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Why RED Blue Energy is ready for upscaling into MW-demonstration scale

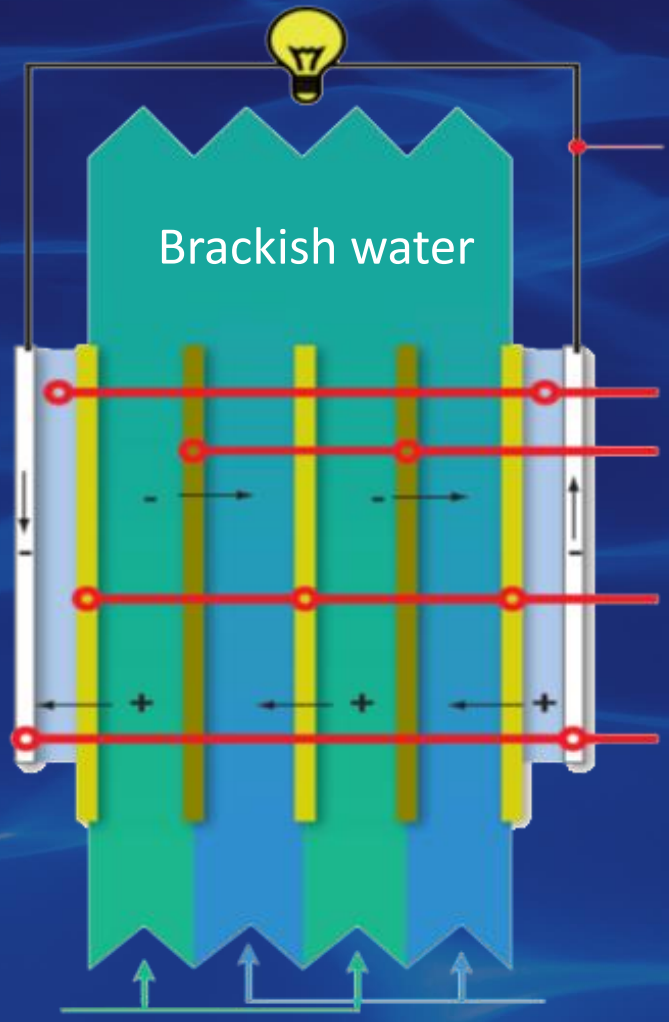
REDSTACK

Blue Energy powering our sustainable future

Blue Energy

- Energy from 2 waterflows with different salt concentrations
- Based on Reverse Electro Dialysis

How it works


Brackish water
DC current
Electrolyte
Membranes allowing negative ions to pass
Membranes allowing positive ions to pass
Electrodes
Salt water
Fresh water

