

Under the Patronage of the Minister of Environment Water & Agriculture  
Eng. Abdulrahman bin Abdulmohsen Al Fadhili

منتدى المياه السعودي  
saudi water forum SWF

"Sustainable Water.. for Sustainable Development"



وزارة البيئة والمياه والزراعة  
Ministry of Environment Water & Agriculture  
Kingdom of Saudi Arabia المملكة العربية السعودية



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2030  
المملكة العربية السعودية  
KINGDOM OF SAUDI ARABIA

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# Transforming the water cycle

Paul Buijs  
KAUST WDRC

# WATER DESALINATION & REUSE CENTER

جامعة الملك عبد الله  
للعلوم والتقنية  
King Abdullah University of  
Science and Technology

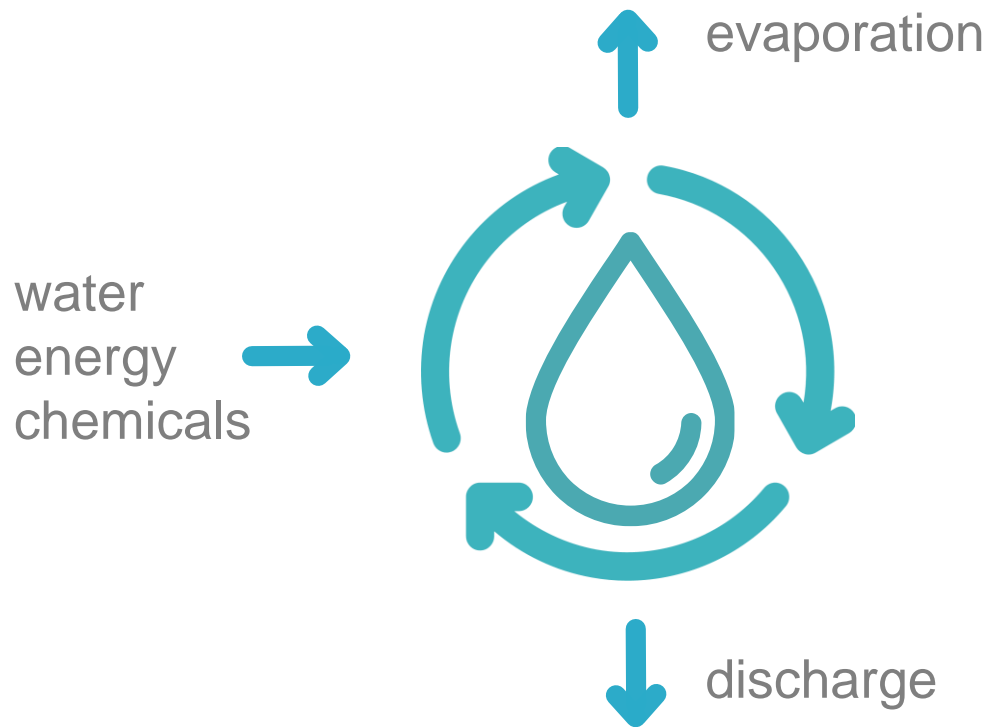


## Transforming the water cycle

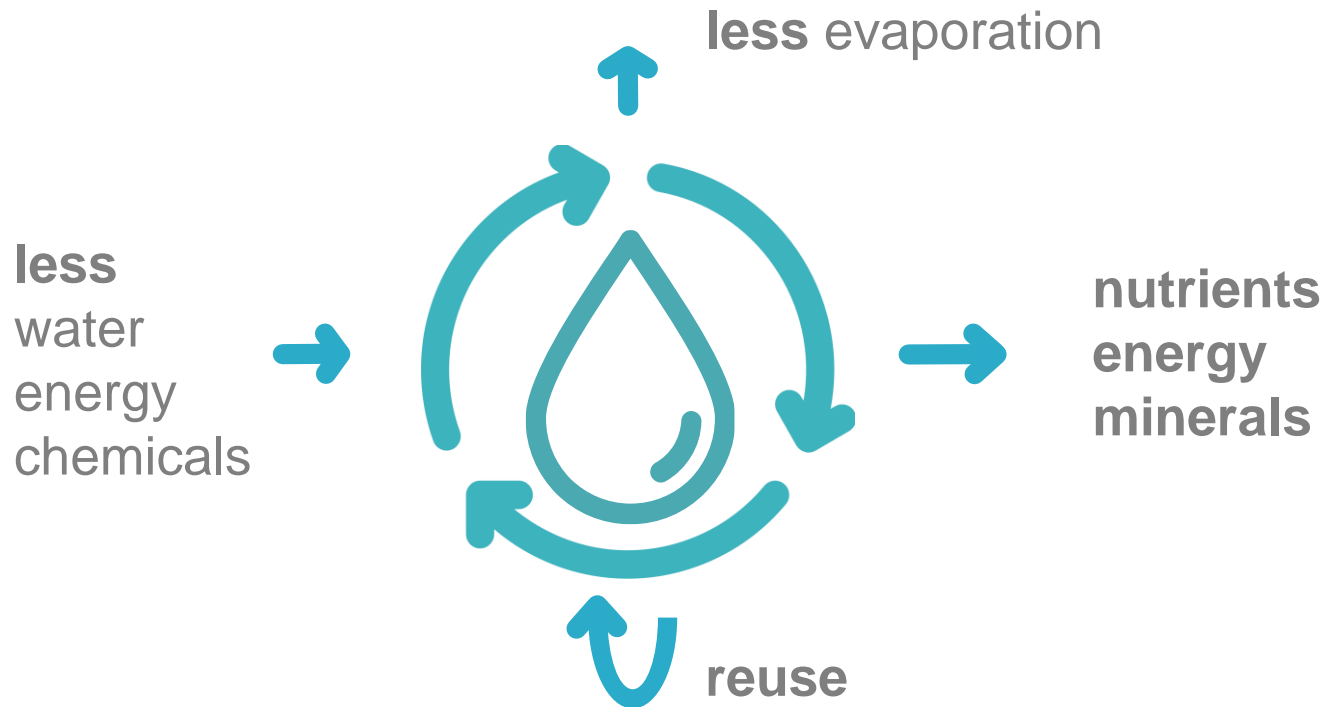
Paul Buijs, KAUST WDRC  
Saudi Water Forum 2019

[wdrc.kaust.edu.sa](http://wdrc.kaust.edu.sa)

# Our purpose: transform the water cycle



# Our purpose: transform the water cycle



# Vision and Mission

## Vision

- To enable a water secure future that will enable social and economic prosperity in the Kingdom and beyond.

## Mission

- To undertake fundamental and applied research that will deliver innovative solutions to the global challenges of water security, safety, sustainability and supply.

# Water Desalination and Reuse Center

Three flagship themes:



