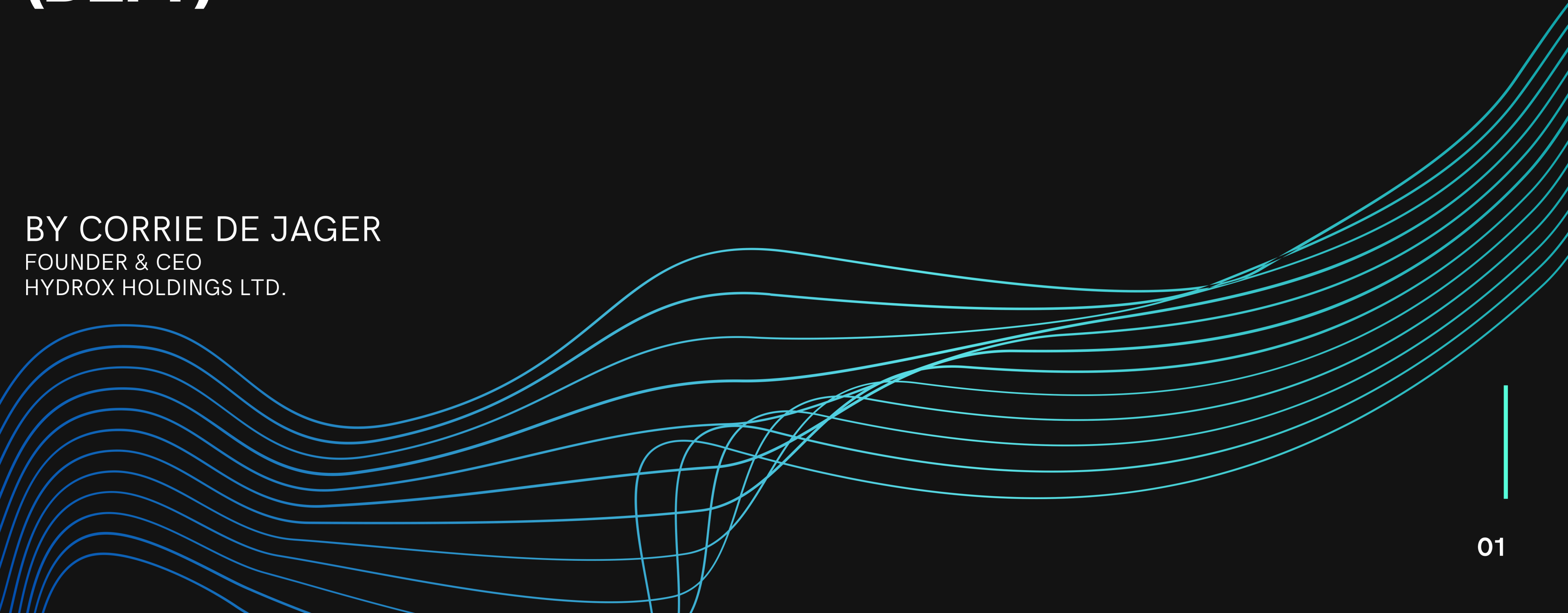


DIVERGENT ELECTRODE FLOW THROUGH ELECTROLYSIS (DEFT)



MONACO
HYDROGEN
FORUM
MOVING THE WORLD
WITH GREEN HYDROGEN

BY CORRIE DE JAGER
FOUNDER & CEO
HYDROX HOLDINGS LTD.



“ INCREMENTAL IMPROVEMENTS TO EXISTING TECHNOLOGIES
AREN'T ENOUGH: WE NEED SOMETHING TRULY DISRUPTIVE”

GOOGLE ENGINEERS ROSS KONINGSTEIN AND DAVID FORK

NOV 2014

The standard method to extract hydrogen from water through electrolysis has for the past 200 years remained unchanged. Two electrodes separated by a membrane. Even the latest state-of-the-art PEM electrolyser (invented more than 60 years ago) all utilize a membrane.

