

**The Power of Simplicity**



**Methanol Fueled Fuel cell Vehicles**

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# SerEnergy in short...

- Located in Hobro, Denmark
- Established 2006
- 25 employees
- 500 kW shipped
- Privately owned
  - Founders
  - Fischer Group GmbH



# HT PEM



Air cooled

Sub 1 Kw

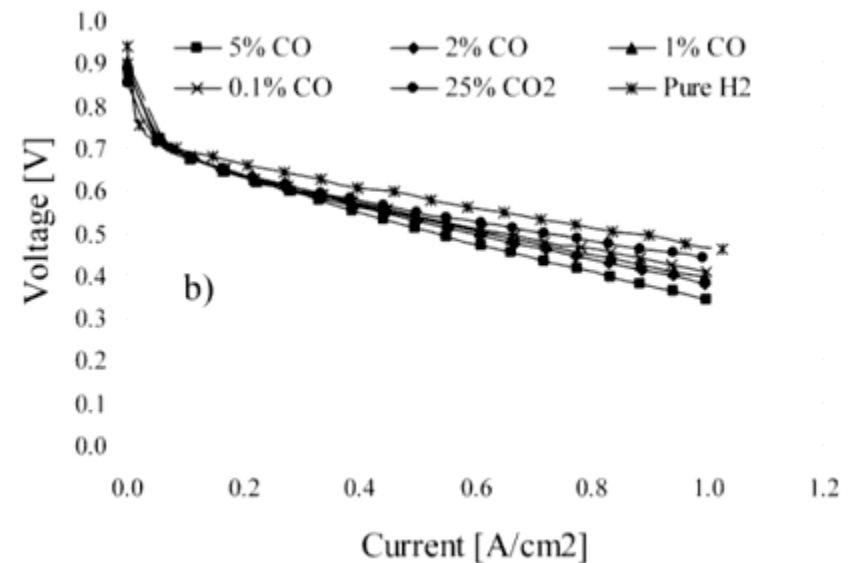


Liquid cooled

1-5 kW

# HT PEM

- High operational temperature (120-180° Celsius) gives you the benefit of:
  - High CO tolerance. High Sulfur tolerance +5 PPM
  - Simple reformer integration
  - Cooling at high temperatures
  - No water management

