



POWERCELL **A paradigm shift for Maritime**

Johan Burgren

Business Manager Marine



1994



POWERCELL

2008



autostack
moves

2011



autostack
core

2012



2014

2015

2017

2018

2021

FIAT GROUP

VOLKSWAGEN GROUP

DAIMLER

VOLVO

BMW

VOLKSWAGEN GROUP

BOSCH

SIEMENS

NIKOLA MOTOR COMPANY

KALMAR

Ford

BMW

VOLKSWAGEN GROUP

DAIMLER

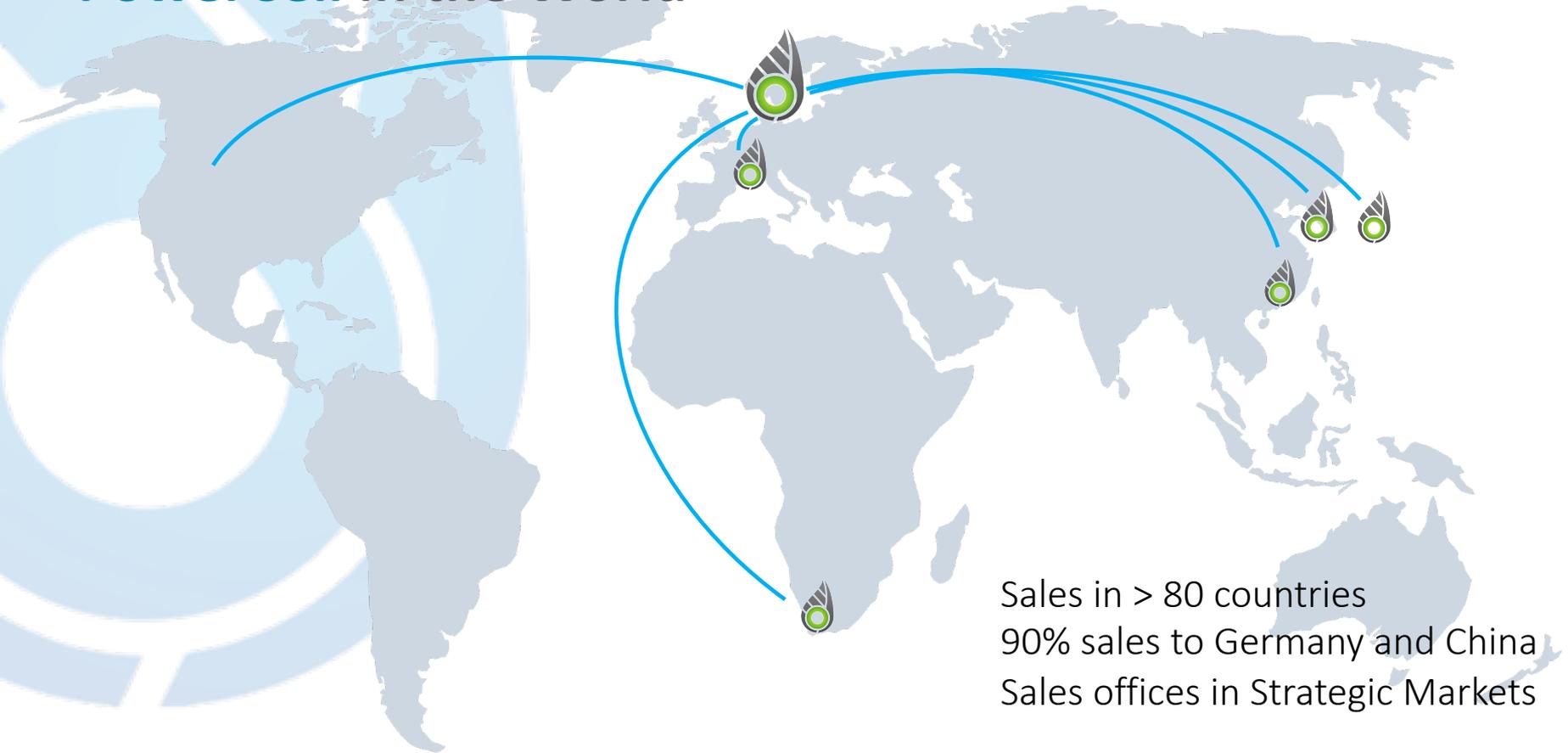
FCH

European Union flag

autostack
industrie



PowerCell in the World



Zero Emission For Maritime



BRUSSELS (Reuters) - The European Union agreed on Tuesday to reduce emissions of carbon dioxide (CO2) from new trucks and buses by 30 percent by a 2030 deadline as part of its commitment to cut its output of greenhouse gases. 15% by 2025!! All compared with 2019 levels.