Hydrox Holdings is proud to pioneer the **FIRST MEMBRANELESS ELECTROLYSER** through their patented DEFT system which promises to be that “truly disruptive technology”



THE CHALLENGE

HIGH PRODUCTION COSTS

Less complexity, fewer components and longer lifespans drive reductions in the associated CAPEX and OPEX. Membraneless operation enables **direct linkage to renewable energy sources** avoiding the cost of power conditioning equipment.

HARD TO ABATE SECTORS - MARINE AND TRANSPORT

Lowering the cost of electrolytic hydrogen is the gateway to the widespread adoption of green hydrogen in the **mobility and marine sectors**. This extends to energy storage applications and large scale **conversion of hydrogen into ammonia, methanol and e-fuels**.

TEMPERATURE LIMITATIONS - WASTE HEAT REMOVAL

Conventional electrolyzers lose between **25-30% of their electrical input** as waste heat. This drives up the price of electrolytic hydrogen making it uncompetitive to that of fossil fuels. DEFT, without a membrane, allows for higher temperature, higher efficiency production.

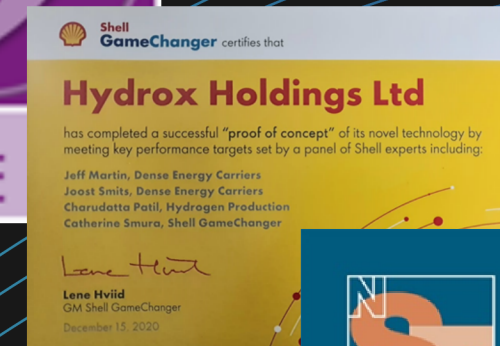
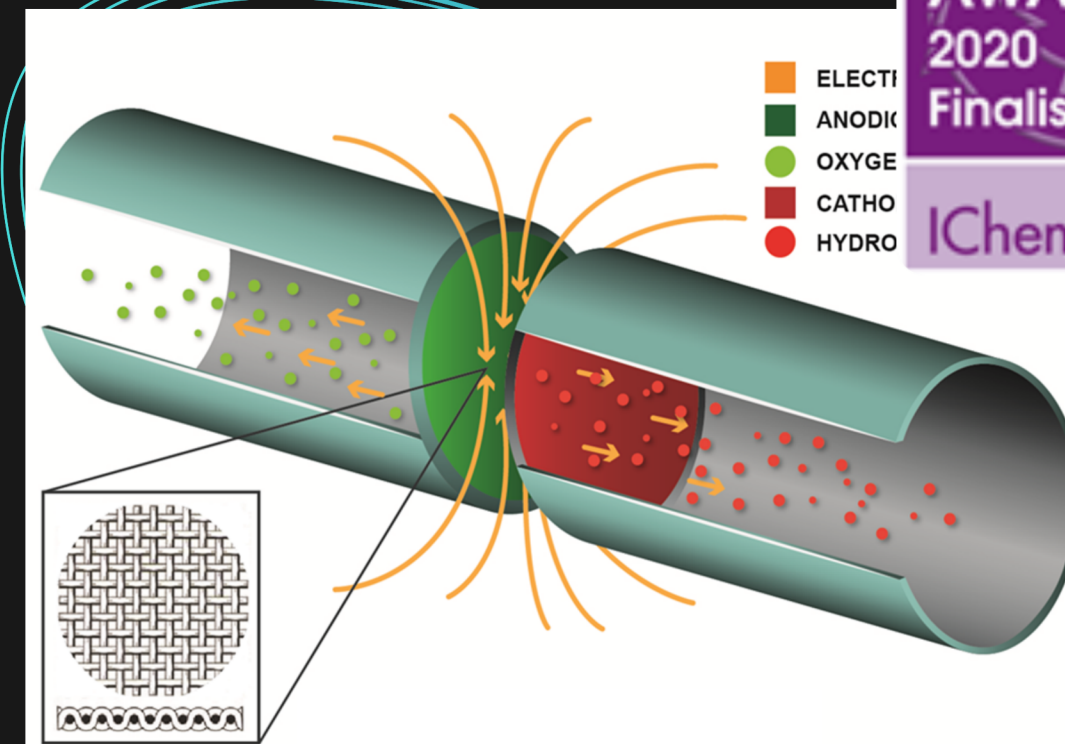
THE DEFT SOLUTION

GAMECHANGER

Hydrox Holdings DEFT solution eliminates the need for a membrane by utilizing the flow of electrolyte to keep the hydrogen and oxygen gases separated and pure.