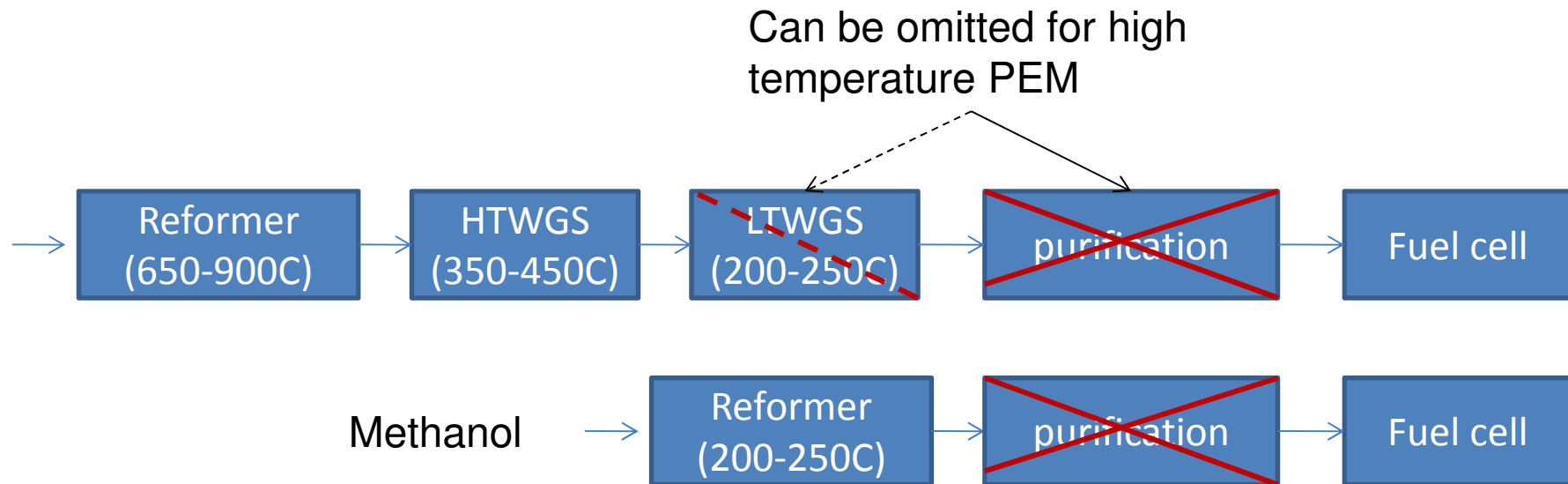


# HT PEM modules

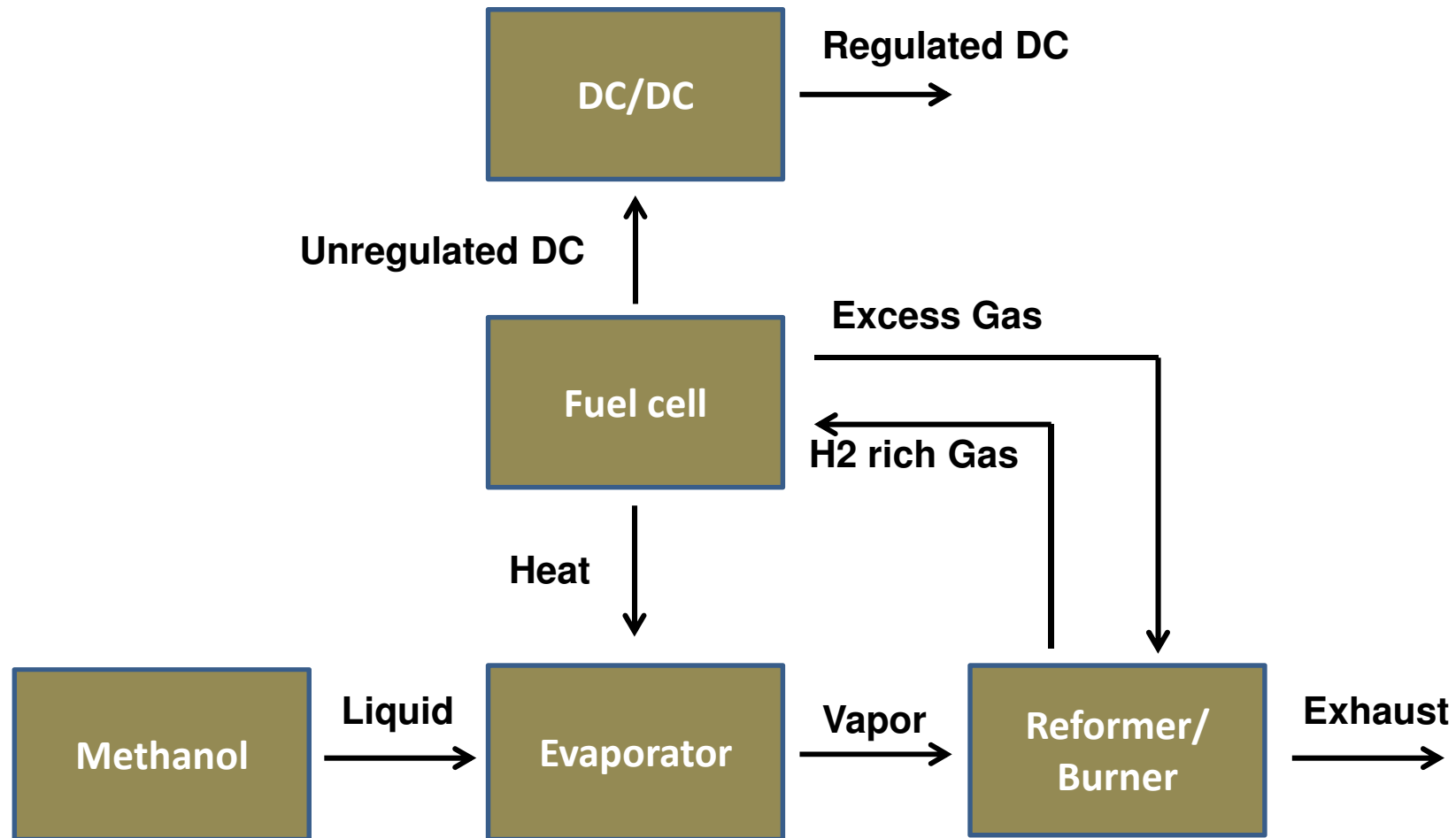
- Serenus 166 Air C – 1 kW
- Serenus 390 Air C – 3,2 kW
- Serenus 25/65/120 Liquid C - 1-6 kW



