

# Scaling up electrolyzers

29 APRIL 2021

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# Leading the way in electrochemistry

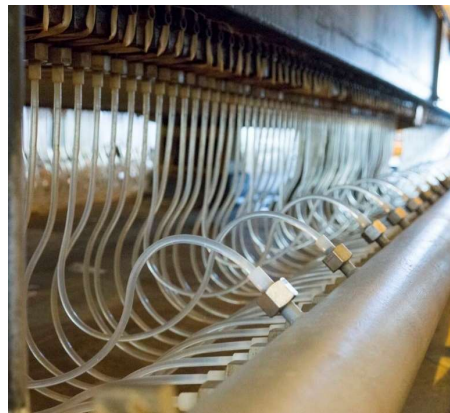
Nouryon operates over 1000 MW of electrolysis capacity

In electro-chemistry since 1899

1000 MW electrolysis capacity

50% renewable energy worldwide

Chlor-alkali



Installed capacity: 380 MW  
H<sub>2</sub> production: 38 kta

Sodium chlorate







Installed capacity: 620 MW  
H<sub>2</sub> production: 62 kta

Water electrolysis

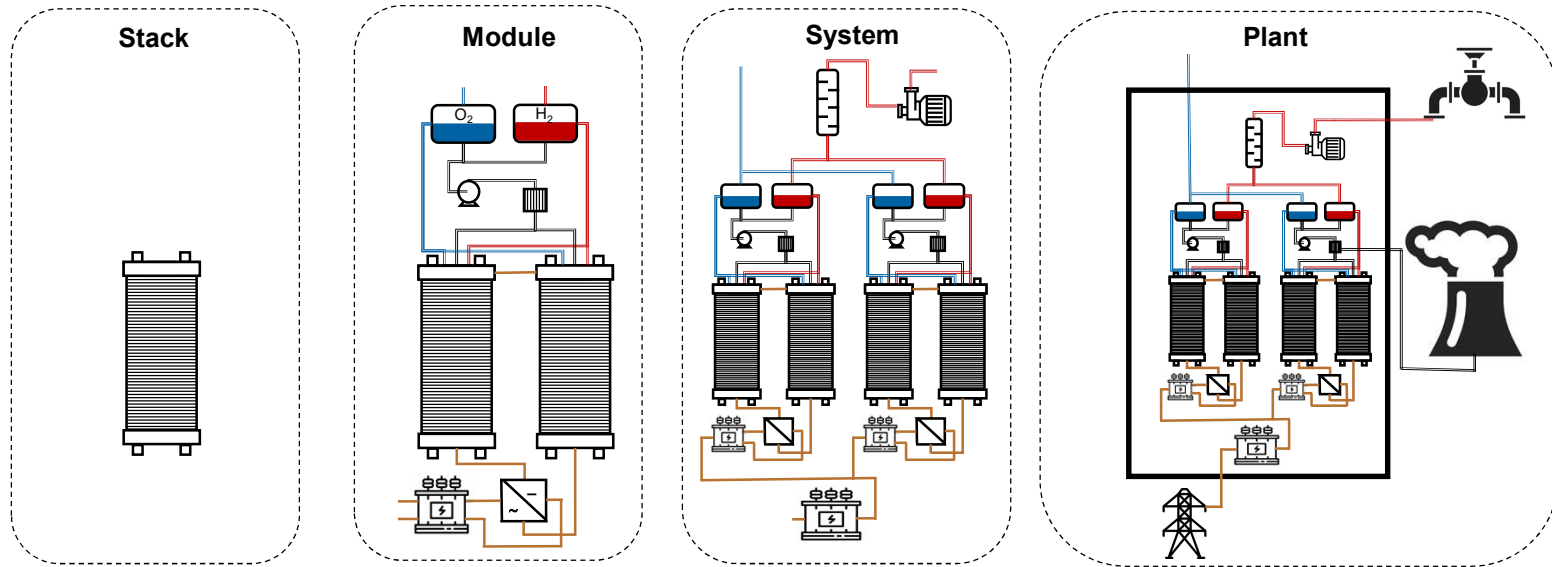


Installed capacity: 8 MW  
H<sub>2</sub> production: 1.2 kta

# Key water electrolysis technologies

	Alkaline	PEM	Solid oxide	AEM
				
Stack size (MW)	1 – 6	0.5 – 1.5	?	0.0025
Largest installed plant (MW)	30 Xinjiang	10 Cologne	0.72 Salzgitter	0.02 Rozenburg
Number of suppliers	7	5	2	1
Stack price (€/kW)	100 - 400	300 - 600	~2500	?
Stack efficiency (% of HHV)	~80%	~75%	~100%	~80%

