

ZEEWATER, ONS DRINKWATER VAN DE TOEKOMST?

dr. ir. Marjolein Vanoppen





Ion-exchange based processes in hybrid water treatment

Marjolein Vanoppen



GHENT
UNIVERSITY

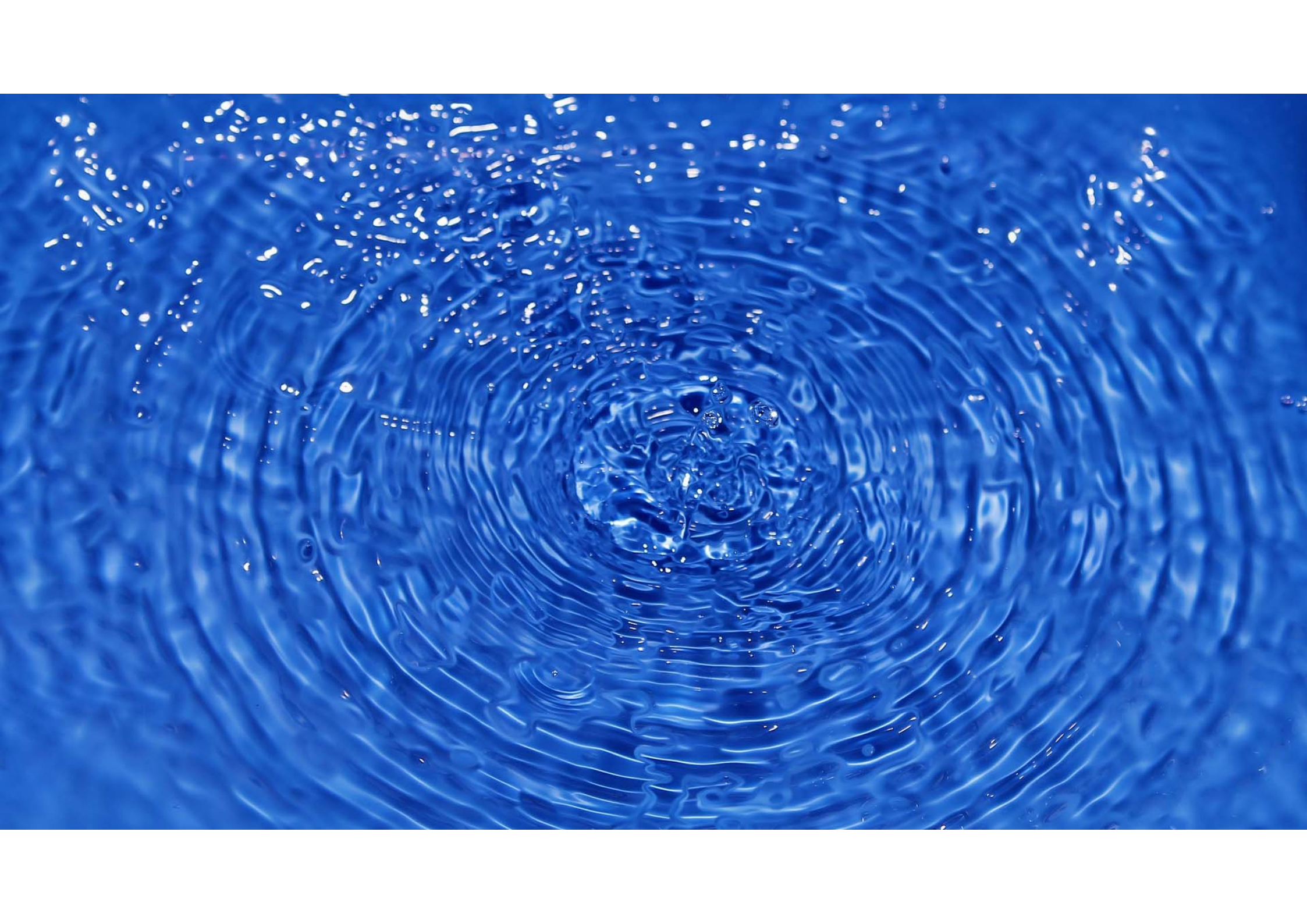


evides

waterbedrijf



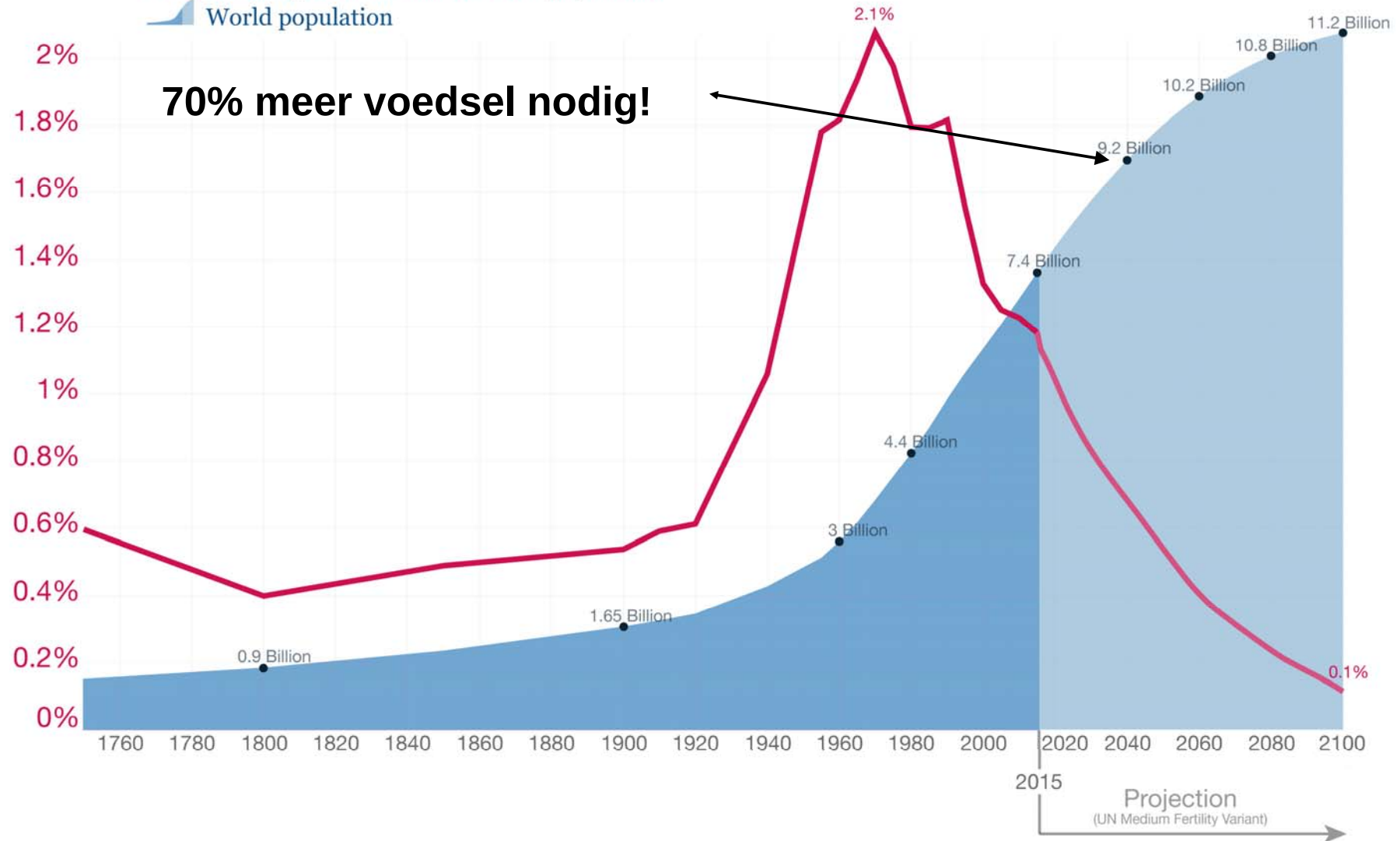
Particle and Interfacial Technology^B





World population growth, 1750-2100

 Annual growth rate of the world population
 World population



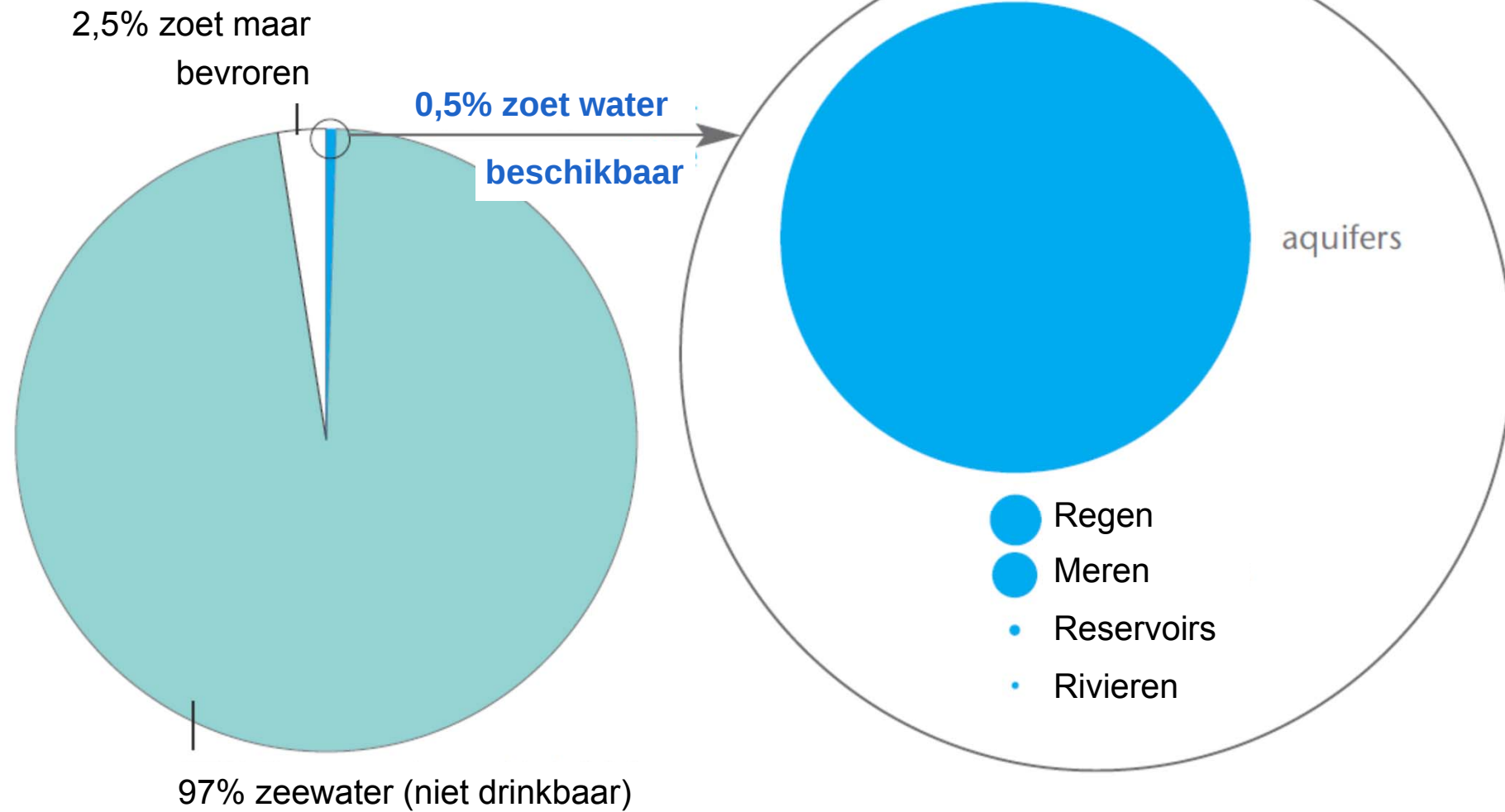
Data sources: Up to 2015 OurWorldInData series based on UN and HYDE. Projections for 2015 to 2100: UN Population Division (2015) – Medium Variant. The data visualization is taken from [OurWorldInData.org](https://ourworldindata.org). There you find the raw data and more visualizations on this topic.

Licensed under [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) by the author Max Roser.



70% van ons watergebruik gaat naar landbouw

Beschikbaarheid zoet water





ZEEWATERONTZOUTING

Scheiding zout en water = niet natuurlijk

➡ kost energie



A close-up photograph of a silver kettle with its lid open, showing steam rising from the spout. The kettle is positioned on the right side of the frame, and the steam is visible on the left. The background is dark, making the steam and the metallic surface of the kettle stand out.