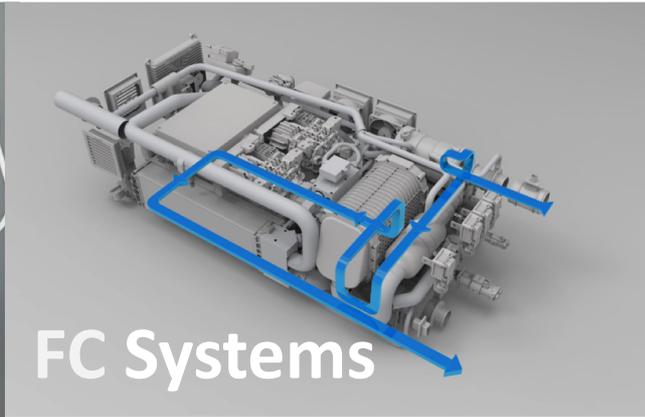
50% GHG reduction by 2050 compared to 2008 on your total tonnage

Evaluation ongoing for 40 % by 2030 and 70% by 2050!

Our solutions



Consultancy



FC Systems



Integration

Testing center of expertise

Fuel Cell stack development lab

FC system development

DCDC development capability

Marine build and test facility in Gothenburg harbor

Development partners

Automotive drives economy of scale for Maritime



Nikola has decided.



NIKOLA™
MOTOR COMPANY

IVECO



NIKOLA ONE™

The fully-electric hydrogen-powered sleeper semi-truck. Available in North and South America.



NIKOLA TWO™

The fully-electric hydrogen-powered day cab semi-truck. Available in North and South America.

BOSCH



POWERCELL

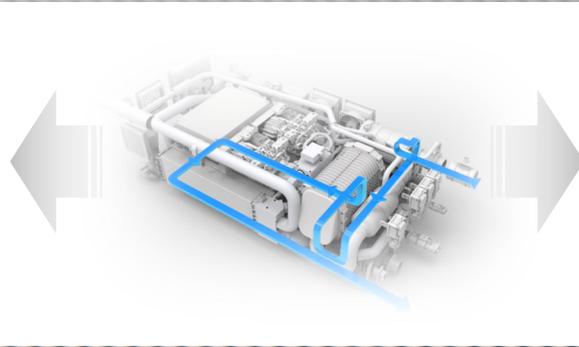


NIKOLA TRE™

The fully-electric hydrogen-powered day cab semi-truck. Available in Europe, Asia and Australia.



Automotive drives economy of scale for Maritime



Multi Mega Watt feasibility studies



H2 powered Heavy Fork Lift

- 54 kW Fuel Cell
- 60 kWh Lion battery
- 9 kg hydrogen
- DCDC
- 1000 hour test so far...



Aranda reaserch vessel

- 165 kW (2 x 82.5 kW AC) fuel cell powertrain based on S3 stack
- Powering Artic research vessel Aranda's electrical equipment and dynamic positioning during measurements - free from vibration, noise and air pollution
- 18-month marine field testing including extreme cold and saline conditions
- Container installation on deck



Photographer: Panu Hänninen

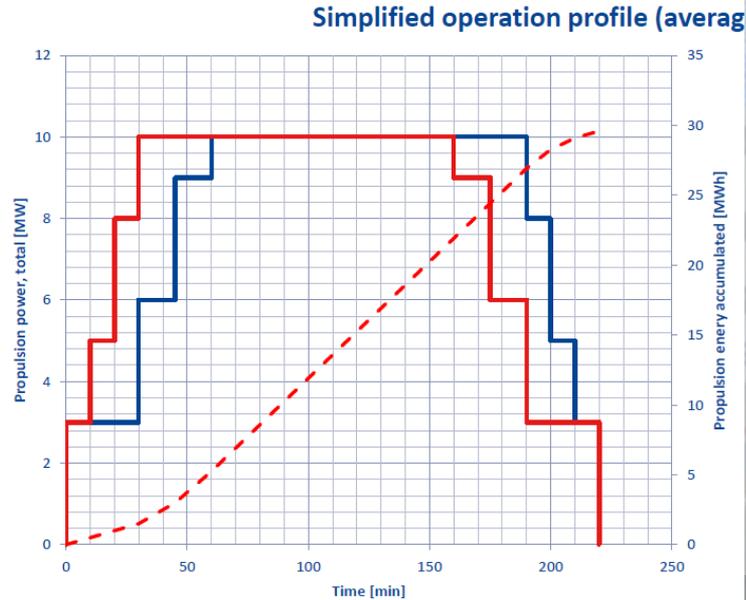


Project consortium:

- VTT Technical Research Centre of Finland Ltd
- Powercell Sweden AB
- ABB Oy
- OMB Saleri SPA
- PersEE
- The Finnish Environment Institute (SYKE)
- Swiss Hydrogen SA

