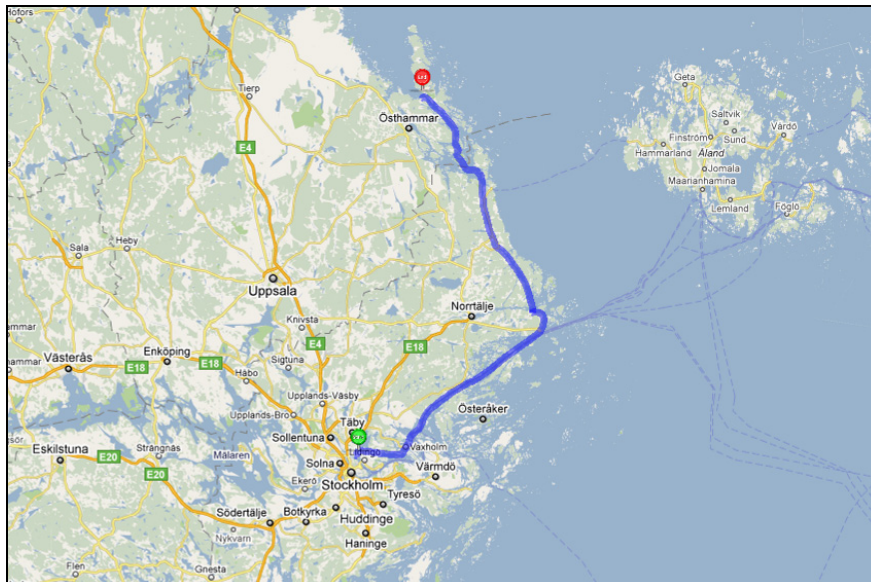


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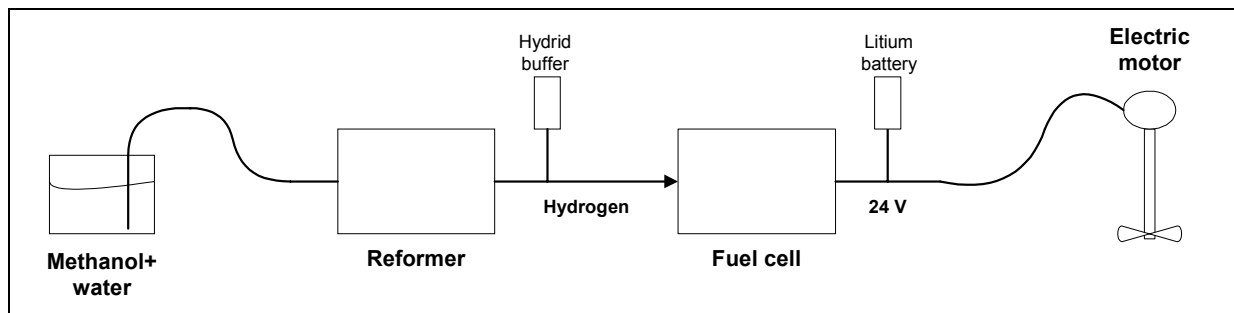
Reliability test of fuel cell system

Powering of boat in 162 km trip through Stockholm archipelago

A boat powered by a fuel cell system has made a trip from Stockholm to Öregrund in the north of the Stockholm archipelago. The trip took place Sunday-Monday 17-18 October. The fuel cell system was based on the Cellkraft S-1000 fuel cell and the Genesis 20L-D reformer. The test was part of project performed by Cellkraft, financed by the Swedish Defence Material Administration. The purpose has been to demonstrate a robust and efficient fuel cell system to generate electric power from methanol. The journey had a total length of 86,5 nautical miles (162 km). It was performed in two non-stop day trips in a small boat with a two men crew. The average speed was 4,6 knots. 13 litres of methanol was consumed. The energy content is equal to 5 litres of diesel.



The boat was propelled by an electric outboard engine that got electric power from a fuel cell. The fuel cell was fed with hydrogen from a reformer that continuously converts methanol to hydrogen. The test is likely the first fuel cell powered boat trip in Sweden and one of the longest in the world. The energy consumption was 0,06 diesel equivalent per nautical mile.



Schematic: The propulsion system

Function: Methanol water mixture is the fuel. It is converted in the reformer to hydrogen. Hydrogen is fed to the fuel cell where it is converted to electric power. There is a small hydrid buffer on the hydrogen side. Similarly there is a lithium ion battery on the electric side. The fuel cell can deliver 1000 W continuously. The battery can supply 1000 W for 30 minutes.

Reformer	Genesis 20L-D
Efficiency	75%
Capacity	20 litres of hydrogen/min
Fuel cell	Cellkraft S-1000
Voltage	24 VDC
Efficiency	47 %
Power cont.	1000 W
Power max (30 min)	2000 W (litiumjonbatteri)
Consumption at 1000 W	12,7 l hydrogen/min
Electric motor	Torqueedo Cruise 2.0 R
Voltage	24 VDC
Power	2000 W
Boat	Linder 440 Fisher

Table: Technical data

Further information:

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Cellkraft is a Swedish manufacturer of fuel cells, founded 2000. Cellkraft is privately held and profitable since 2001. Cellkraft has earlier shown their technological excellence when they were the first manufacturer to develop and sell fuel cells able to start up from sub zero without relying on electrical heating – Systems that have been tested in the Antarctic.