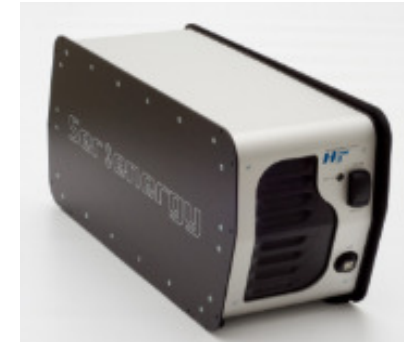
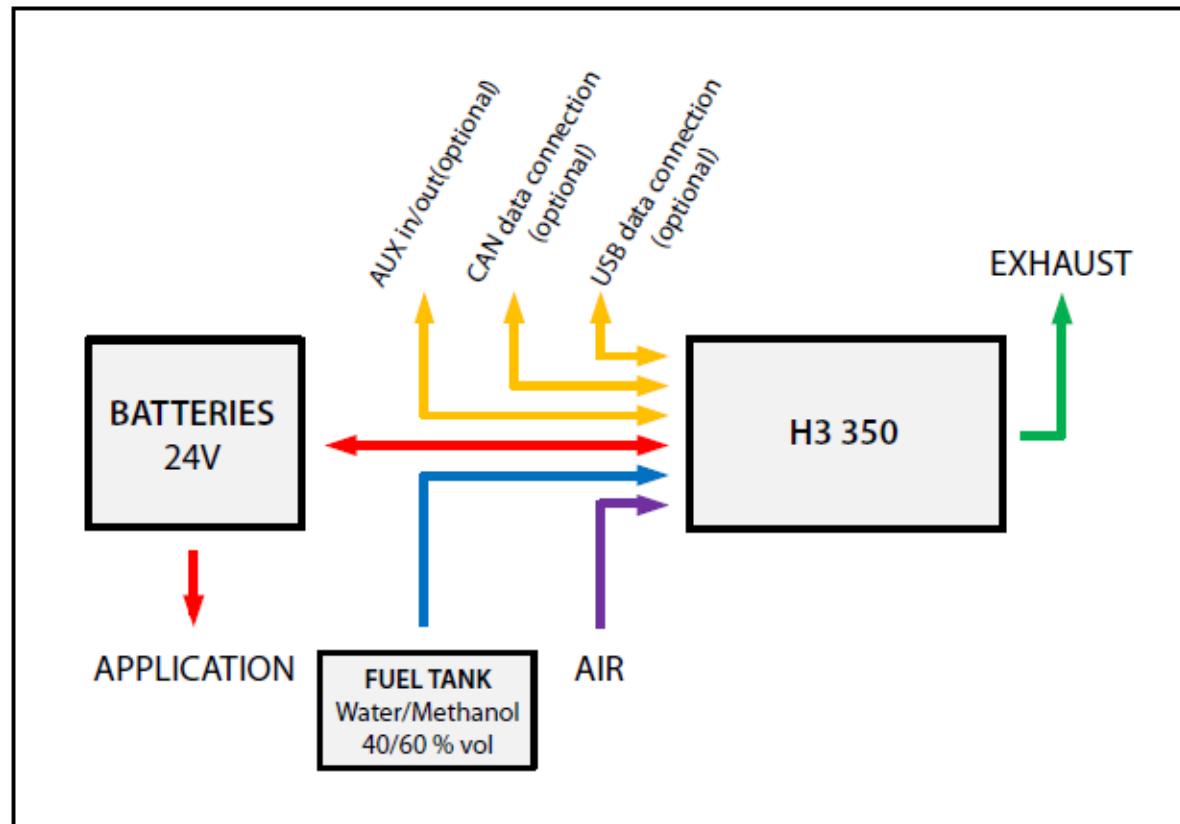
# Fuel reforming