# More than just a stack

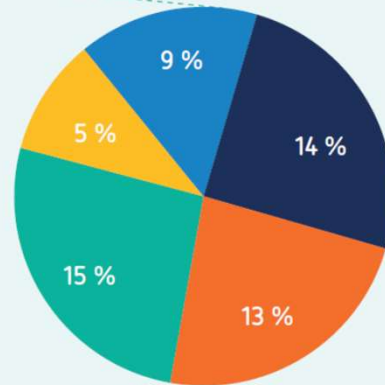
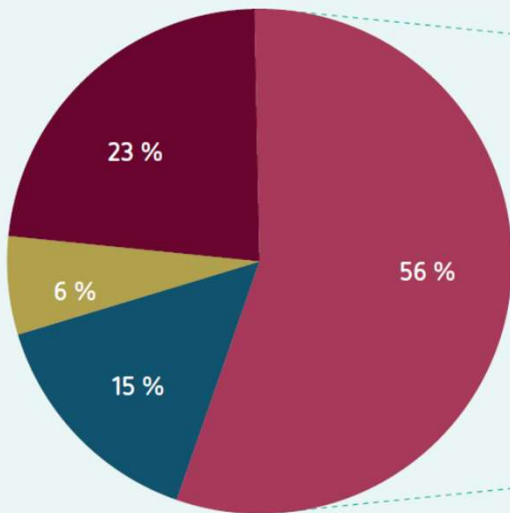