RoPax Ferry concept development

Assumptions



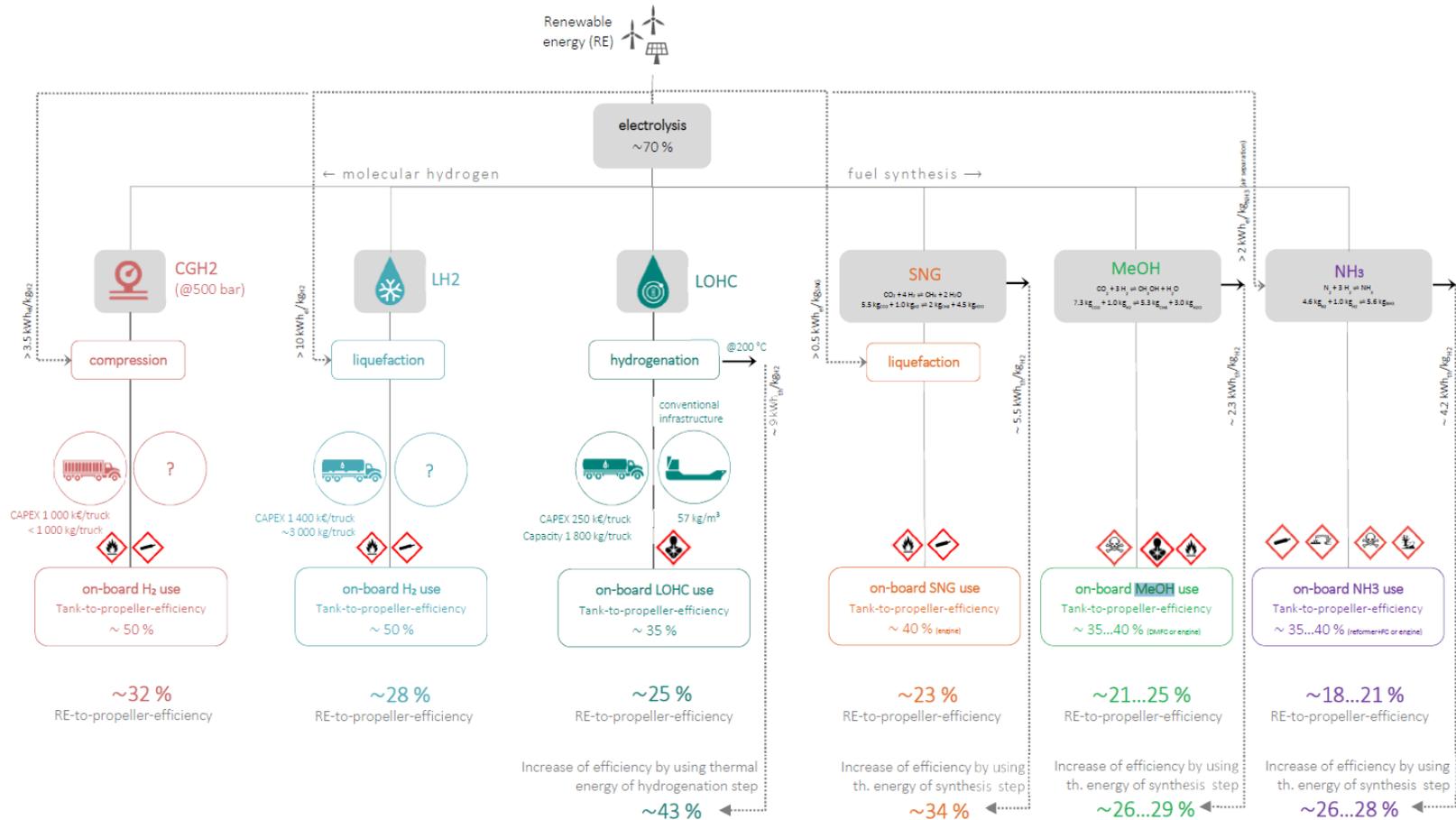
RESTRICTED - May 2018

Energy profile study

Fuel Cell / Battery Balancing

H2 Storage Concept

Electro fuels



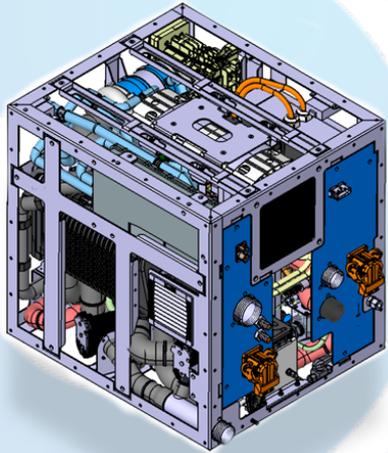
Challenges for maritime implementation

- Bridging the cost gaps – Norway is in the forefront of implementing state funded demonstration projects- 12 projects running with hydrogen.
- Bridging the technology matureness versus commercial expectations.
- Making clean hydrogen available at a low cost in large quantities.
- The real z-emission alternatives are there – legislation is not!

Towards Zero Emissions



Competitive edge with Robustness and Power



	PowerCell MS100	Closest competitor	Difference MS-100 vs competitor
Power (kW)	106.00	100.00	Same
Power density kW/L	0.40	0.15	+169%
Power density kW/kg	0.53	0.25	+105%
Current range (A)	45-450	20-250	Per stack same
Voltage range (V)	250-500	250-500	Same
Idle Power	8	8	
Dimensions (mm)	600*690*590	1200*870*506	-116%
with air filter	NA	NA	NA
Weight (kg)	200	250	-20%
Environmental protection	IP54*	IP67	Design ongoing
Operating temperature C	-30 to 45 C	-30 C to 50 C	Almost same
Max efficiency (%)	61	57	Same
Power ramp rates (A/s)	51	25	104%