15 – 30 kWh/m³ geproduceerd water



3960 liter (200g)



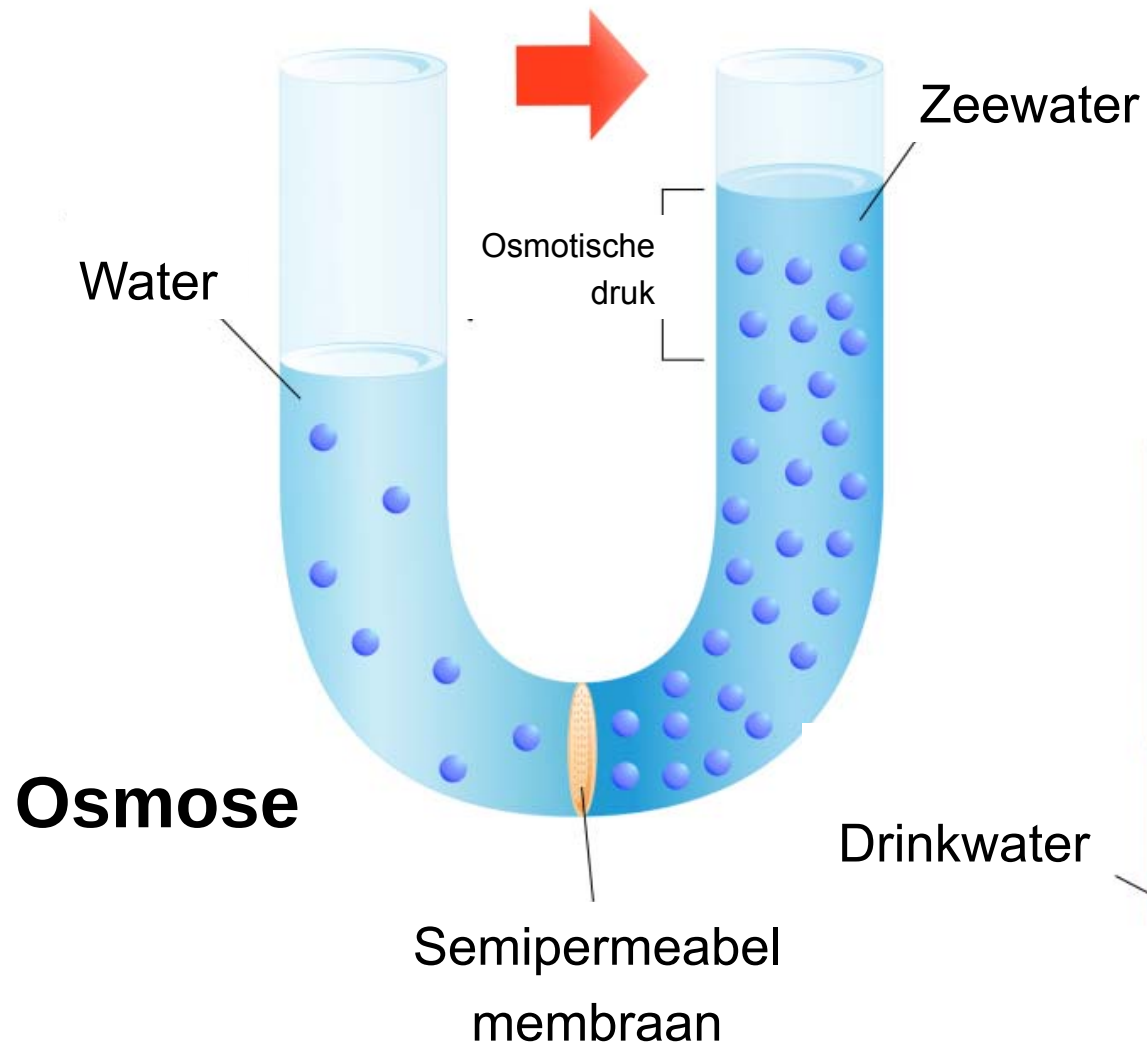
208 liter



70 liter (200g)

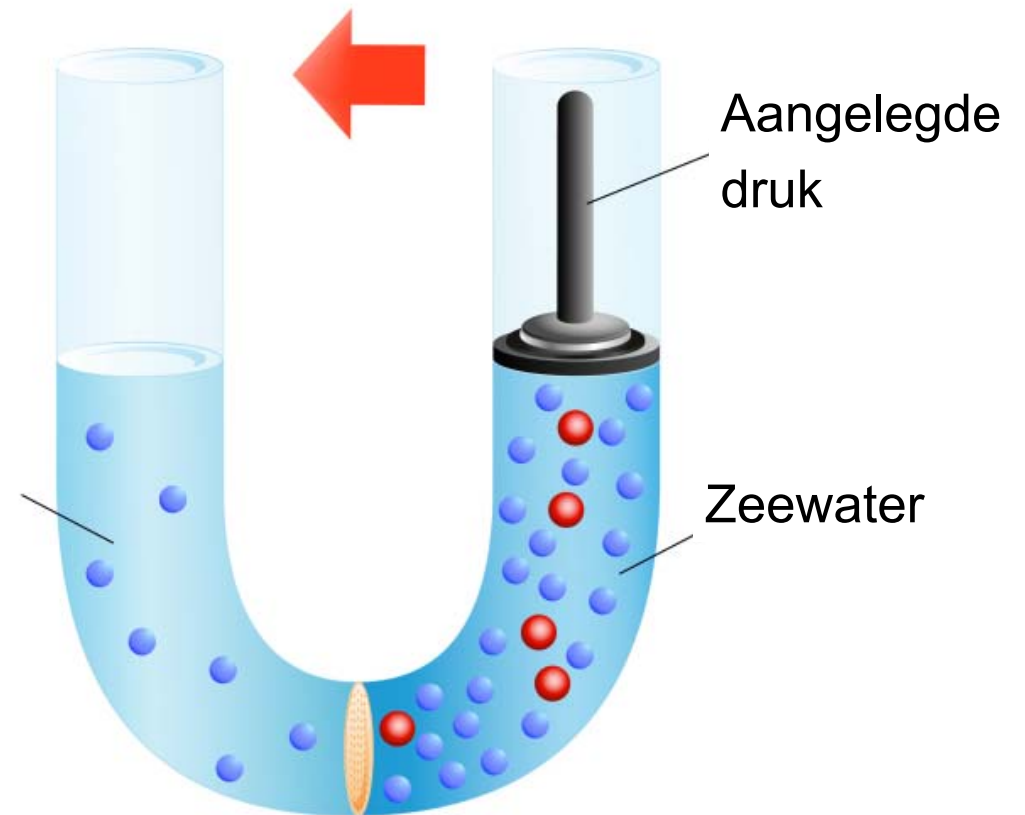
afmetingen [μm]	0.001	0.01	0.1	1.0	10	100	1000
molecuulgewicht	100	200	1000	10000	20000	100000	
deeltjes		virussen		bacteriën			
	zouten		humuszuren		algen		
				klei	cysten		Zand
					slib		
Zuiverings- methode					conventionele filtratie		
				microfiltratie			
		ultrafiltratie					
		Nanofiltratie					
	omgekeerde osmose						