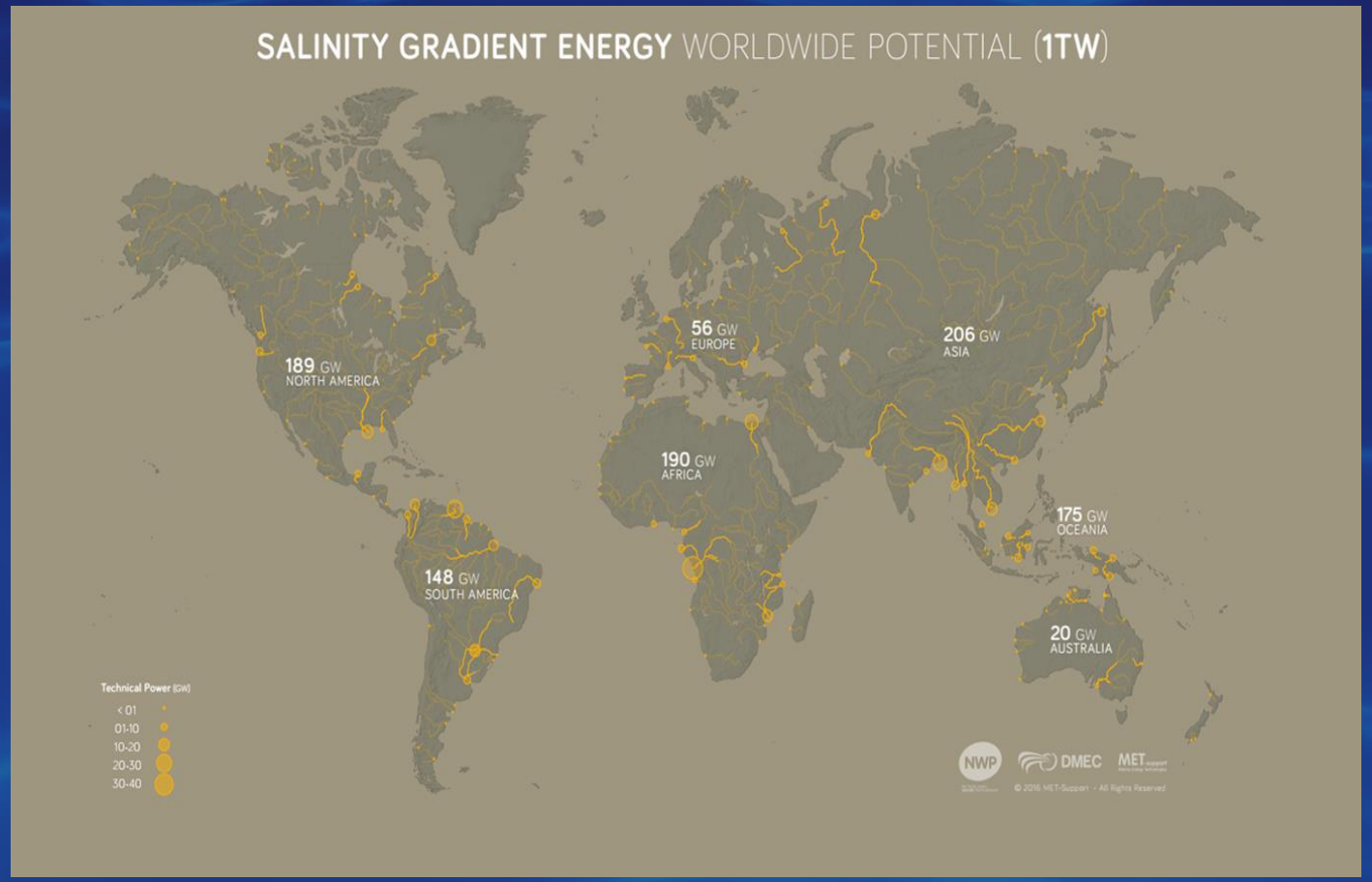
Position Blue Energy within energy mix

- Full sustainable
- Full continuous
- Predictable
- No buffer / storage needed
- No conversion losses
- Generating DC current – Ideal for H2 electrolysers
- Very small ecological impact

Potential in the Netherlands

- Up to 1750 MW based on 365/24/7 continuous production
  - 3 MW The Hague (sewage effluent)
  - 100 MW Afsluitdijk
  - 25 MW IJmuiden
  - 100 MW Zeeland
  - 1500 MW Rotterdam area
  - 25 MW various locations

Global potential of Blue Energy represents up to 12% of global electricity consumption



Who is REDstack?

- Spin-off from Wetsus, European Centre of Excellence in Sustainable Water Technology
- Back-up and support by Wetsus with 18 PhDs
- Wetsus researchers use the REDstack pilot facilities
- Team of 12 fte in close cooperation with institutes and companies
- Founded in 2005, started in 2014, when pilot plant (TRL7) was commissioned
- Developments supported by several EU-funds
- Awarded the title of Dutch National Icon by the full Board of Ministers

Pilot plant (TRL7) at Afsluitdijk (NL)

Pilot plant (TRL7) at Afsluitdijk (NL)