Membraneless operation reduces the cost and complexity of green electrolytic hydrogen production by simplifying the design and operation of electrolyser cells.

Without the limitations imposed by the inclusion of a membrane the DEFT technology is able to push the boundaries going beyond the operating realm of conventional electrolysers.



DEFT ADVANTAGES



Due to the absence of a membrane the DEFT system can operate off sea water and has the potential to treat acid mine water



The DEFT system can handle fluctuating currents associated with renewable energy sources as there is no membrane. This eliminates the need for power conditioning equipment



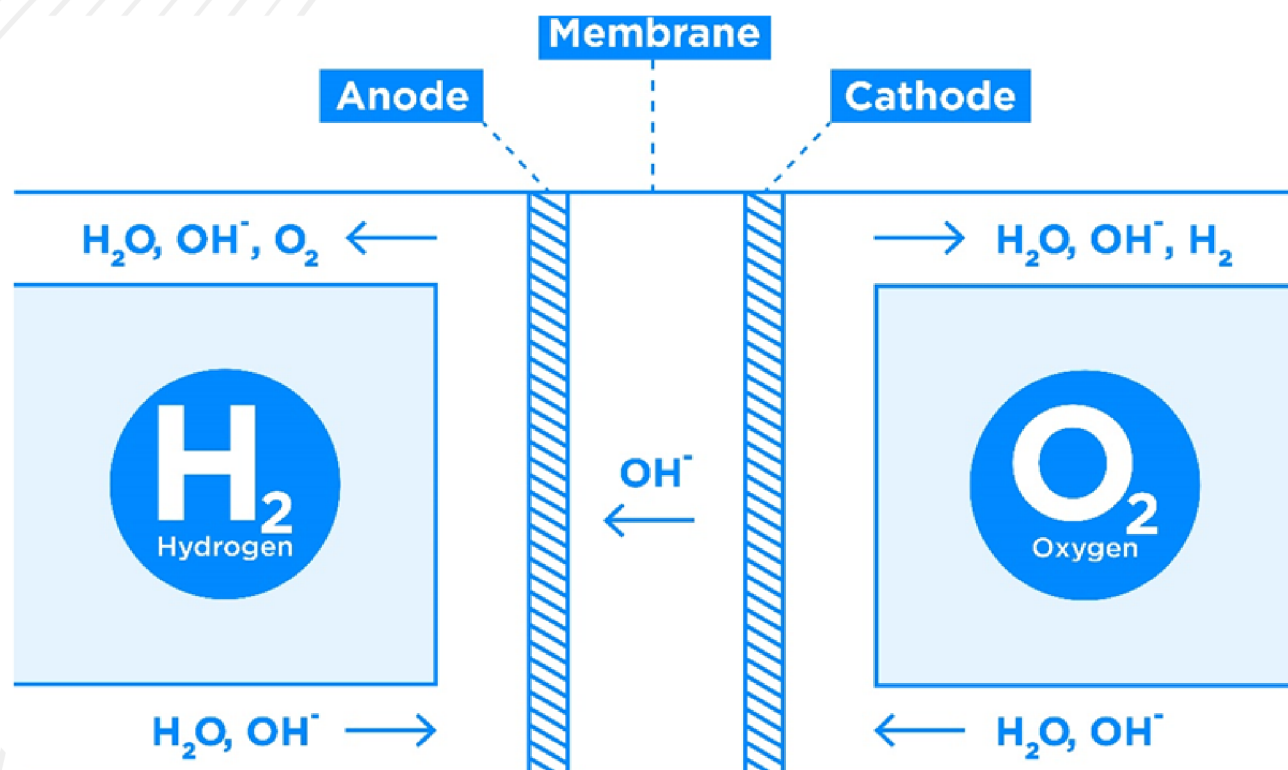
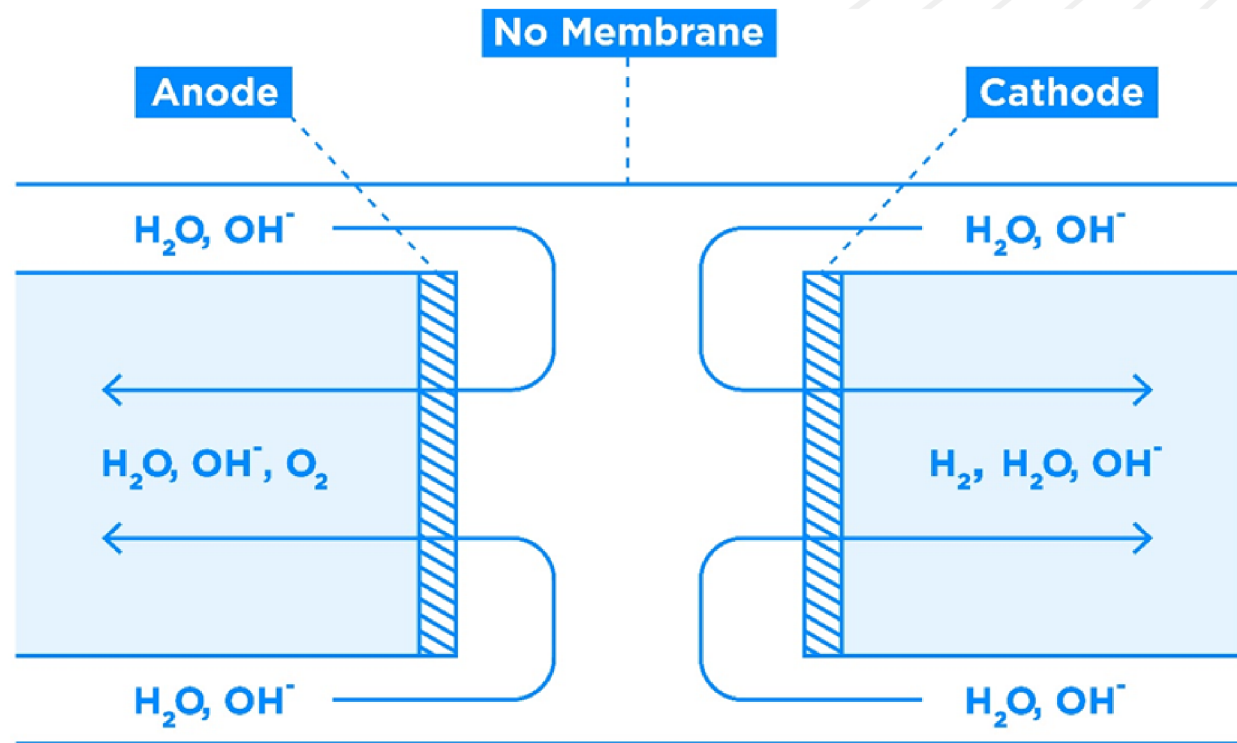
Lower capital costs; less components and a smaller footprint as a consequence of a higher current density (the DEFT system is ideally suited to handle high production volumes of gas)



Lower maintenance costs and longer life spans. Eliminated risk of unexpected shutdowns as a consequence of membrane degradation and rupture.

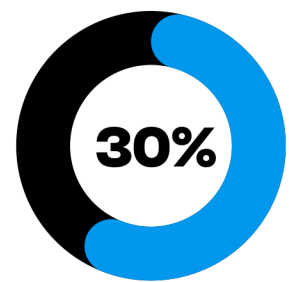


Lower operating voltages as a result of higher current densities; This has a positive effect on the electrolyser's efficiency.



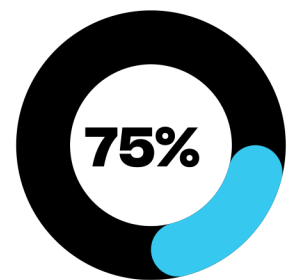
HIGH TEMPERATURE

The DEFT technology can operate at elevated temperatures which drastically increases energy efficiencies as energy losses through waste heat is minimised.