# Reformed Methnaol Fuel Cell



# RMFC concept

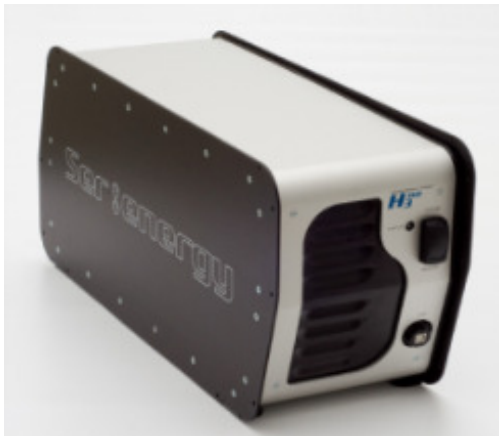


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# Hybridisation

- Energy density of a liquid fuel
- Power density of a battery



**Energy**

**+**

**Power**

**=**

**Solution**

# H3-350

**Weight: 13kg**

**Charging power: 350W**

**Fuel consumption: 0.45l/h**

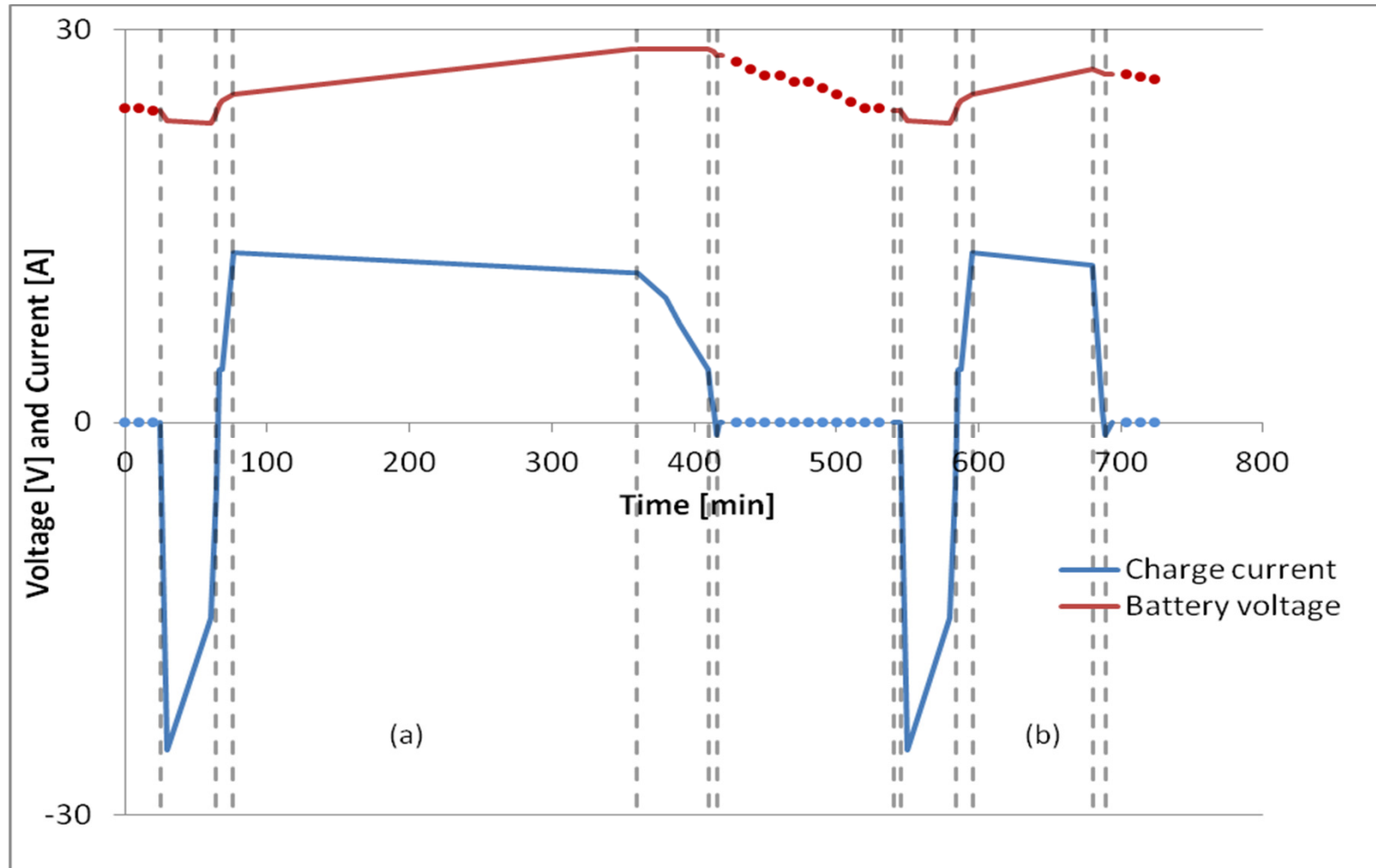
**Fuel: 60%MeOH in Water (~12MJ/kg)**

**10L gives 22 hours of operation (7.7kWh)**



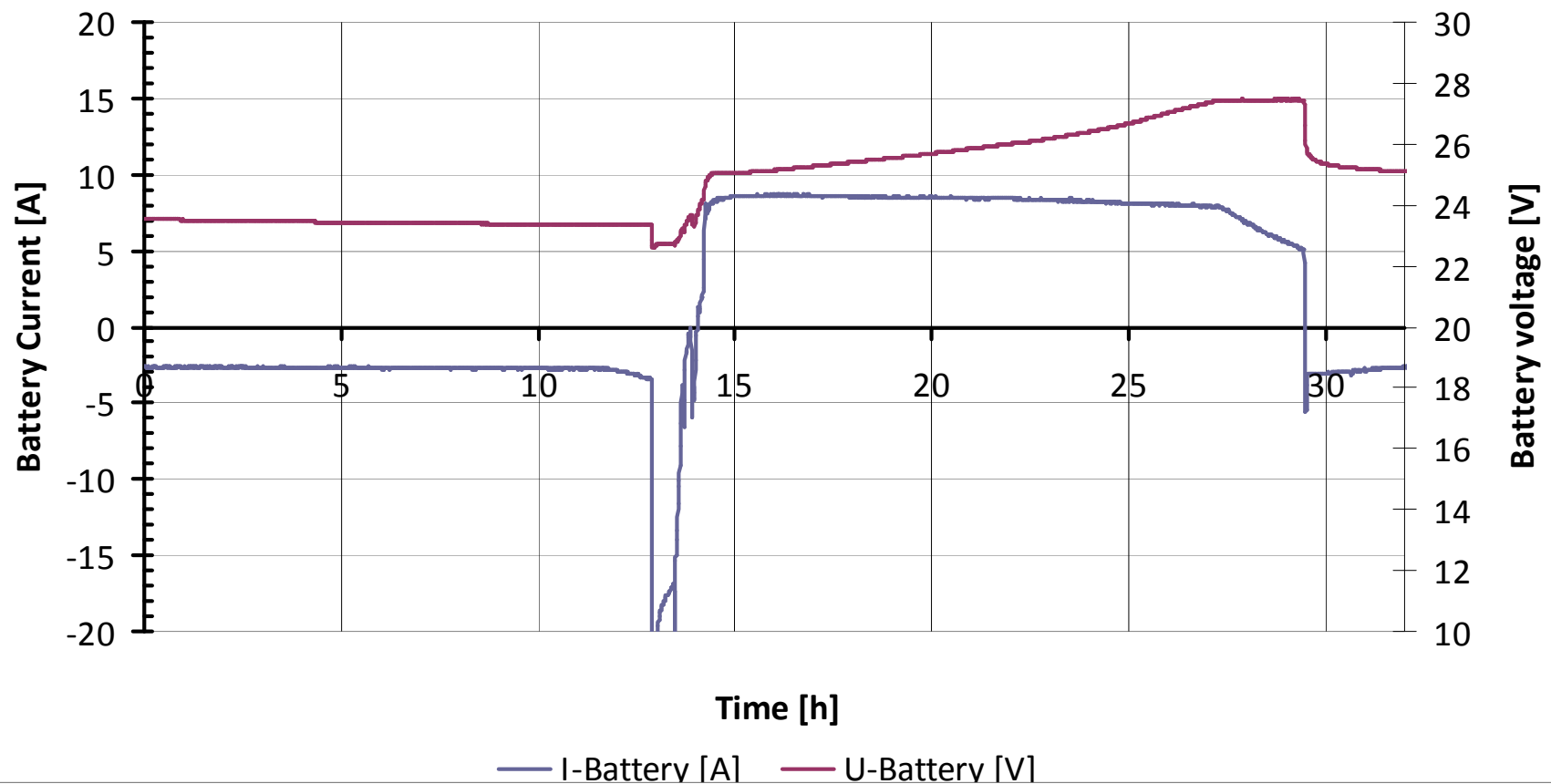