## **Greener Desalination**

Less energy, chemicals, discharge



## **Water Security**

Sufficient & safe for all



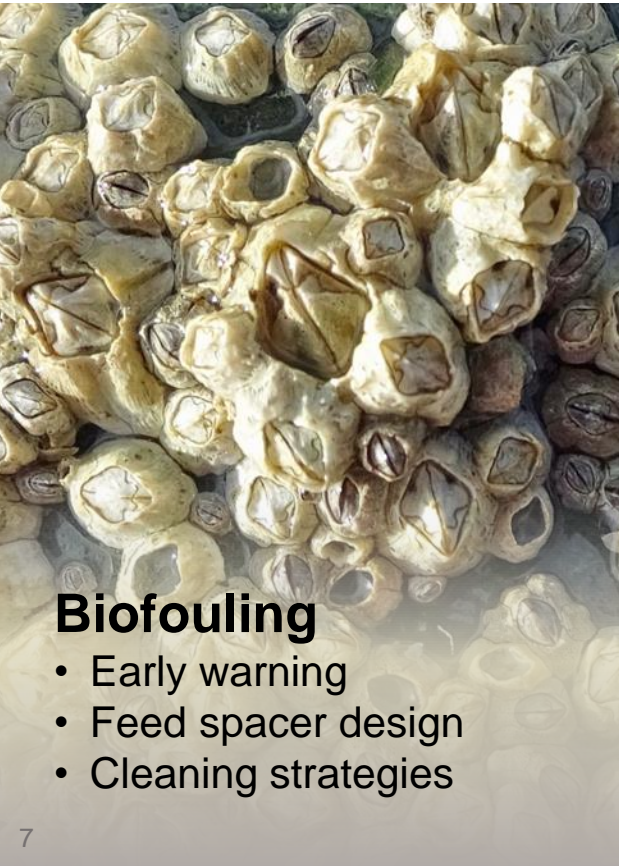
## **Waste to Resource**

Recovery of water, nutrients, minerals and energy





# Greener desalination



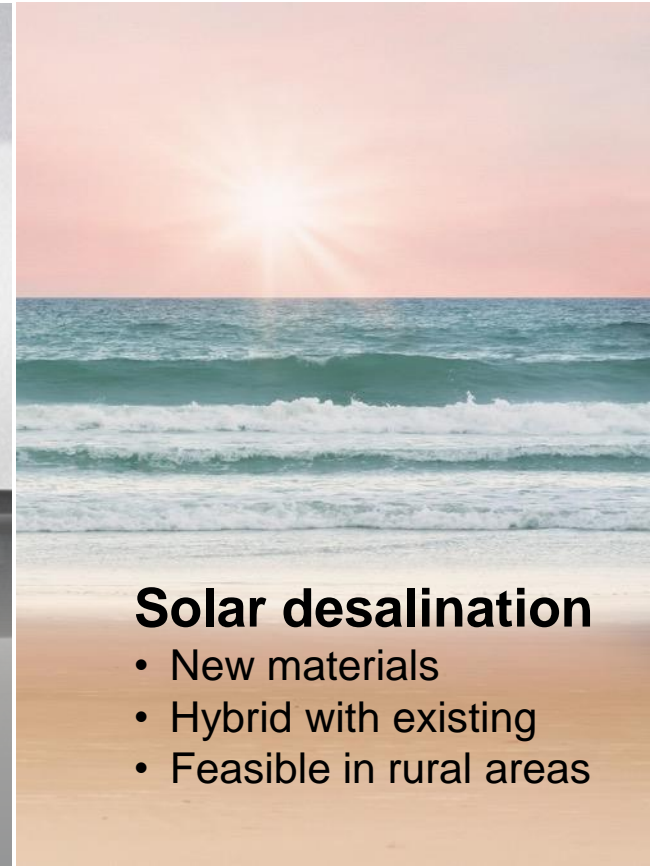
## Biofouling

- Early warning
- Feed spacer design
- Cleaning strategies



## Hybrid processes

- Energy savings
- Brine reduction



## Solar desalination

- New materials
- Hybrid with existing
- Feasible in rural areas

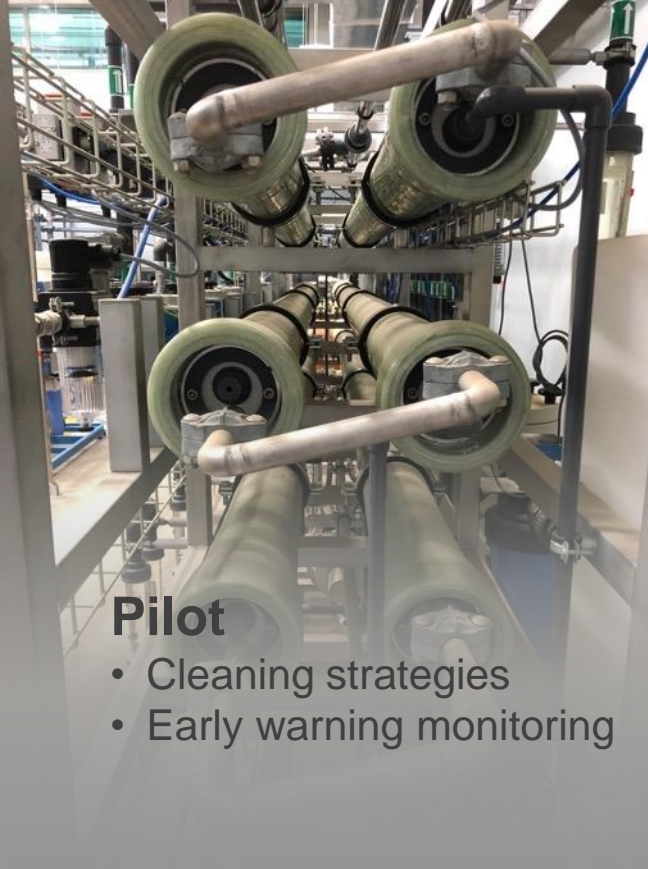


# Biofouling of RO membranes



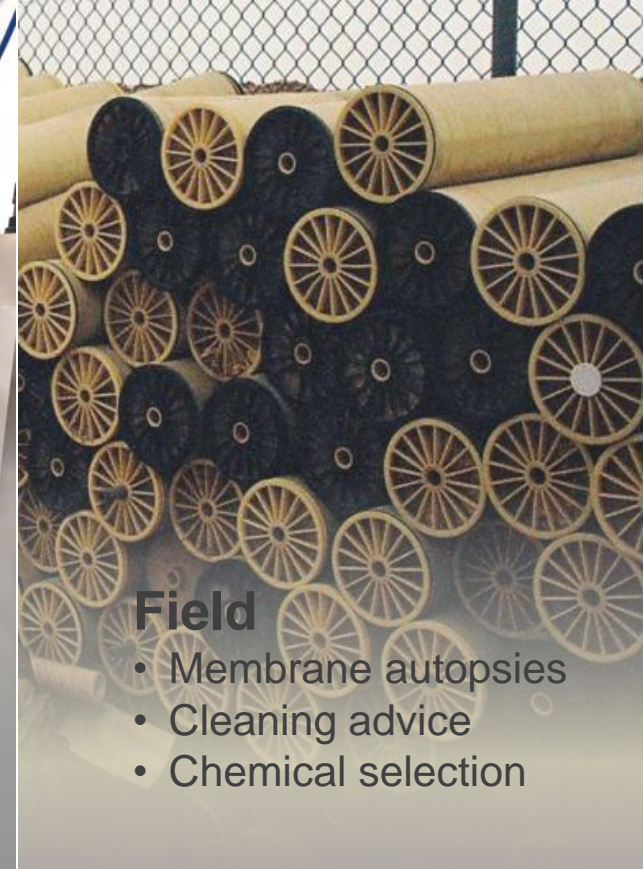
## Lab scale

- Fouling simulator
- Evaluate water/chemicals
- Predictive/representative



## Pilot

- Cleaning strategies
- Early warning monitoring



## Field

- Membrane autopsies
- Cleaning advice
- Chemical selection





# Membrane desal pilot



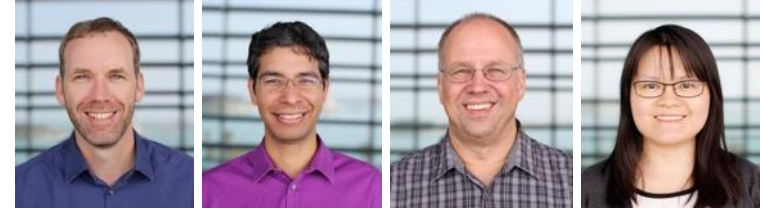
- First phase translation from lab to full scale
  - Novel fouling monitoring and remediation
  - Innovative membrane spacer designs
  - New pretreatment technologies



- Important educational tool
  - Student exposure to 'large scale' equipment
- Link to industry
  - Collaboration opportunities