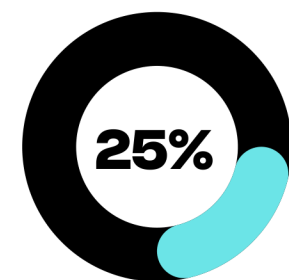
Energy to Waste Heat

With conventional, low temperature electrolyzers up to **30% of the electrical input** is wasted through heat generation/removal



High Energy Cost

The cost of the energy/electrical input accounts for **65 - 75% of production costs.**

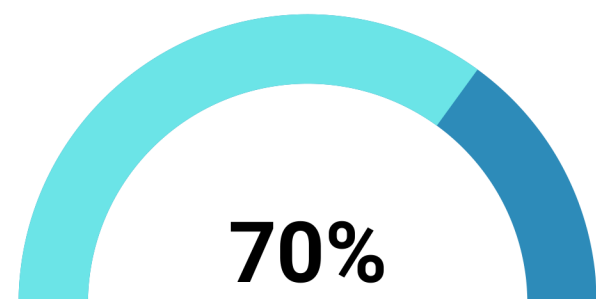


High Temperature - Cost Saving

Operating at elevated temperatures reduces energy consumption and production costs. A **25% reduction** in the production cost of green hydrogen is a very real possibility.