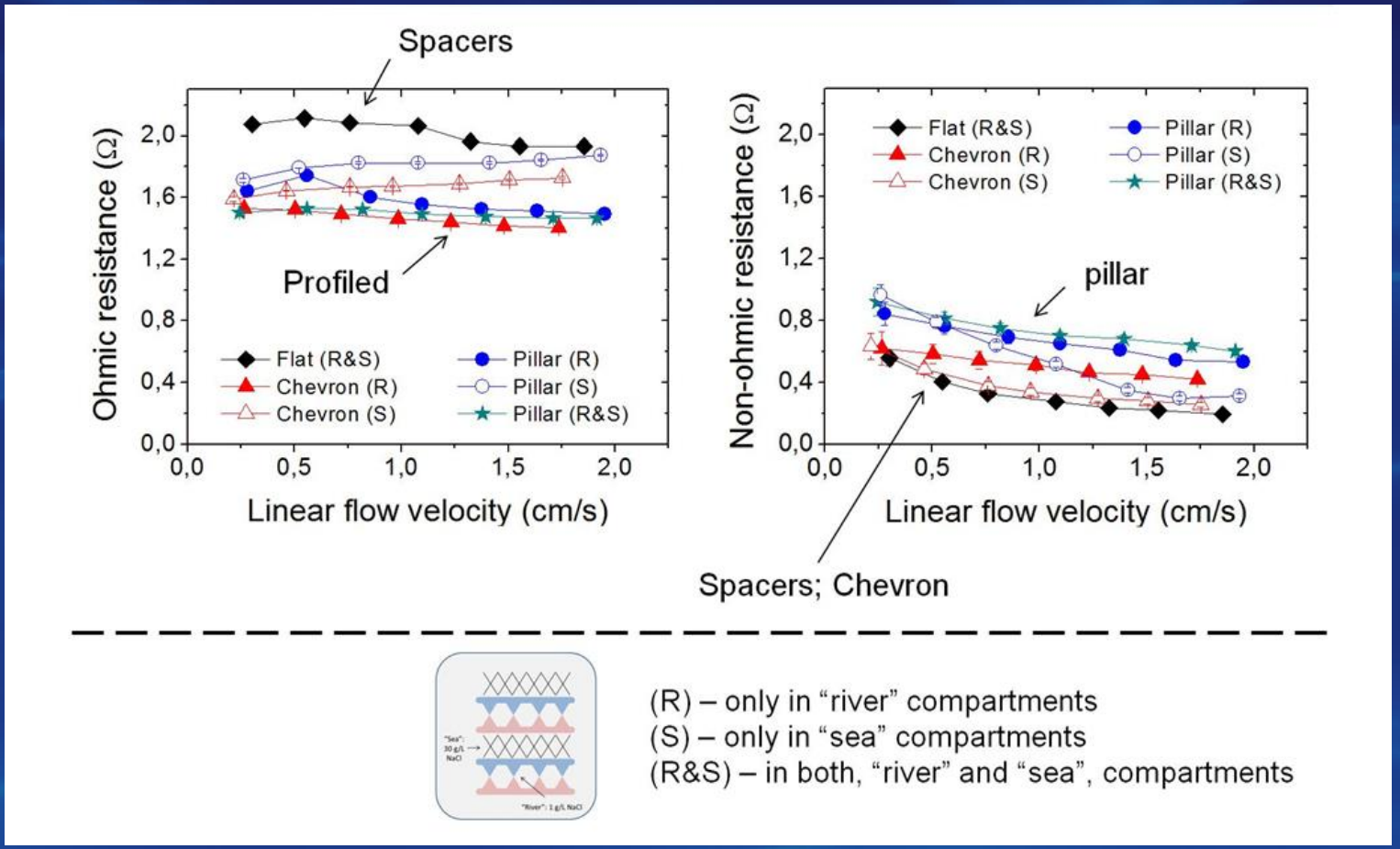
How did we meet our targets?

- In 2004 model-calculations stated that:
  - 1 MW could be harvested at flow of 1 m3/s of freshwater and 1 m3/s of seawater
  - Power density of 2 W/m2 of membrane, should be achievable when using seawater and river water as power source
  - Confirmed by test in Wetsus laboratories (2011) and pilot plant TRL7 (2019)
  - However, salt concentrations and temperature are important