afmetingen [μm]	0.001	0.01	0.1	1.0	10	100	1000
molecuulgewicht	100	200	1000	10000	20000	100000	
deeltjes		virussen		bacteriën			
	zouten				algen		
		humuszuren			cysten	Zand	
				klei	slib		
Zuiverings- methode					conventionele filtratie		
				microfiltratie			
		ultrafiltratie					
		Nanofiltratie					
	omgekeerde osmose						



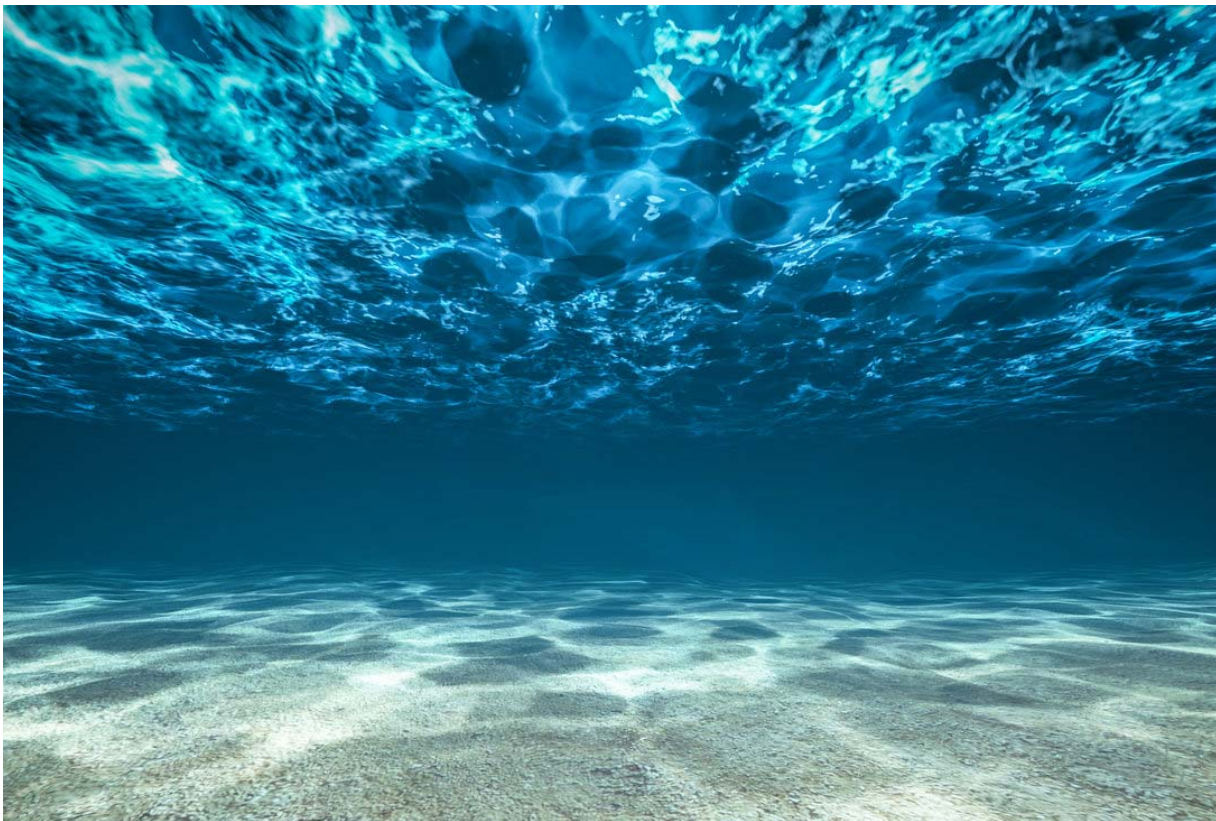
Omgekeerde osmose

2-4 kWh/m³

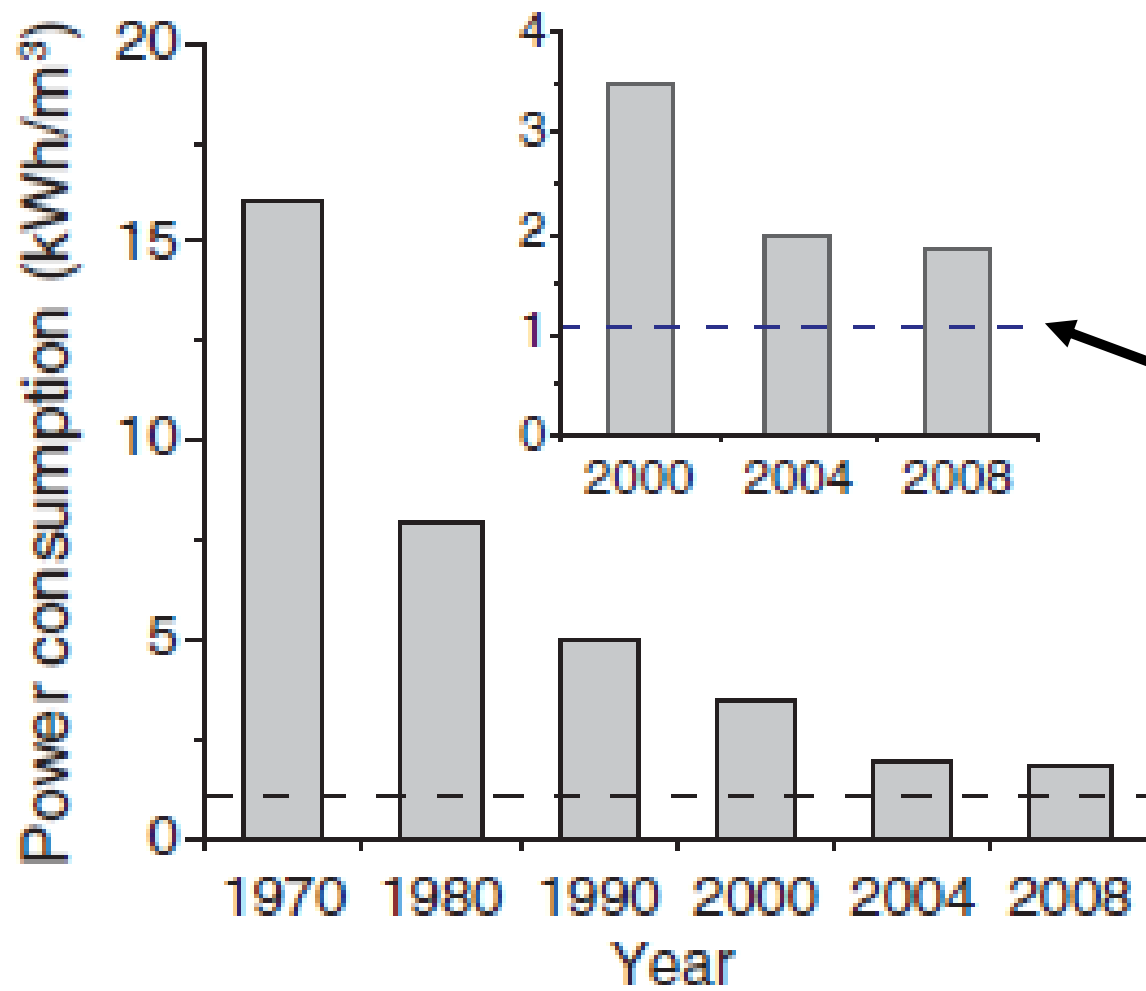


OMGEKEERDE OSMOSE

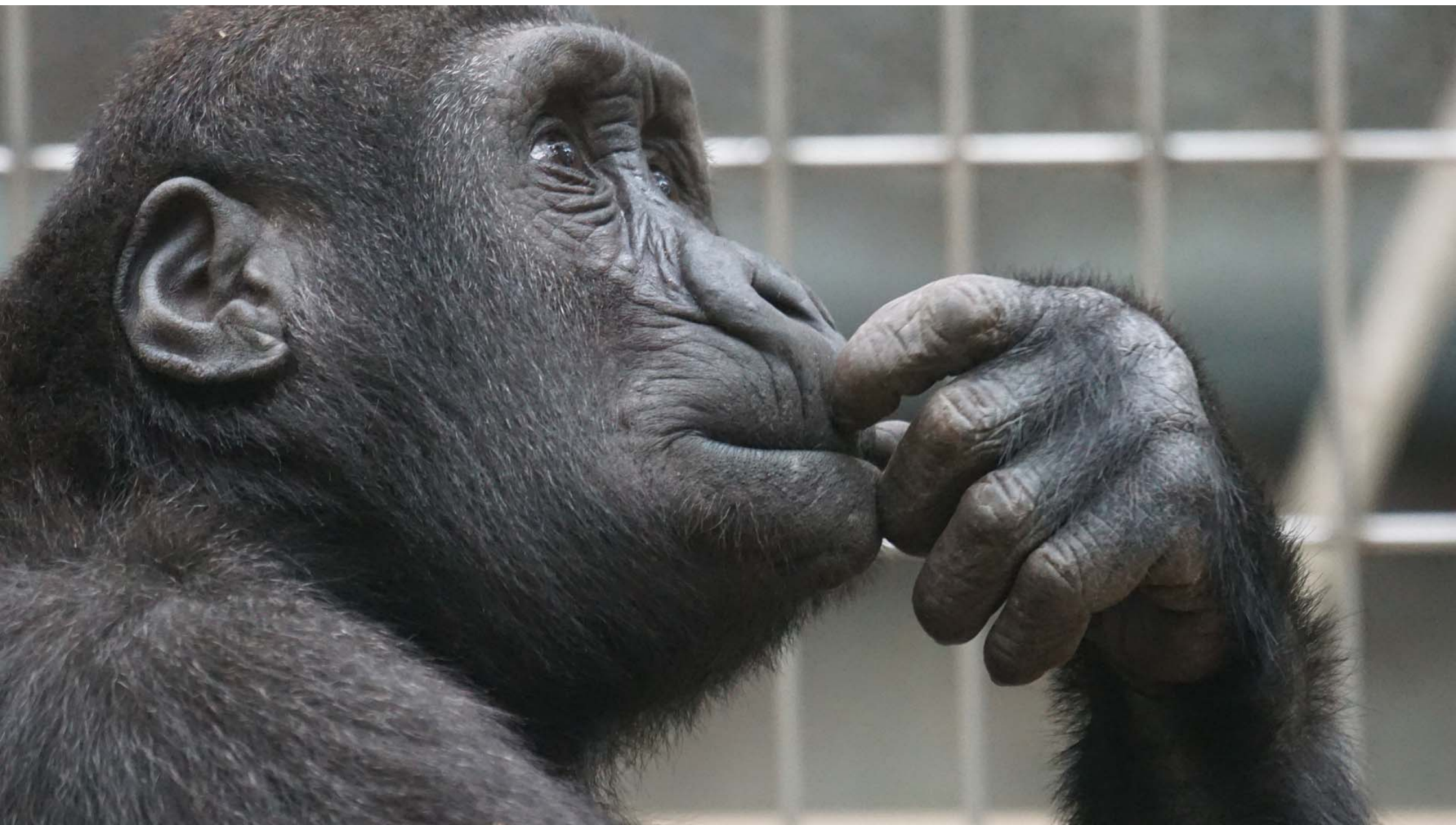
- 1 bar $\approx$ 1 kg/cm² $\approx$ de atmosferische druk
- Osmotische druk zeewater $\approx$ 25 bar