**Ser:energy®**

# Theoretical charging cycle

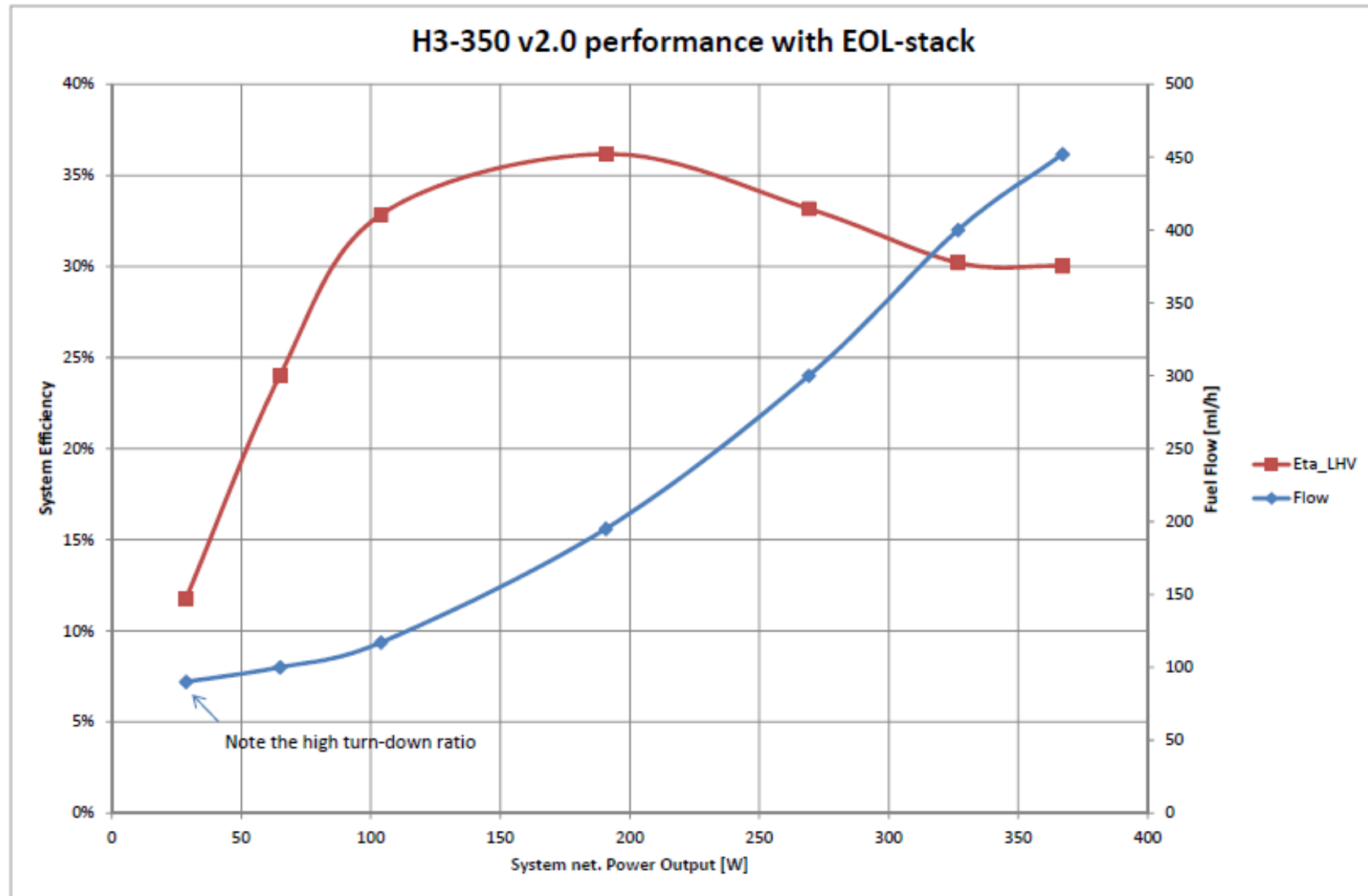


# Charging example

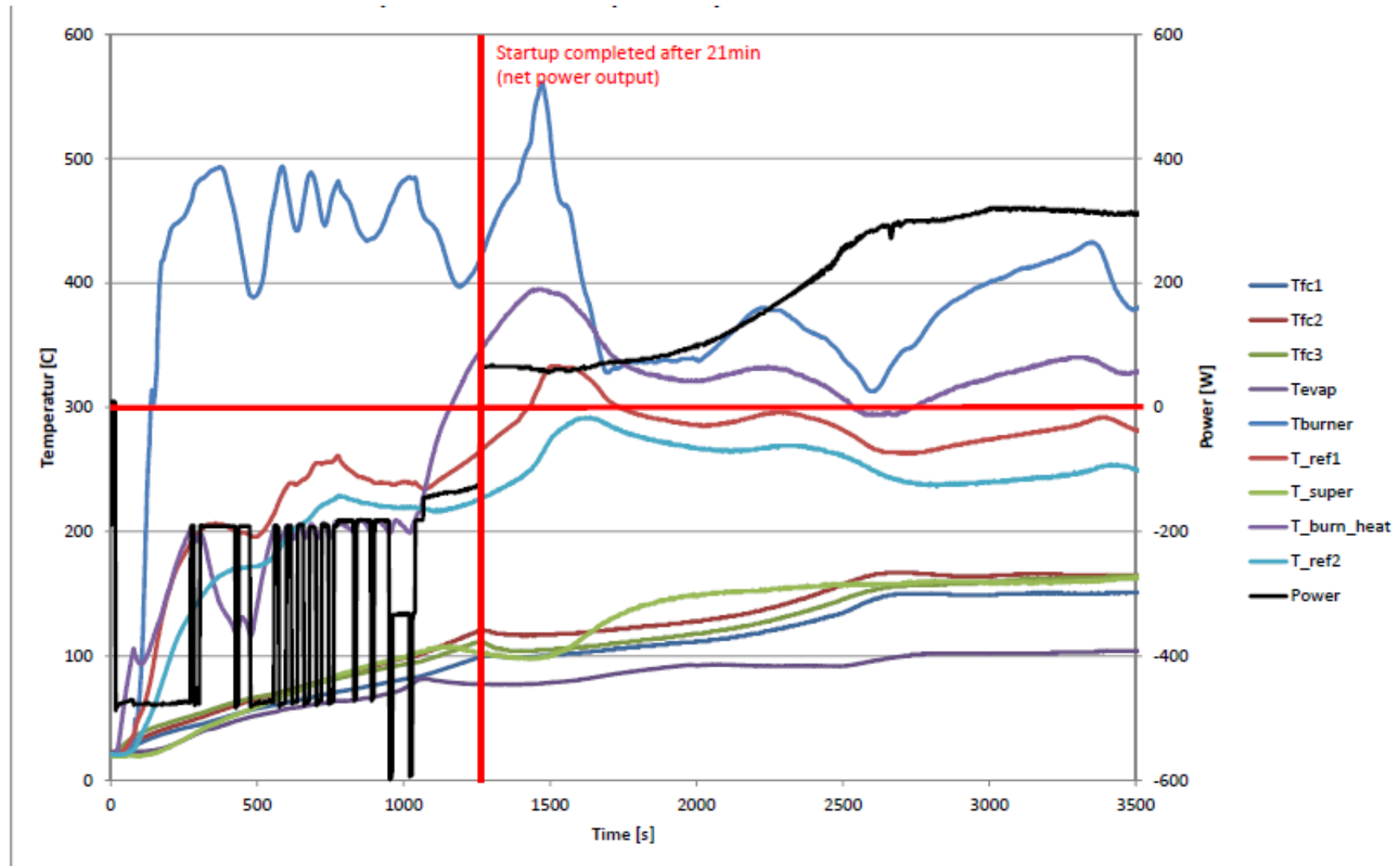
Charging cycle obtained  
24V battery system in operation