Attached: Pictures



Fuel cell system in the boat.



1000 W to engine



Methanol tank.



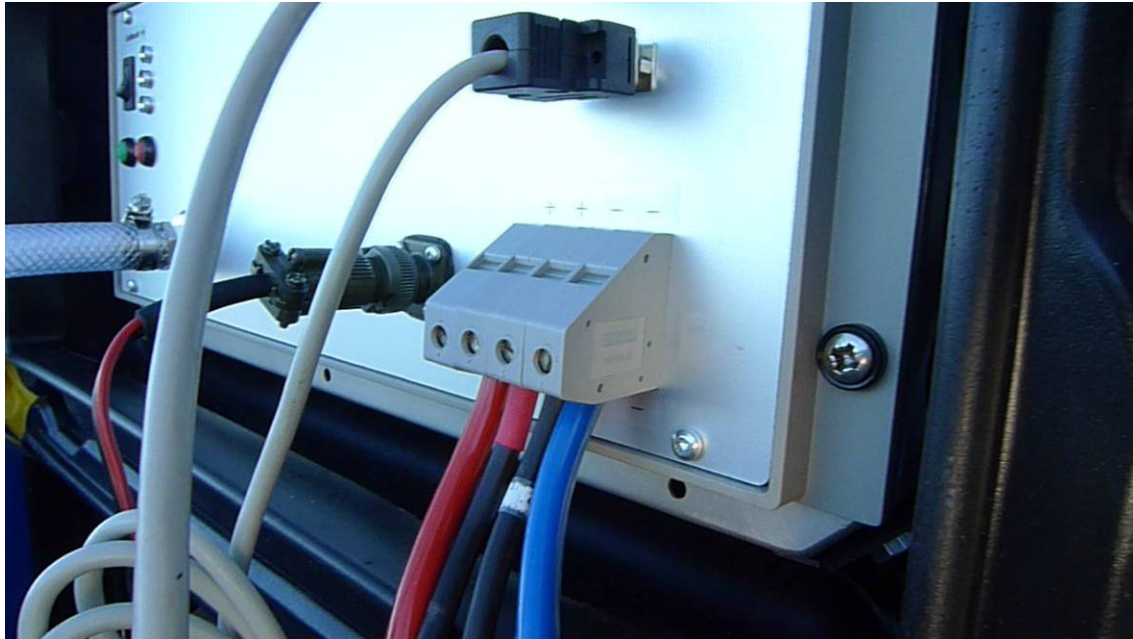
Reformer.



Hydrogen output from reformer.



Fuel cell.



Electric power from fuel cell.



Electric cable to motor.



Throttle. Voltage: 26,0 V. Speed: 4,7 knots. Power: 854 W.



Motor.



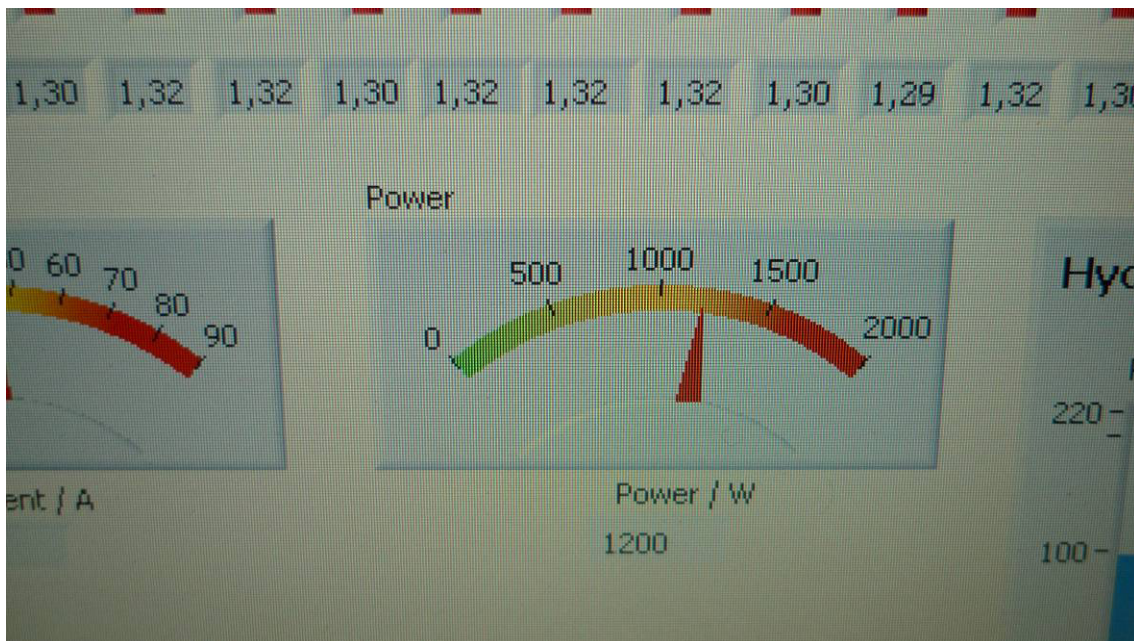
Sunset day one.



Lantern.



Fuel cell.



Fuel cell power.



Singö bay.



Singö bay 2.



Öregrund. Peter Gode.



Öregrund. Anders Ocklind.