250 meter water



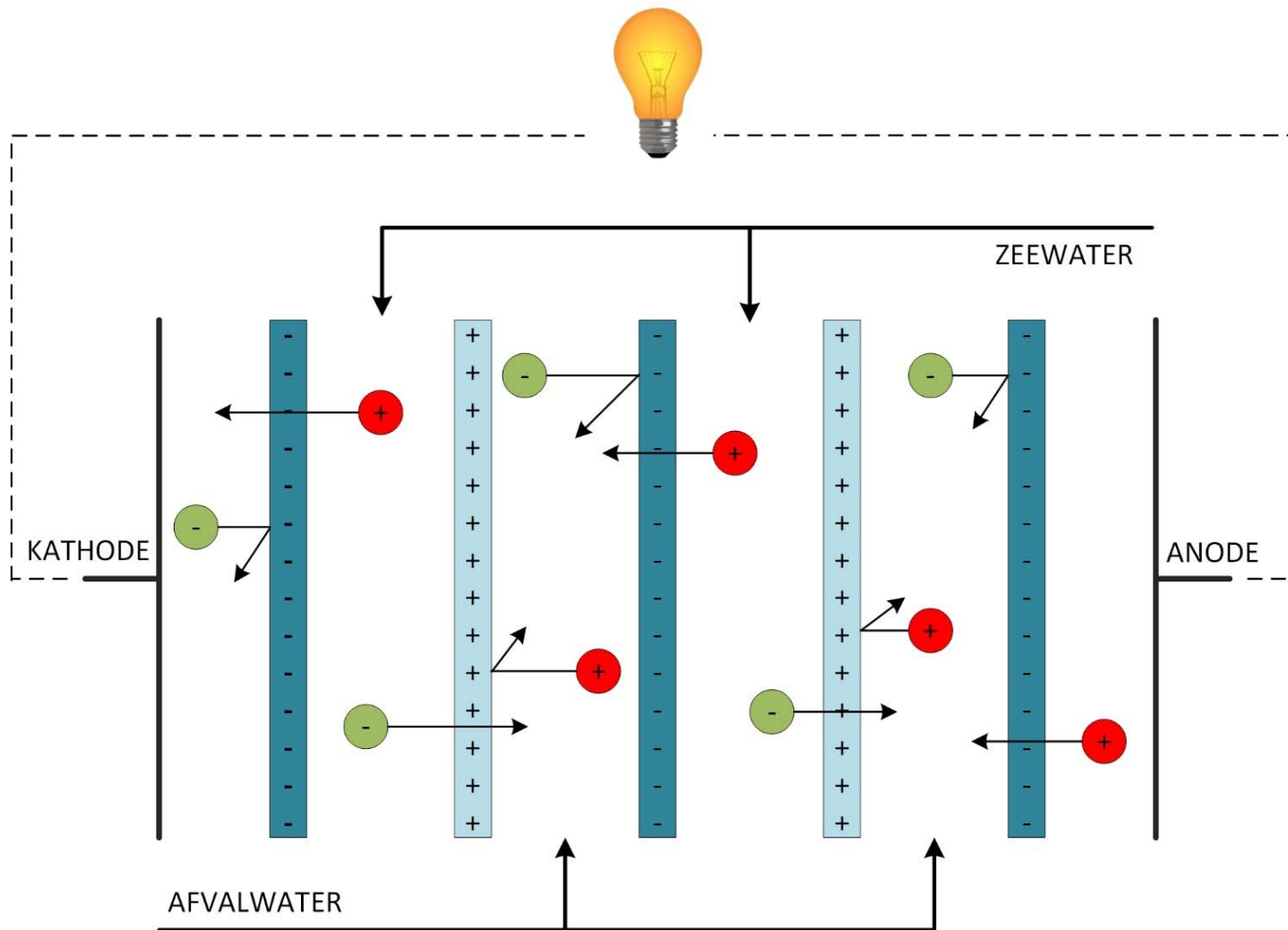
Natuurlijke limiet
→ Lagere energievraag
onmogelijk!







OMGEKEERDE ELEKTRODIALYSE



OMGEKEERDE ELECTRODIALYSE

- Eerst beschreven in 1977

POTENTIEEL

- Nederland:
 - 3300 m³/s rivierwater → zee
 - Max. helpt ontzout in RED → eq. met dam 135m
 - $E = m \cdot g \cdot \Delta h = 4.5 \text{ GW}$



