National Centre of Excellence in Desalination

Australia

Australian Desalination Research

Presentation to
Texas Water Development Board
28 February 2013

David Furukawa, CSO

Australia's Desalination Plants

The Big Six

Reverse Osmosis

Green energy offsets for 5, RECs for 1

Media and membrane pretreatment

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Perth Seawater Desalination Plant

- Located in Kwinana
- 38mgd Capacity: 40,552 AF/Y
- 24 MW Power Required

- 140 mg/L Product Water
- Commenced operation in Nov. ‘06
- Wind Power is used as offset

Courtesy of Water Corporation

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Perth Seawater Desalination Plant

Sustainable Power - Wind Energy

Zero Greenhouse Gas Emissions

Stanwell/Griffin Joint Venture - Emu Downs wind generation facility – at Badgingarra

200 north of Perth

Water Corporation is purchasing 66 percent of the energy output

24 MW (185 GW hrs/annum)

Opened on 12 November 2006

Courtesy of the Water Corporation

Gold Coast Desalination Plant

- Located in Tugin
- 36 MGD Capacity: 38,000 AF/Y
- Total Capital Cost: $943 million
- Purpose: Supplement surface supply in dry years

- Commenced operation in Nov. '08
- Green Energy (REC) as offset
- Status: Hot Standby Mode; local reservoirs near capacity

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Courtesy of SEQWater

Sydney Desalination Plant

- Located in Kurnell
- 66 MGD Capacity: 77,000 AF/Y
- Total Capital Cost: $1.44 billion
- Purpose: Supplement surface supply in dry years

- Commenced operation in Nov. ‘10
- Wind Power is used as offset
- Status: Standby Mode: Local reservoirs near capacity

Courtesy of Sydney Water

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Adelaide Desalination Plant

- Located in Port Stanvac
- 72 MGD Capacity: 70,000 AF/Y
- Total Capital Cost: $1.5 billion
- Purpose: Supplement surface supply in dry years

- To commence operation in Jan. ‘13
- Wind Power is used as offset
- Status: To be placed in Hot Standby Mode; reservoirs and river flows at high levels

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Courtesy of SA Water

The Victorian Desalination Project

- Located in Wonthaggi
- 120 MGD Capacity: 130,000 AF/Y
- Total Capital Cost: $3.8 billion
- Supplement Surface Supply in dry years

- To commence operation in Dec. ‘12
- Wind Power as offset
- Status: Commissioning

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Courtesy of Victorian Government

Southern Seawater Desalination Plant

- Located in Binningup
- 80 MGD Capacity: 85,000 AF/Y
- Total Capital Cost: $1.27 billion
- Purpose: Base load core supply
- Commenced operation in Sept. ‘11
- Wind / Solar/ Wave Power as energy offset
- Status: Phase 1: operating
  Phase 2: commissioning

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Courtesy of Water Corporation

Note: Brisbane desal capacity includes Western Corridor recycling

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The National Centre of Excellence in Desalination Australia

- Established in 2009
- $20m funding over 5 years from Australian Government's Water for the Future Initiative
- $3m funding from WA Government
- Research Roadmap developed

Australian Government

Water for the Future

THE GOVERNMENT OF WESTERN AUSTRALIA

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Rockingham Desalination Research Facility