# Water Security



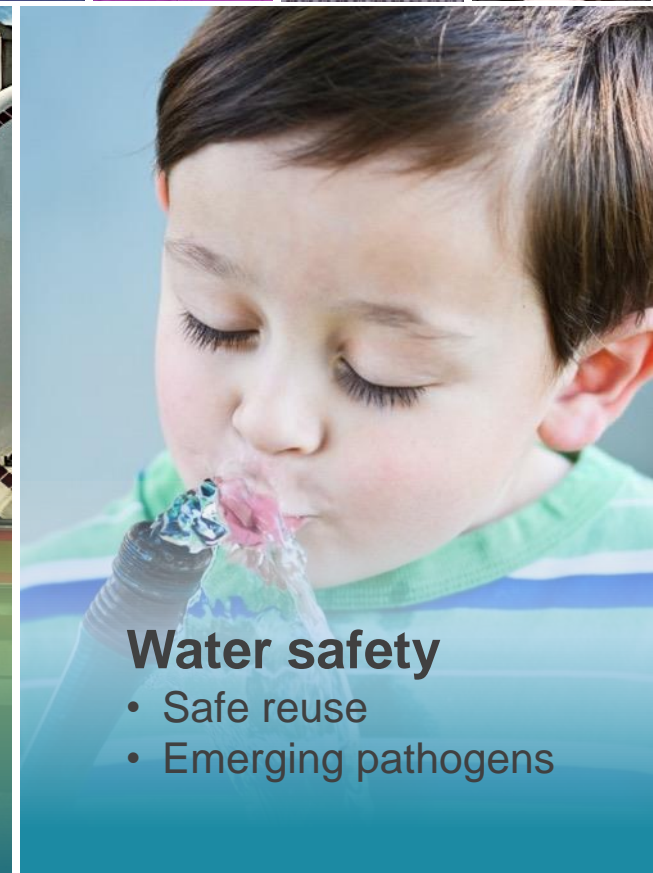
## Agriculture

- Improving irrigation
- Hydrophobic mulch



## Water quality during distribution

- Biostability
- Asset management



## Water safety

- Safe reuse
- Emerging pathogens





# Ministry for Environment, Water and Agriculture (MEWA) project

- Agricultural groundwater use KSA
- Basis of compliance framework
- New digital platform for food security monitoring
- Key to MEWAs Vision 2030 Objectives



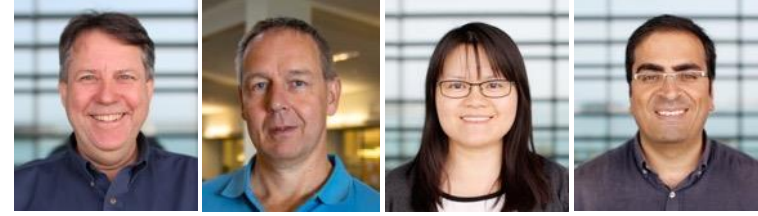


WDRC collaborations exploring the impact of **impaired quality (i.e. brackish) waters** on crop production and the **application of hydrophobic sands** to reduce water use (McCabe, Mishra, Ghaffour, Hong and Tester).