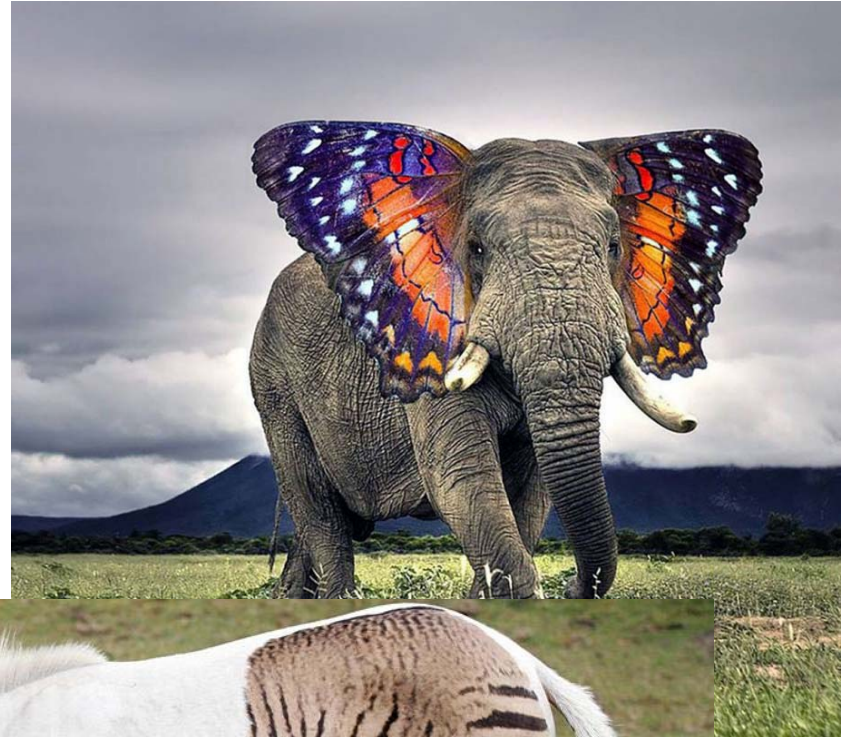
REVERSE ELECTRODIALYSIS

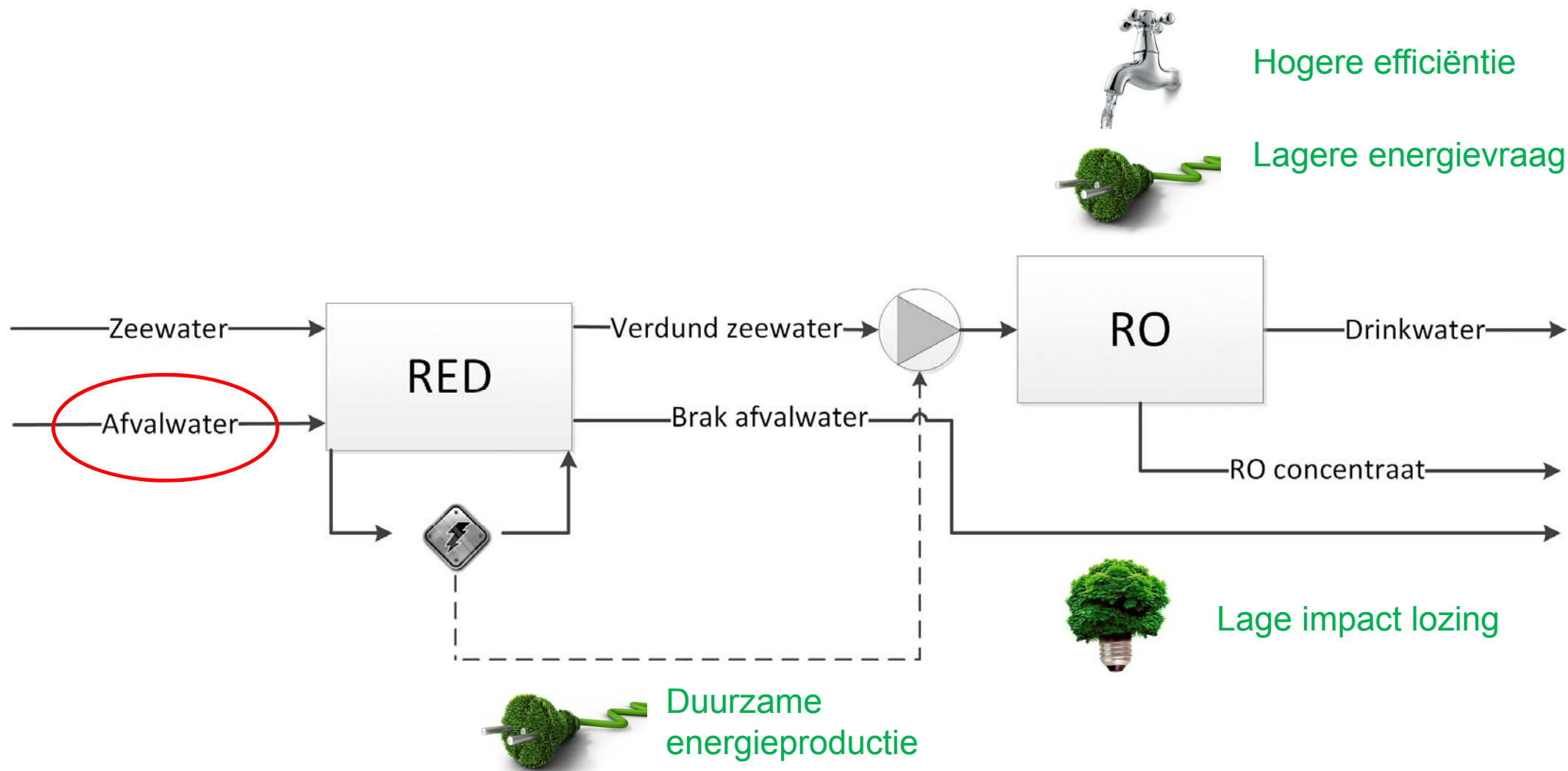
- Eerst beschreven in 1977

POTENTIEEL

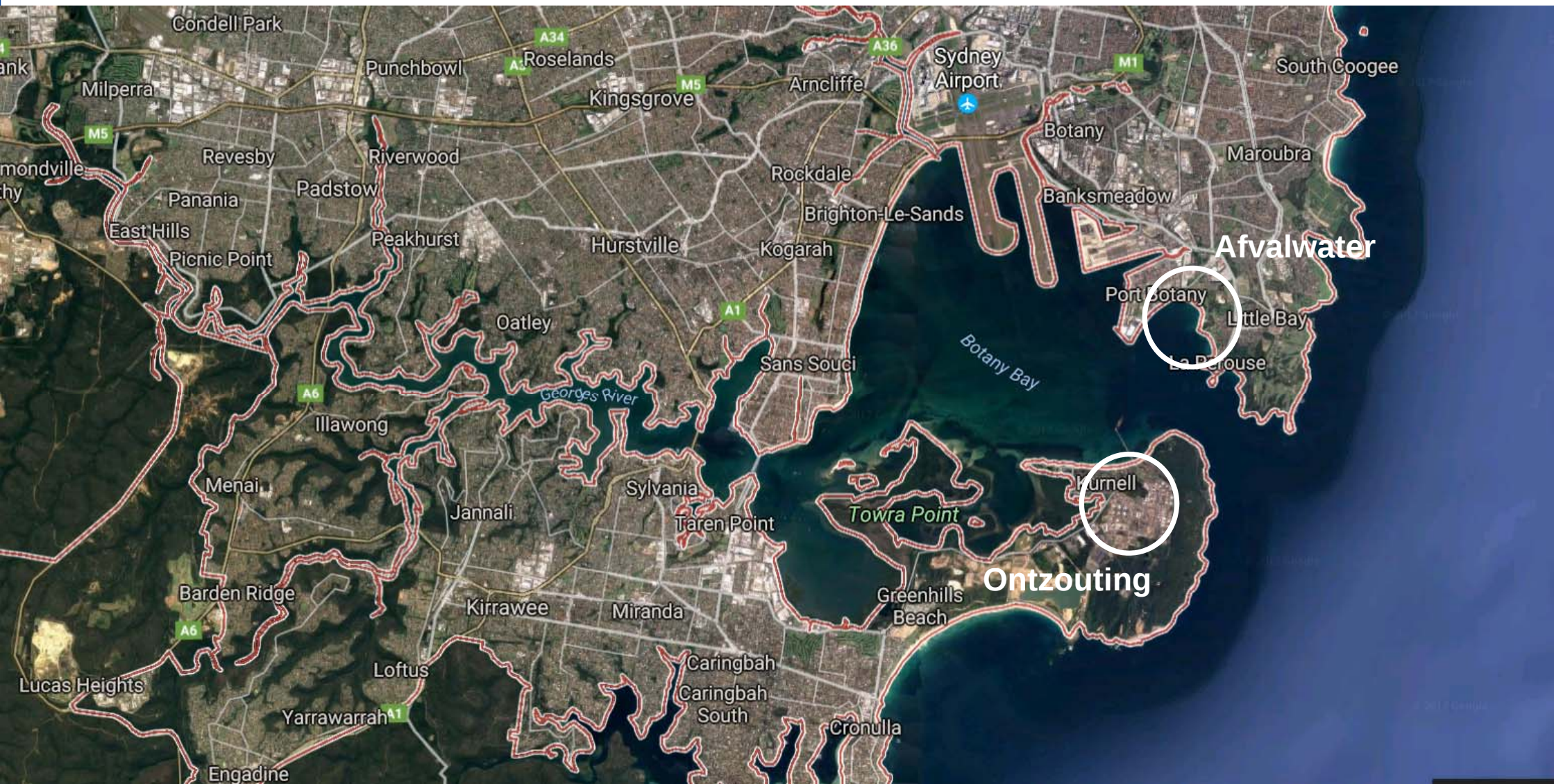
- Nederland:
 - 3300 m³/s rivierwater → zee
 - Max. helpt ontzout in RED → eq. met dam 135m
 - $E = m \cdot g \cdot \Delta h = 4.5 \text{ GW}$