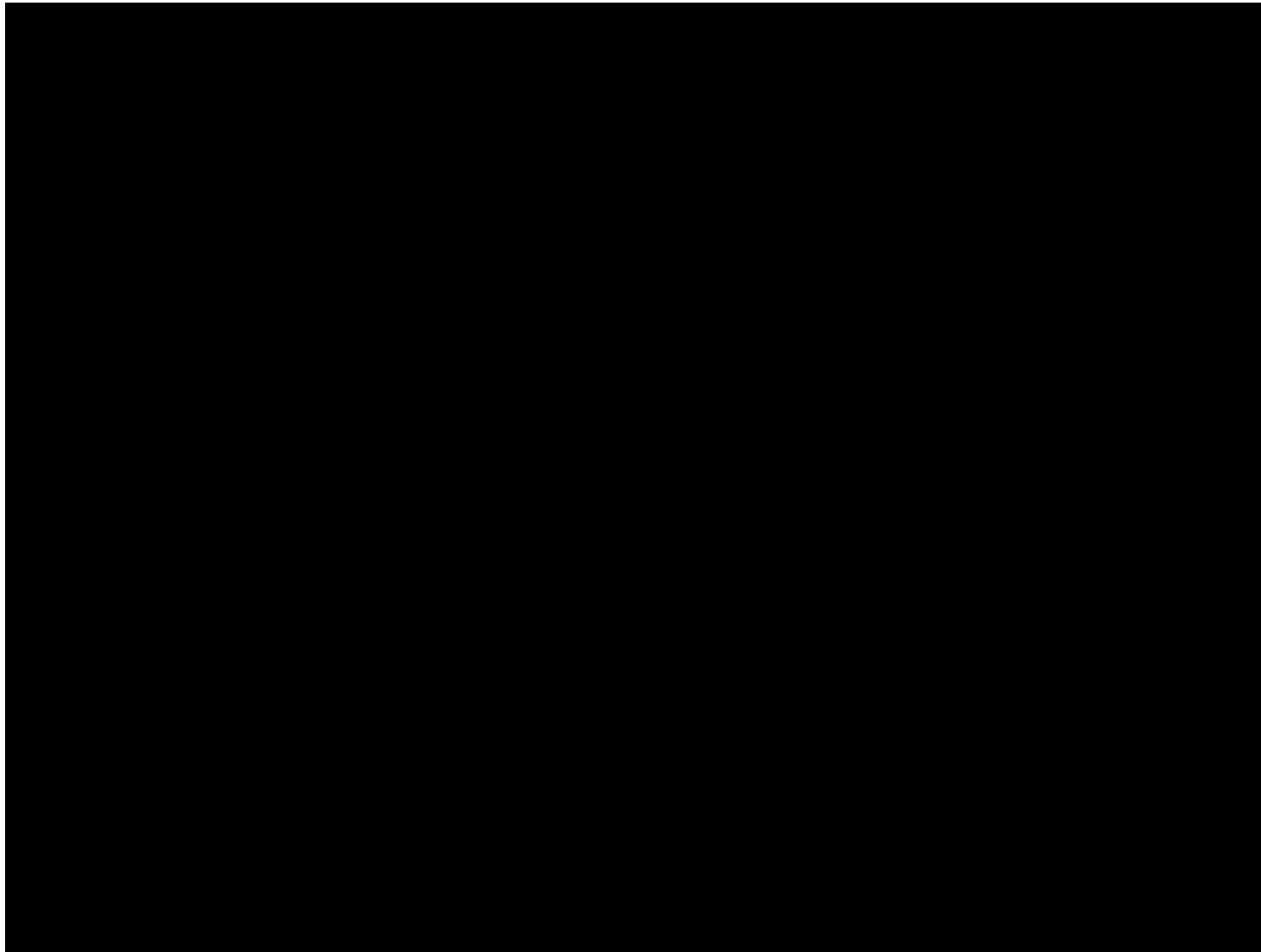
# H3 350 - EOL performance



# H3 350 start up - EOL



# GMR – Stama truck



<http://www.youtube.com/watch?v=EKLaP5ytwxw>

# Methanol

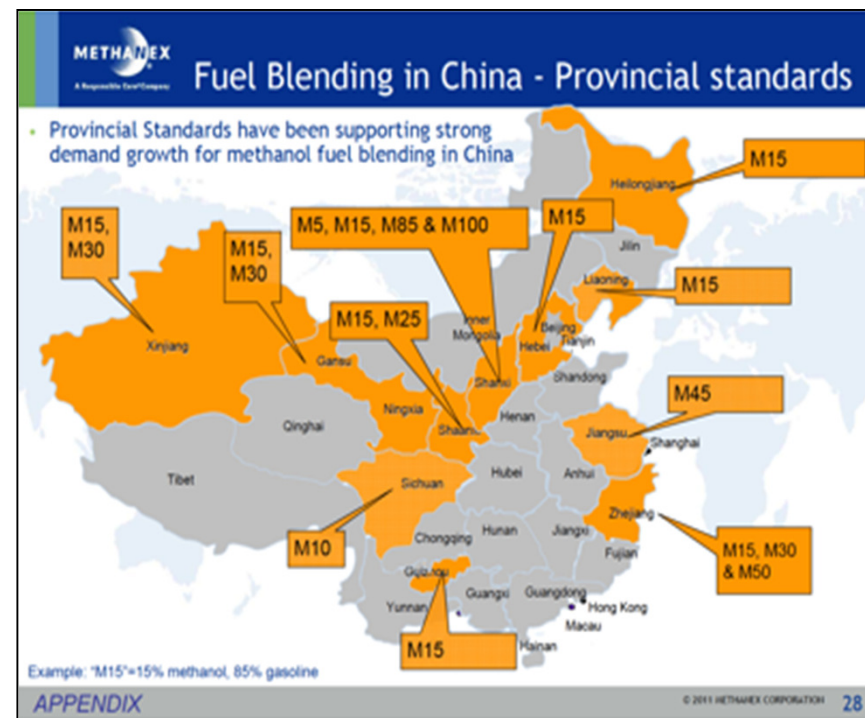
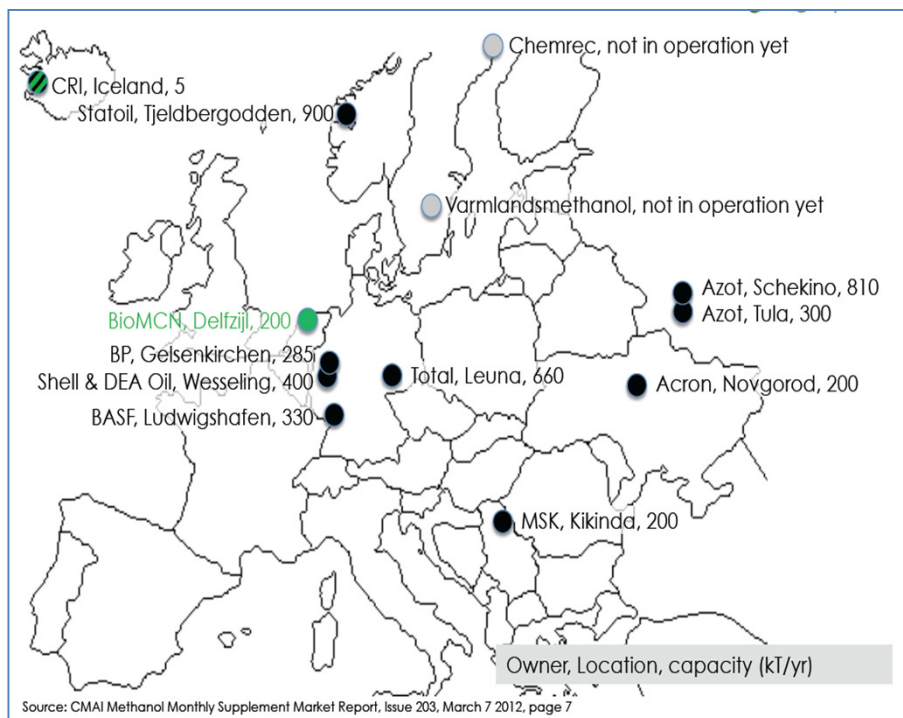
- WW market
  - 50 Bn liters
  - 1250 Bn liter (Gasoline)
- Renewable?
  - CRI (H<sub>2</sub>+CO<sub>2</sub>)
  - BioMCN (Glyserin)
  - Varmland (Biomass)