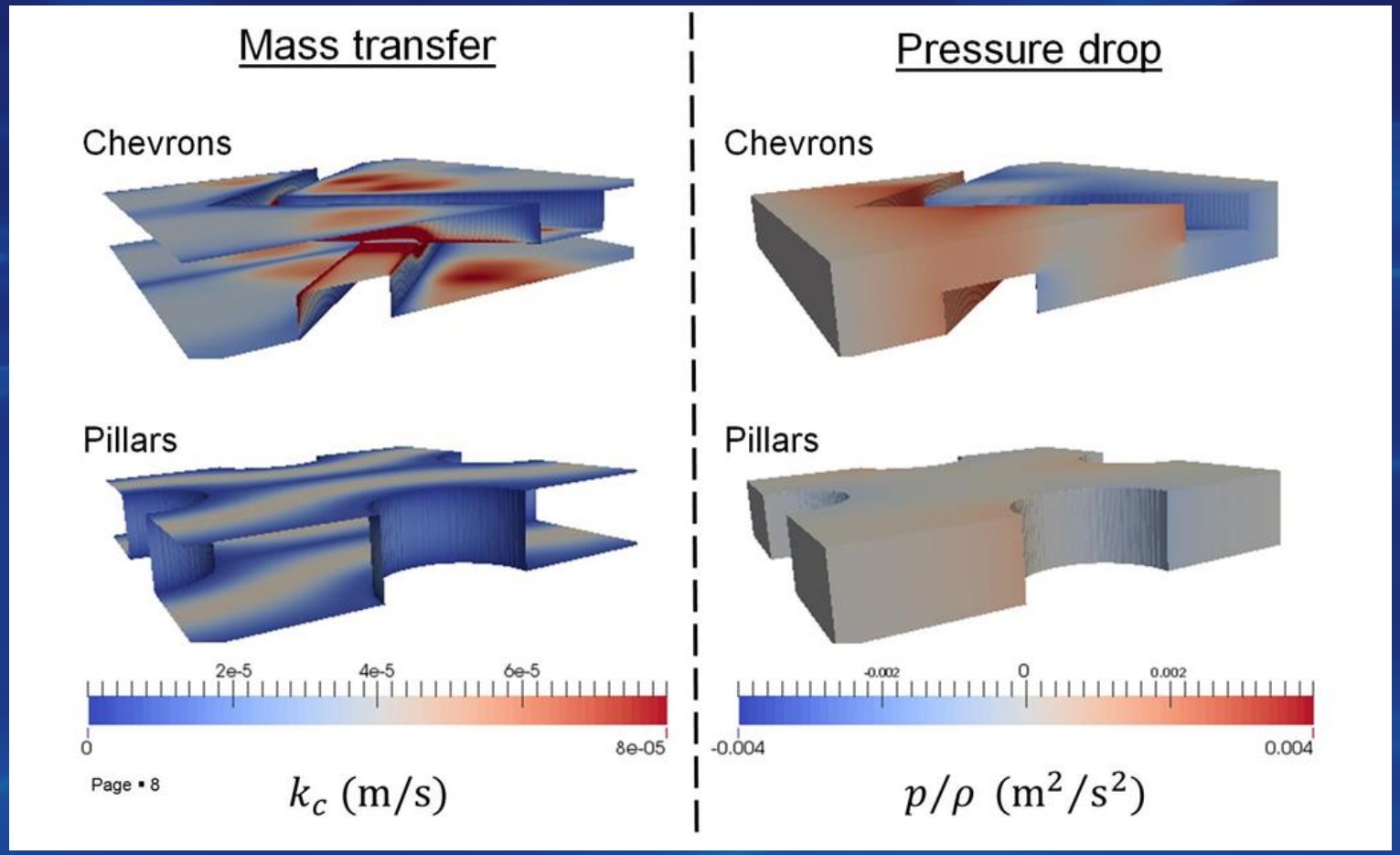
How did we meet our targets?

- Clogging and fouling could be a major risk to continuous operation
- This was no issue after optimizing
  - stack design
  - profiles on membranes
  - using right pre-treatment
  - operations-procedures
- Since then, the stack has been operating in the pilot plant without reduced performance

Experimental results



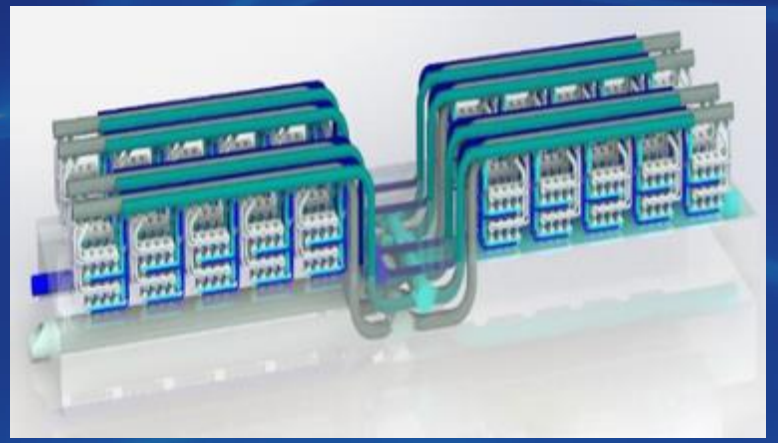
CFD: Mass Transfer & Pressure Drop (u=1.0 cm/s)



Upscaling the stacks

- We started with stacks with 0.25 m2 of membrane
- Now we have stacks with more than 500 m2 of membrane
- Performance and efficiency of the stacks did not decrease
- Next step is a stack with 2000 m2 of membrane

Upscaling the stacks



Impact on marine life

- Water inlet-systems and filtration systems can have a negative impact on marine life
- Independent professional third parties (Deltares, NIOZ, etc.) analysed impact on marine life at pilot plant TRL7
- No significant environmental or ecological effects have been detected
- Not even to be expected with large-scale application in an ecologically vulnerable and protected environment

Challenges

- Relatively new technology
- No experiences on large scale
- World wide leader
- Small company, technology driven
- Risk of upscaling
- Cost-down-curve to go
- Unknown license and permit procedures

Opportunities

- The LCoE calculated to be euro 0.11 per kWh for the first 100 MW plant, and going down to 0.05 after 2040
- LCoE lower than power from nuclear and storage systems
- Full continuous and eco-friendly power generation
- World wide potential of 1000 GW

Are you in?

Then please contact us at p.hack@redstack.nl, g.singh@redstack.in or find more information at www.redstack.nl, www.redstack.in