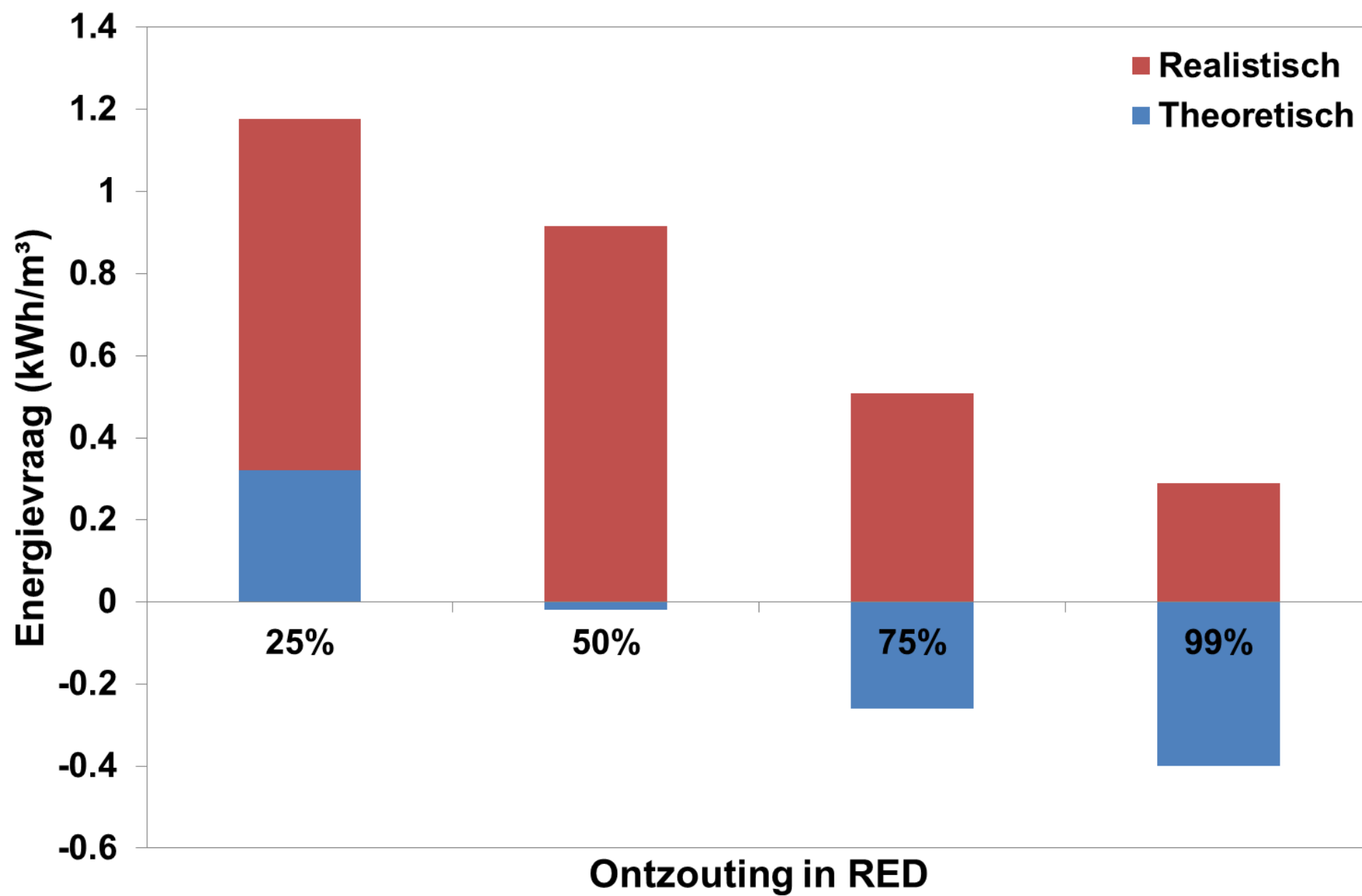












Never mind about "coming in peace"! TELL me you brought alternative energy technology!



dr. ir. Marjolein Vanoppen

Leerstoel Industriële en Circulaire

Watertechnologie

PARTICLE AND INTERFACIAL TECHNOLOGY
GROUP

E marjolein.vanoppen@ugent.be

T +32 9 264 99 11

www.ugent.be



Ghent University



@ugent



Ghent University