# A clear need for innovations to reduce costs

## Capex cost breakdown Alkaline technology

Total Installed Costs 1400 Euro/kW

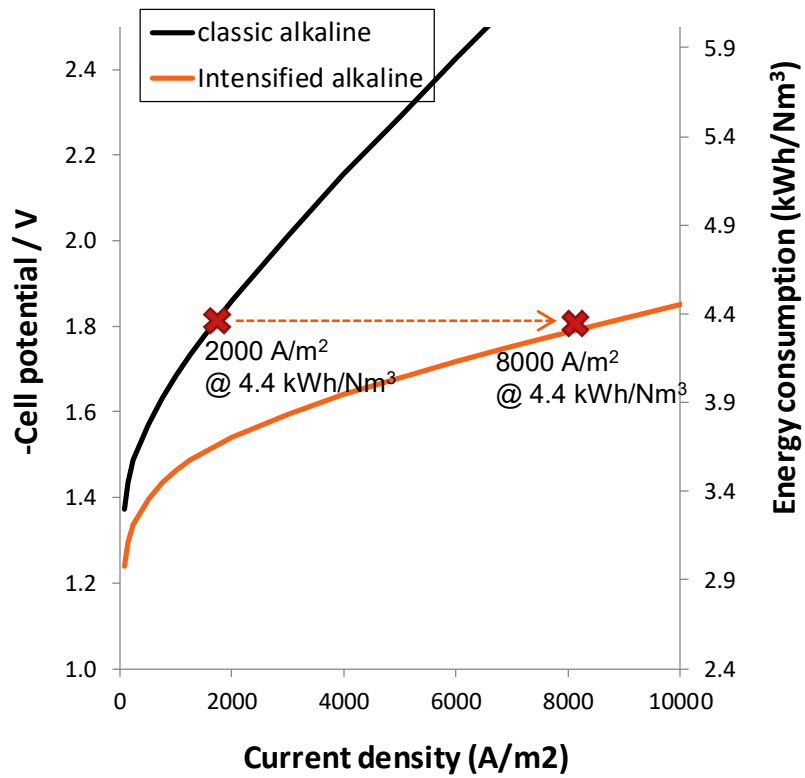
Directs Costs 800 Euro/kW



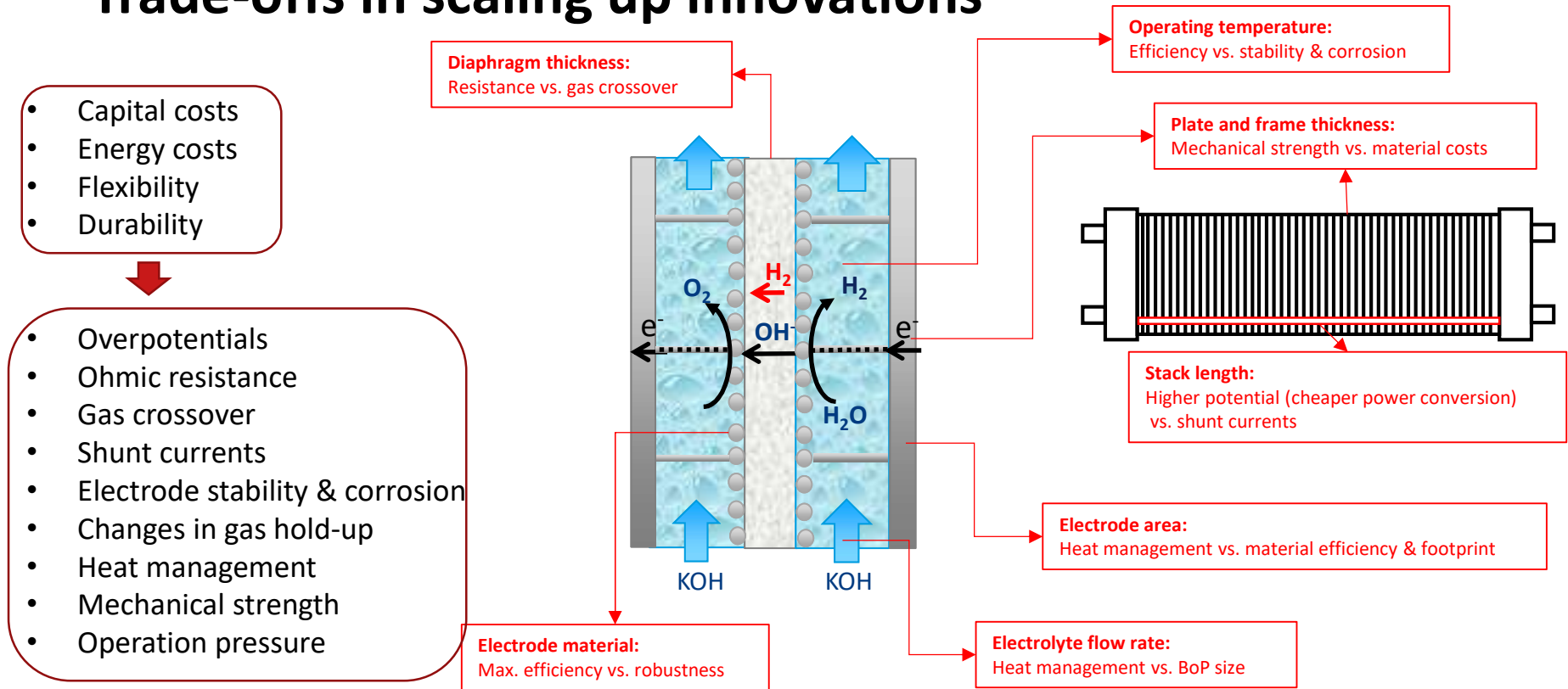
- Balance of plants
- Civil, Structural & Architect.
- Utilities and Process Automation
- Power supply and electronics
- Stacks

- Indirect costs
- Owners costs
- Contingency
- Direct Costs

# Intensifying alkaline electrolysis



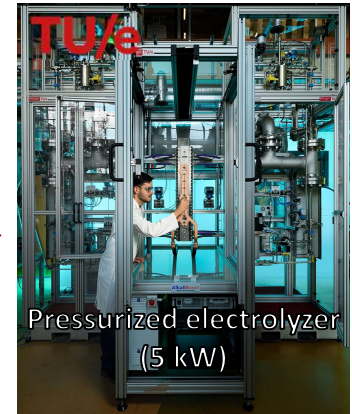
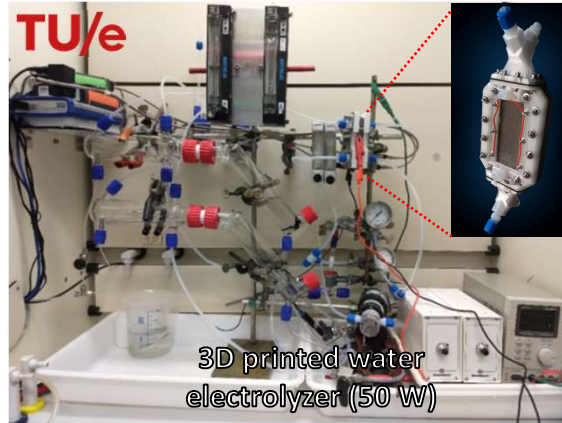
# Trade-offs in scaling up innovations



