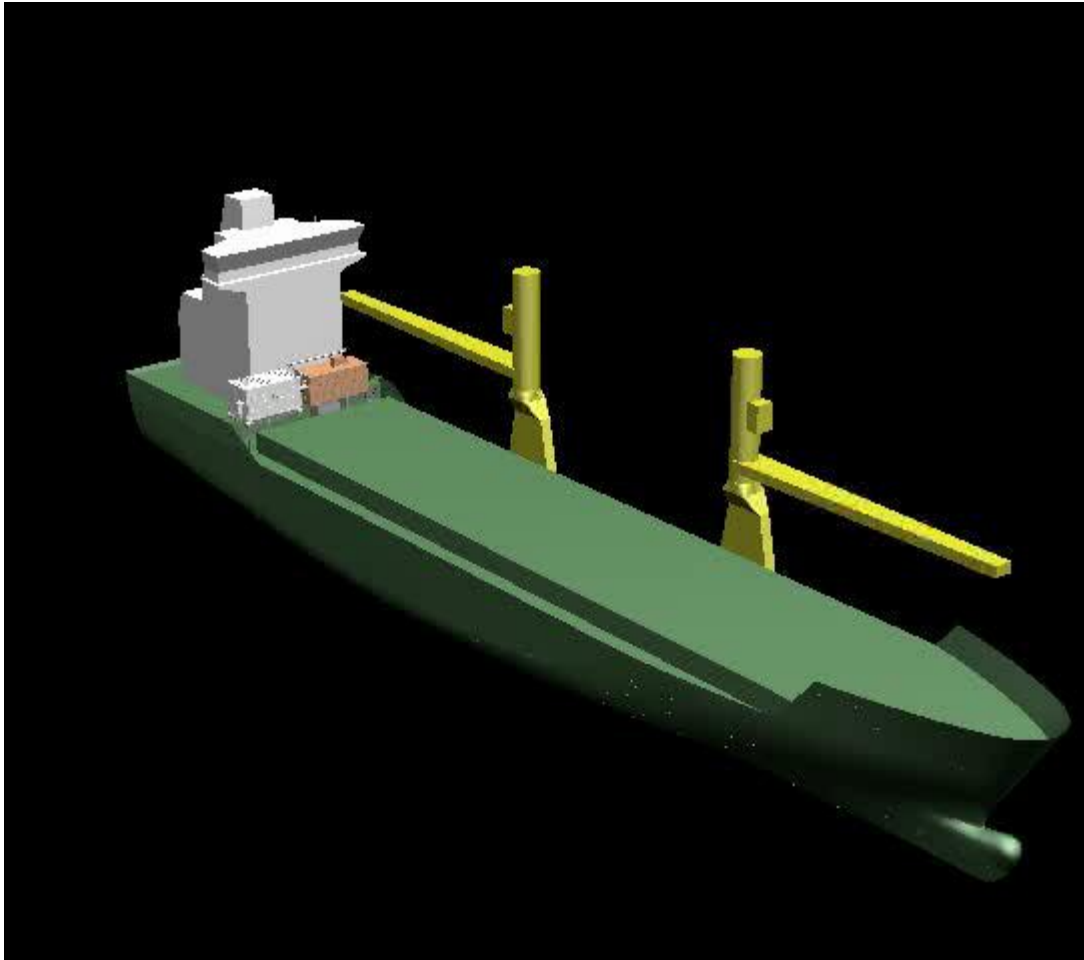


# SchIBZ

The demonstration project



# SchIBZ – demonstrator



20.04.2010

Keno Leites, TKMS Blohm + Voss

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# SchIBZ - Development partners

## TKMS Blohm+Voss

- ≡ Project leader
- ≡ Ship integration
- ≡ System integration
- ≡ Water conditioning
- ≡ Air conditioning
- ≡ Battery
- ≡ Preventive fire protection
- ≡ Packaging
- ≡ Test environment



## Imtech Marine Germany

- ≡ Frequency inverter
- ≡ Load management
- ≡ Supervising automation



## MTU CFC

- ≡ MCFC
- ≡ Reformer connection
- ≡ Safety system



## Germanischer Lloyd

- ≡ Safety analysis
- ≡ Data collection
- ≡ Certification
- ≡ Rules and Regulations



## OWI

- ≡ Reformer
- ≡ Fuel gas supply
- ≡ Exhaust gas integration



## Helmut-Schmidt-University

- ≡ Academic support
- ≡ Thermodynamic analysis



## Reederei Braren

- ≡ MS Cellus



# SchIBZ - Time Frame

Quarter	III/09	IV/09	I/10	II/10	III/10	IV/10	I/11	II/11	III/11	IV/11	I/12	II/12	III/12	IV/12	I/13	II/13	
System definition	█																
Plant construction			█														
Laboratory test			X														
Factory tests components							█										
Initial start-up											X						
Land based test											█						
Conversion MS Cellus								X						X			
Sea based test													█				

Project duration 48 months





# Thank you!

[www.e4ships.de](http://www.e4ships.de)



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