Membrane distillation

14 Research Partners

CSIRO

Curtin
University of Technology

DEAKIN
UNIVERSITY AUSTRALIA

AUSTRALIA
ECU
EDITH COWAN
UNIVERSITY

Flinders
UNIVERSITY

MONASH
University

UNSW
THE UNIVERSITY OF NEW SOUTH WALES

THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

University of
South Australia

UNIVERSITY OF
TECHNOLOGY SYDNEY

VICTORIA
UNIVERSITY

THE UNIVERSITY OF
WESTERN AUSTRALIA

University of Wollongong

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Australia

Universities

Research centres

Water utilities

Mining

Government

Other industry

World

USA

Asia

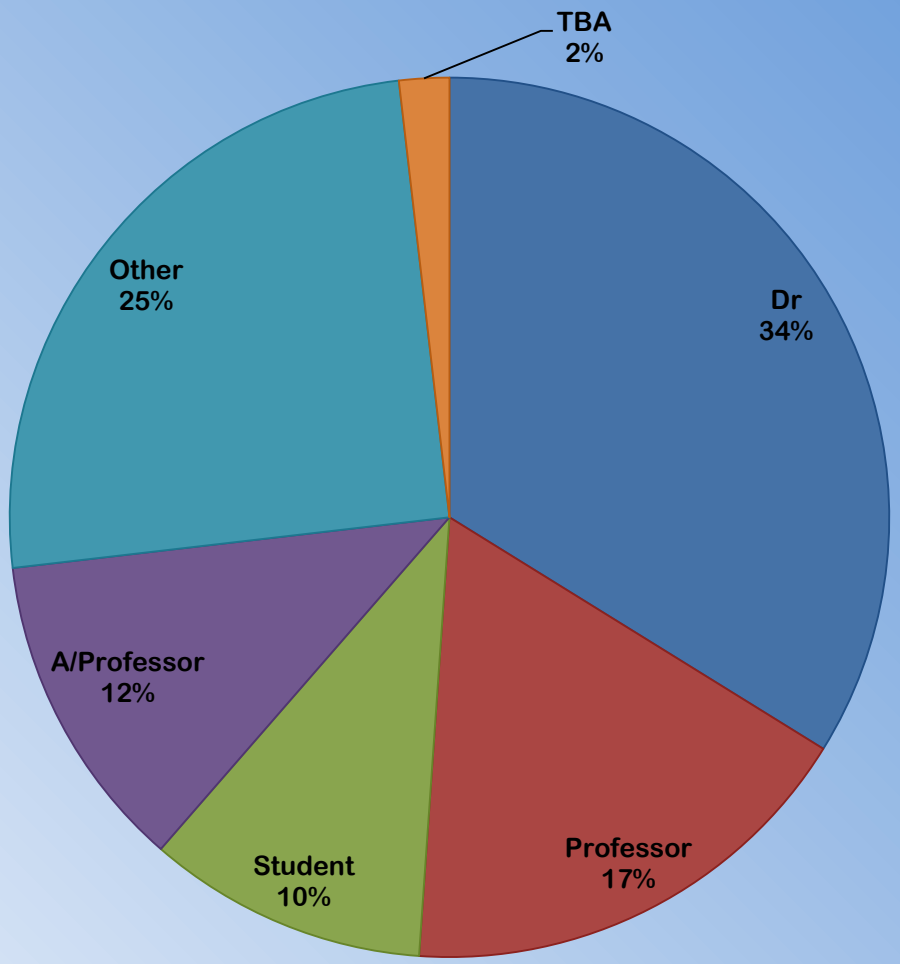
Europe

Middle East

Over 90 national and international research partners

More than 30 international collaborators include:

272 researchers



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Research Projects

Research Projects

Funding Round	Projects	NCEDA Funds	Partners Cash and In Kind	TOTAL
1	11	$2.8m	$8.2m	$11.0m
2	12	$3.0m	$6.9m	$9.9m
3	10	$2.5m	$6.1m	$8.6m
4	10	$2.7m	$6.3m	$9.0m
TOTAL	**44**	**$11.0m**	**$27.5m**	**$38.5m**