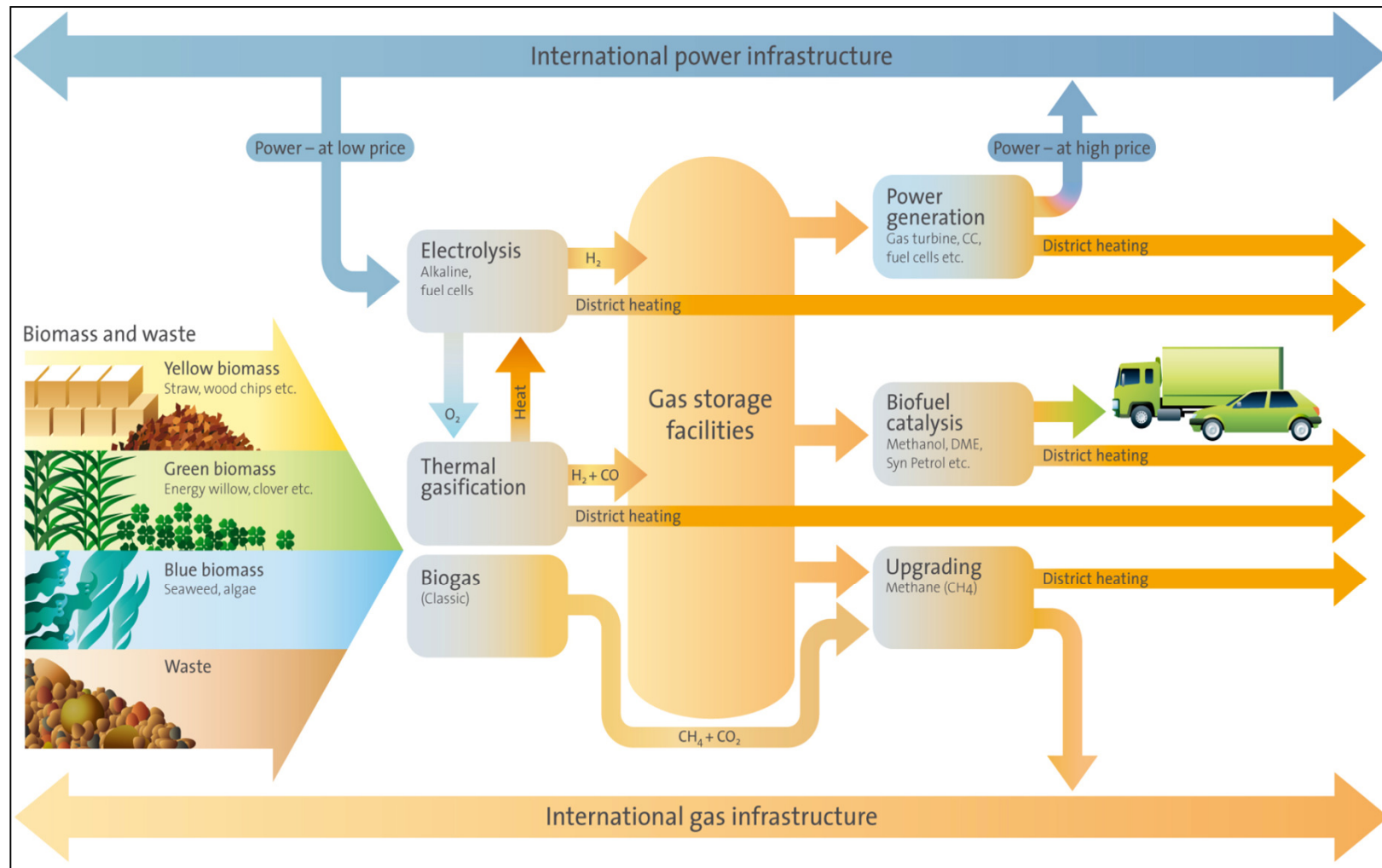


# Capacity and usage

- Low blends – High blends – pure methanol



# Energinet.dk



# MecC

- Enabling E mobility for all purposes and user needs
- Range between refueling up to 800 km
- Heat and cooling as fuel cell waste products
- Cheap, clean and renewable fuel from biomass or hydrogen synthesis
- No infrastructure investment – a rolling change from fossil to Methanol



**Ser & energy**®

# Outlook

- Fewer components
  - Lower complexity
  - Heat rejection
  - Simple fuel system
  - Component recycling
- 
- Demonstration
  - Further technology development





# Thank you

Work was supported by the EUDP program