Improved Electrical Efficiency

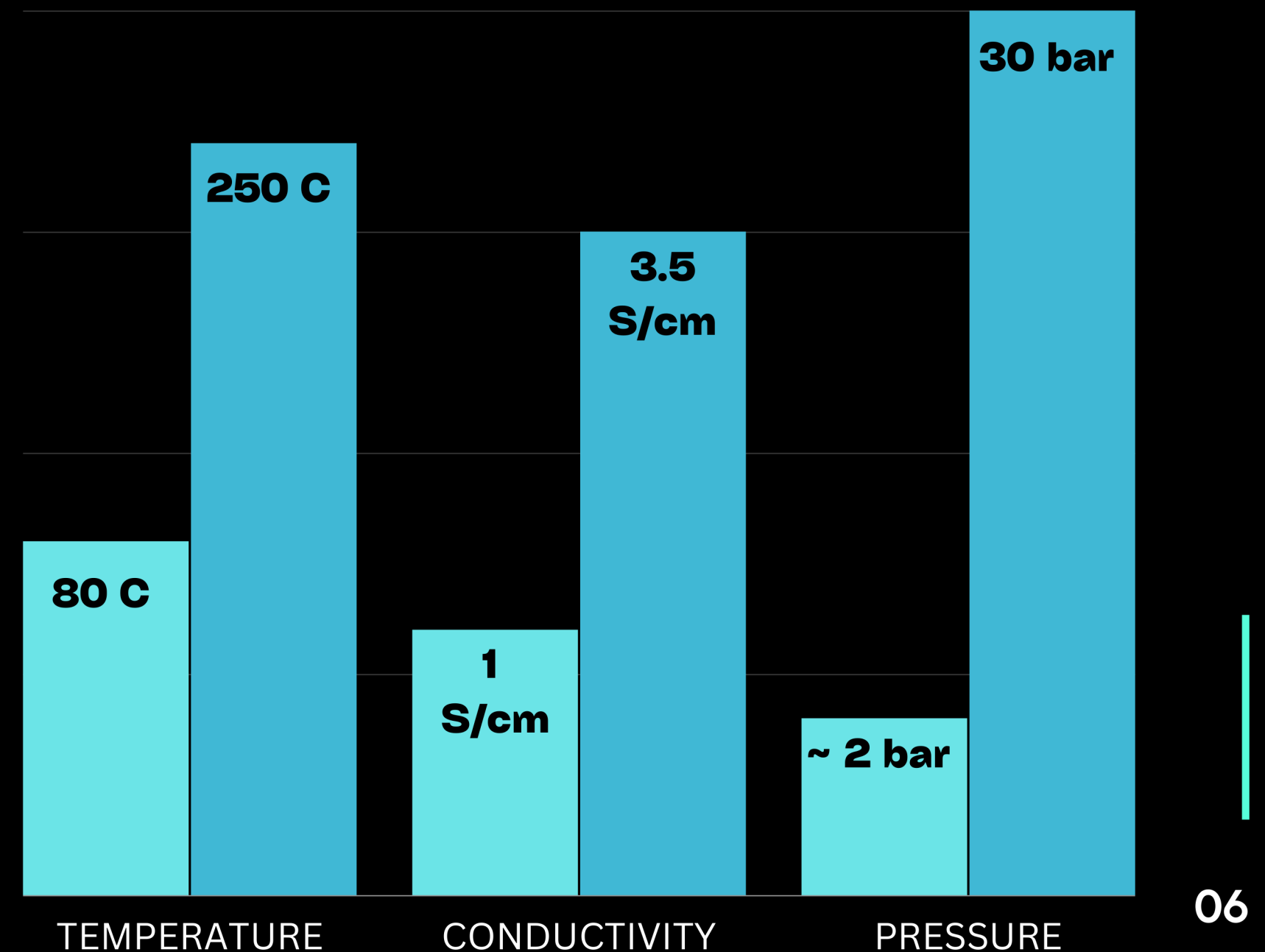
CONVENTIONAL



DEFT



■ CONVENTIONAL ■ DEFT



Thank you

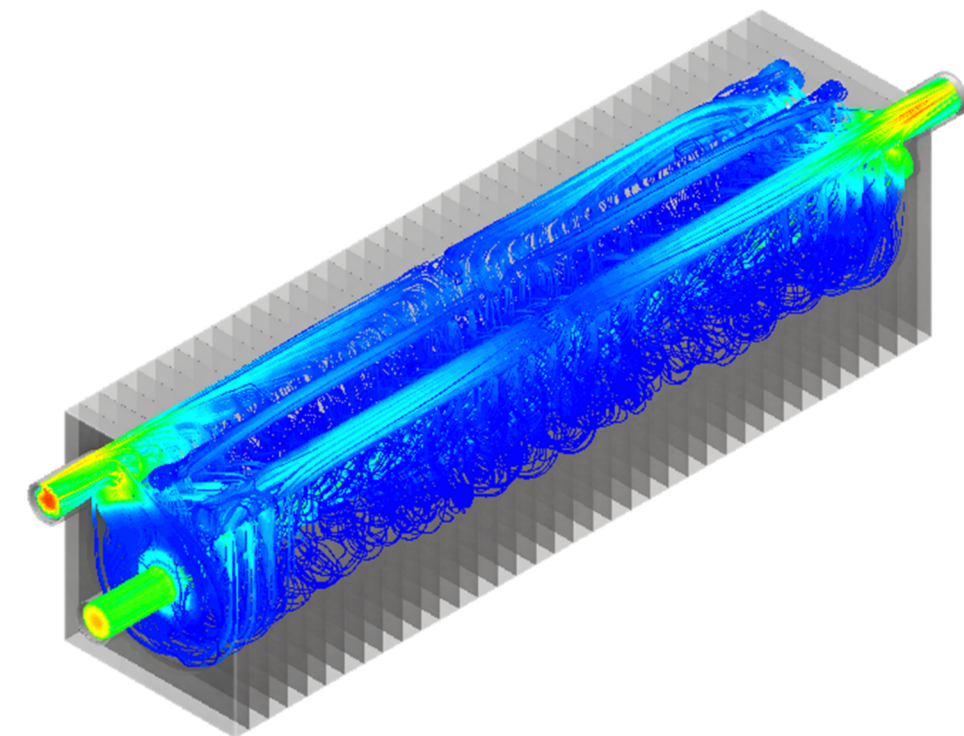


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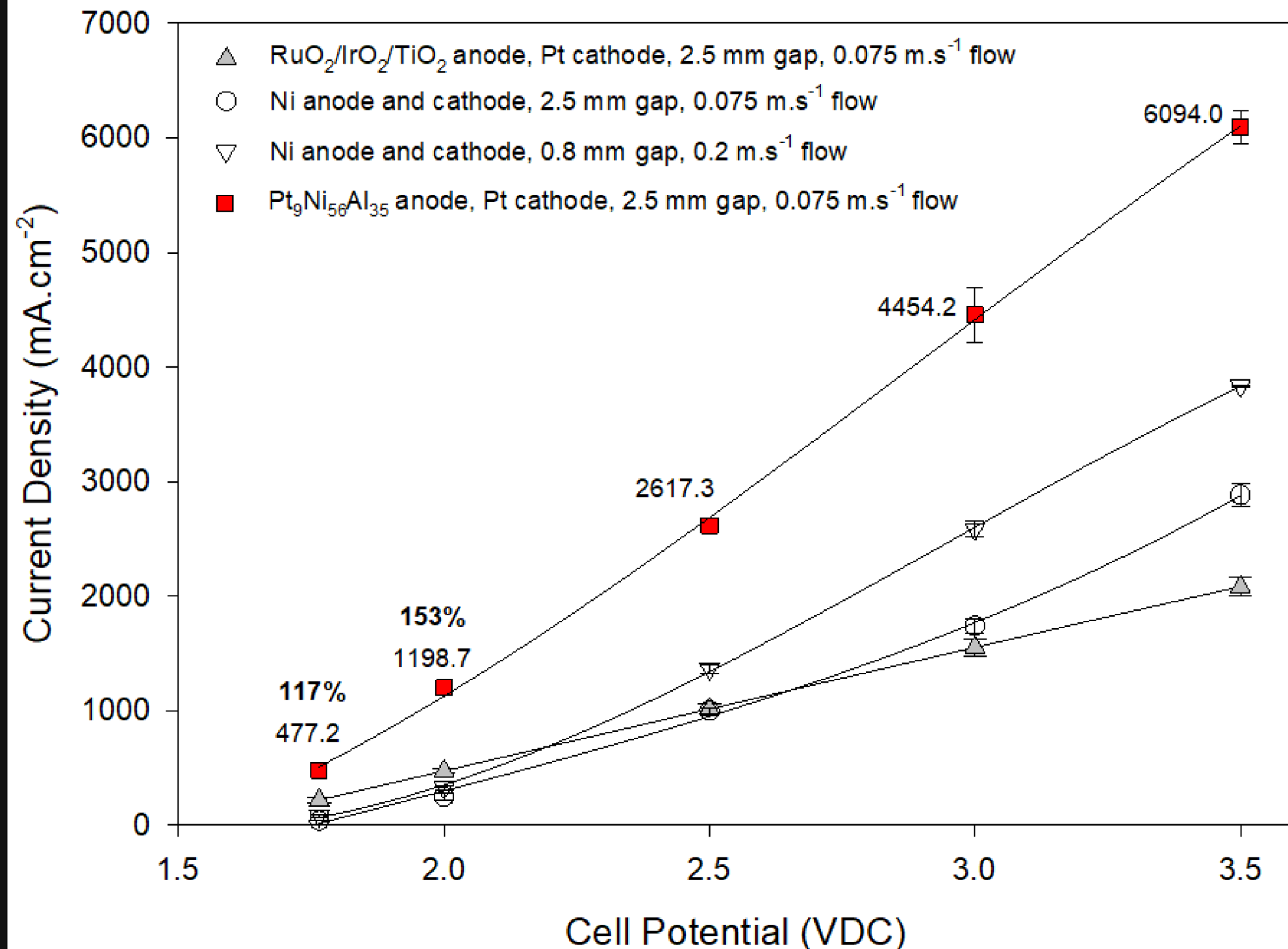
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APPENDIX SLIDE

OPERATING PERFORMANCE CURVE



Source: RJ Kriek, LA van Heerden, A Falch, MI Gillespie, AY Faid, F Seland, *Journal of Power Sources*, Elsevier, 2021, 494, 229344