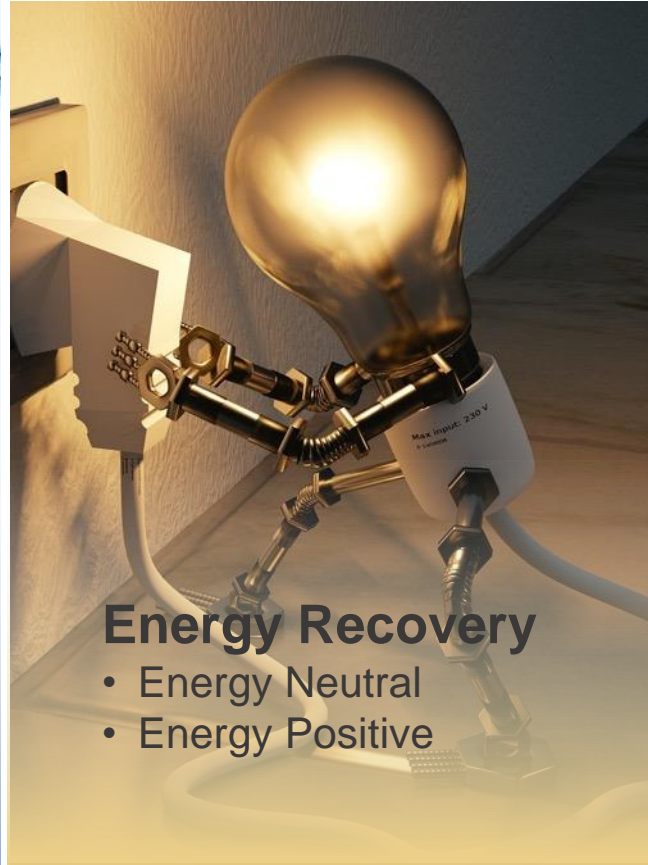


# Waste to Resource



## Tailor made Water

- Irrigation
- Industry
- Cooling



## Energy Recovery

- Energy Neutral
- Energy Positive

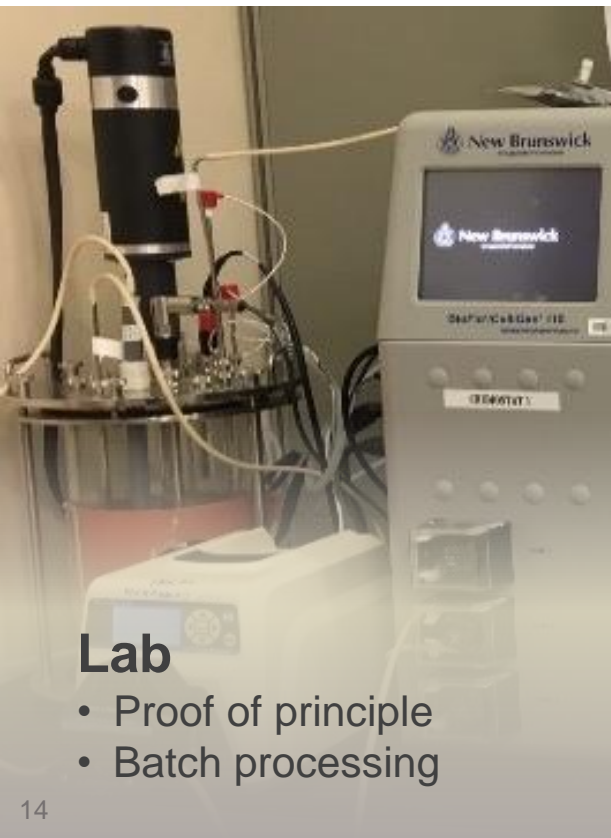


## Materials Recovery

- Nutrients (N,P)
- Minerals

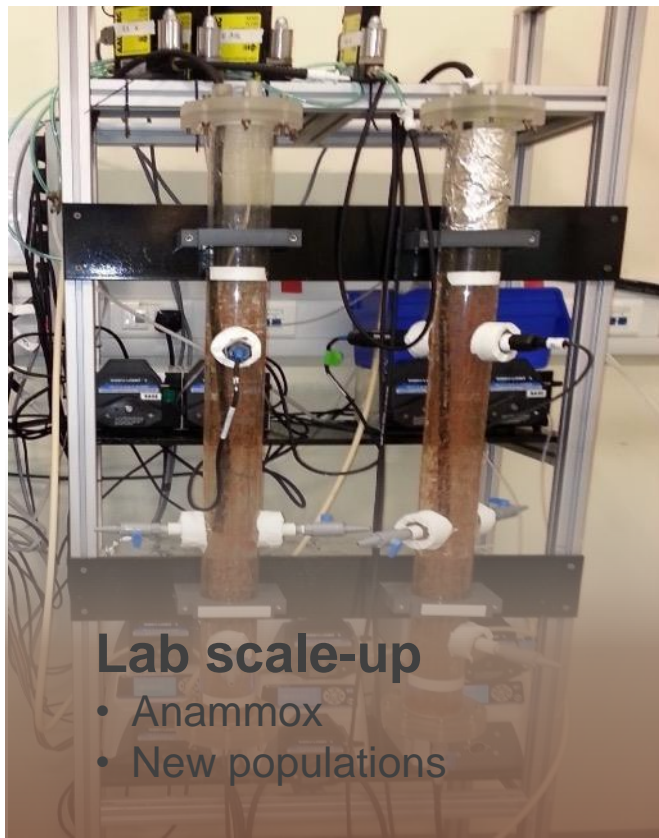


# Recovery of water



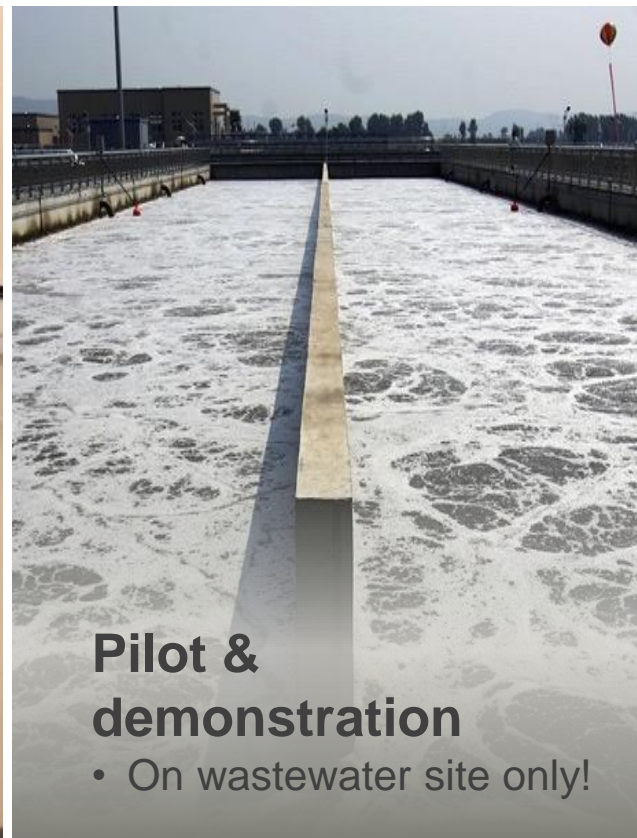
## Lab

- Proof of principle
- Batch processing



## Lab scale-up

- Anammox
- New populations



## Pilot & demonstration

- On wastewater site only!

# In Kingdom partners



جامعة الفيصل  
Alfaisal University





# Global academic partners (selection)

- Penn State University
- Yale University
- MIT
- University of Technology Sydney
- Princeton University
- EAWAG
- Wetsus
- Delft University of Technology
- University of Western Australia
- University of Aveira
- National University of Singapore
- University of Illinois at UC
- City University of Hong Kong
- University of New South Wales
- NASA JPL
- Ghent University





# Center Industry Affiliates Program

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Ministry of Environment Water & Agriculture

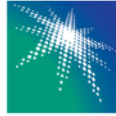
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شركة المياه الوطنية  
National Water Company



أرامكو السعودية  
Saudi Aramco



Schlumberger



NALCO Water  
An Ecolab Company



# Industry projects

- Short term:
  - 1-5 days
  - Expert opinion, analysis
- Medium term:
  - 3-24 months
  - PI, PostDoc, PhD
- Long term:
  - Full PhD research

## Sustainability Vision

The Red Sea Project aims to be the world leader in environmental sustainability across all phases of development – planning, construction and operation – pushing the boundaries of innovative standards & technologies and leveraging local & global partnerships; in order to achieve net positive impact on biodiversity and prove that human development and nature can successfully coexist.





To be launched on  
World Water Day:

## Brains for Brine

International challenge for  
Protecting the  
Marine Habitat from  
Brine Discharge