# Scaling up innovations

**TU/e**

“Fundamental”  
electrode &  
membrane  
development  
focused on  
overpotentials and  
selectivity

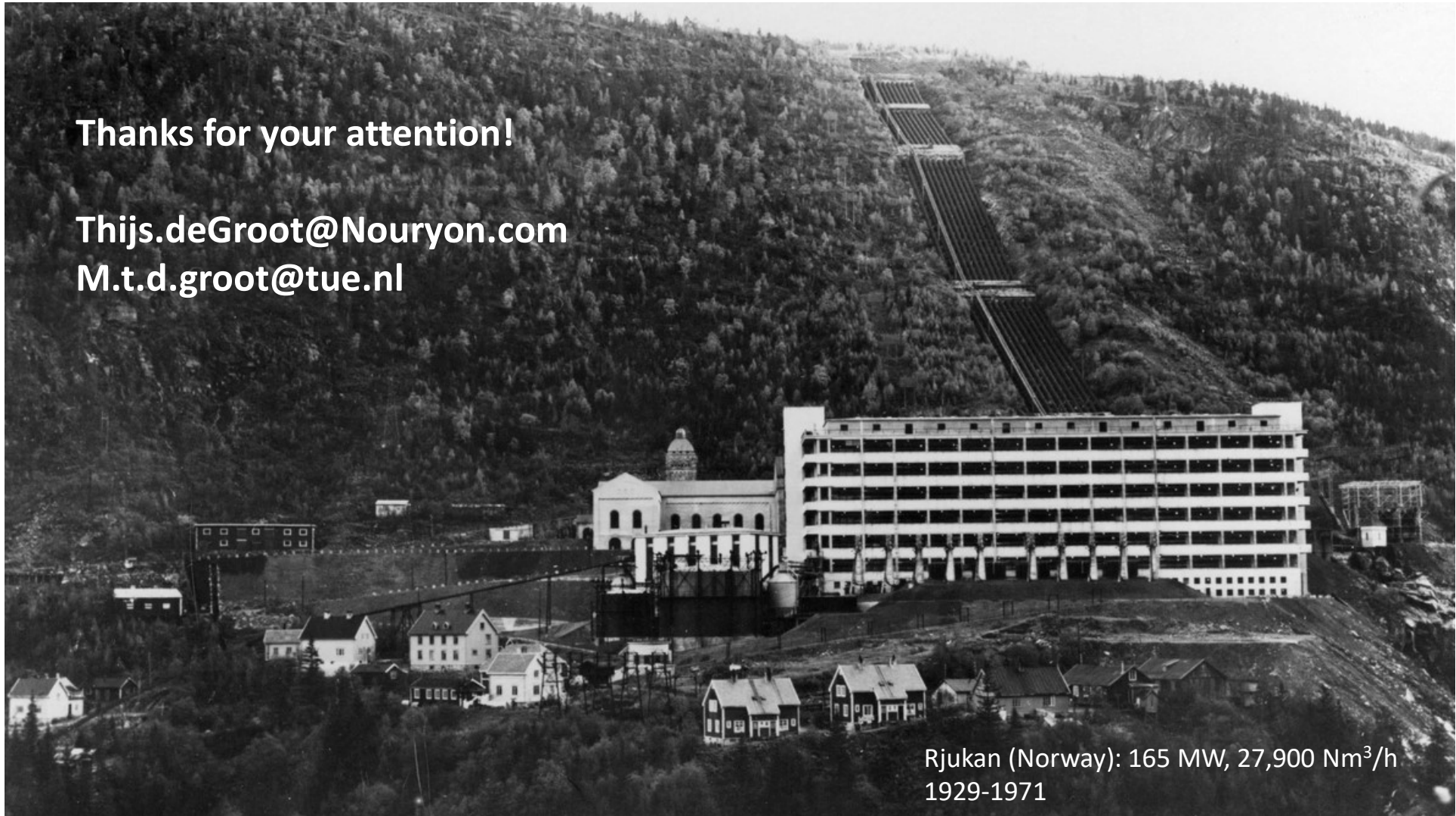




Thanks for your attention!

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Rjukan (Norway): 165 MW, 27,900 Nm<sup>3</sup>/h  
1929-1971