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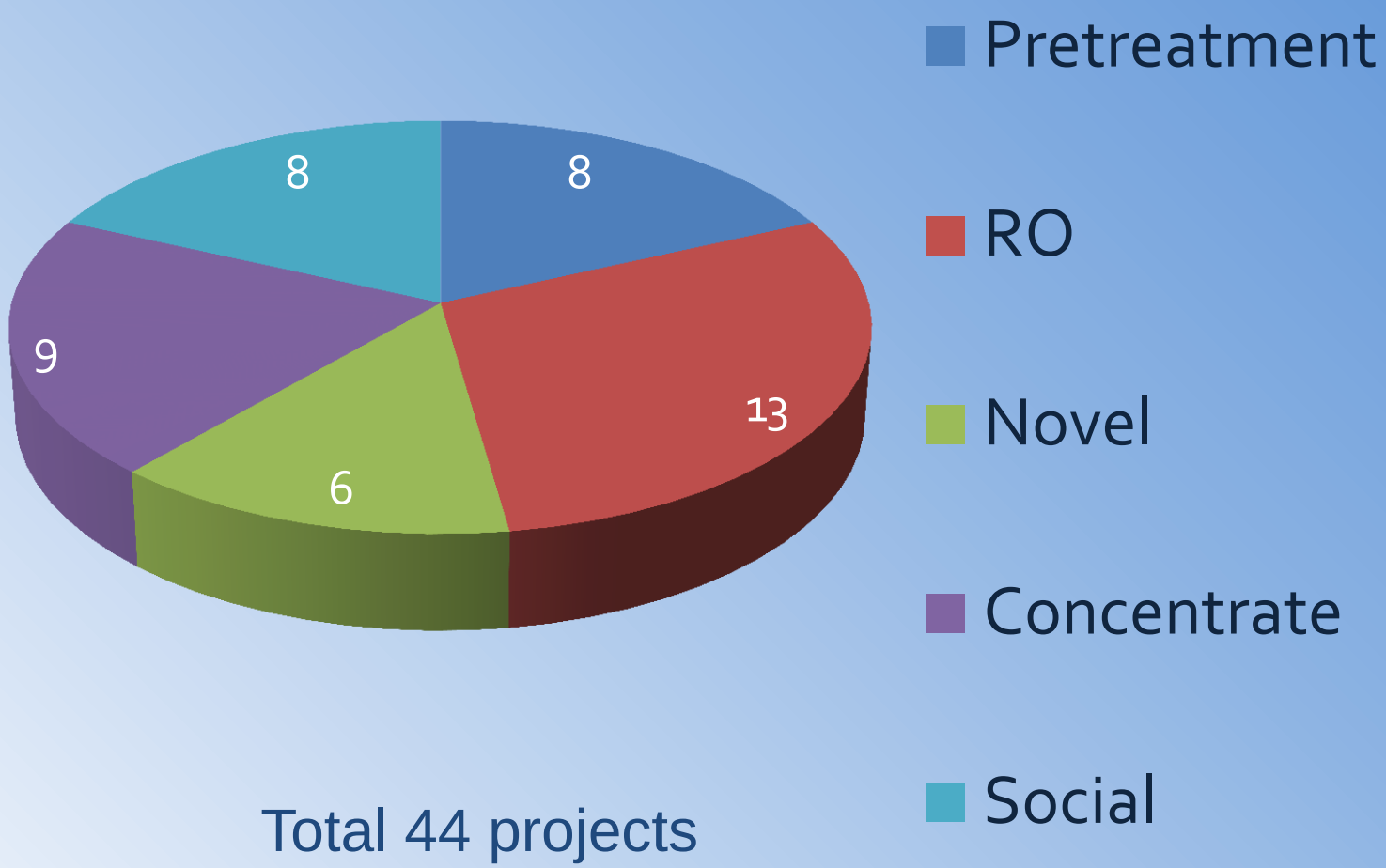
Projects by priority research themes



Total 44 projects

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Concentrate Minimization/ZLD Research Projects

Concentrate minimization

University of New South Wales

Submerged hollow fiber membrane distillation with transverse mechanical shear

Victoria University

RO brine minimization with membrane distillation crystallization

University of Queensland

Hi recovery ceramic membrane distillation

Curtin University

Vibratory shear membrane technology to maximize recovery

Concentrate minimization

University of Wollongong

Extraction of water and minerals from coal seam gas produced water to reduce volume

Victoria University

Silica removal from groundwater to maximize RO recovery

University of Technology-Sydney

Fertigation with FO to reduce Salt Interception Scheme BW volume

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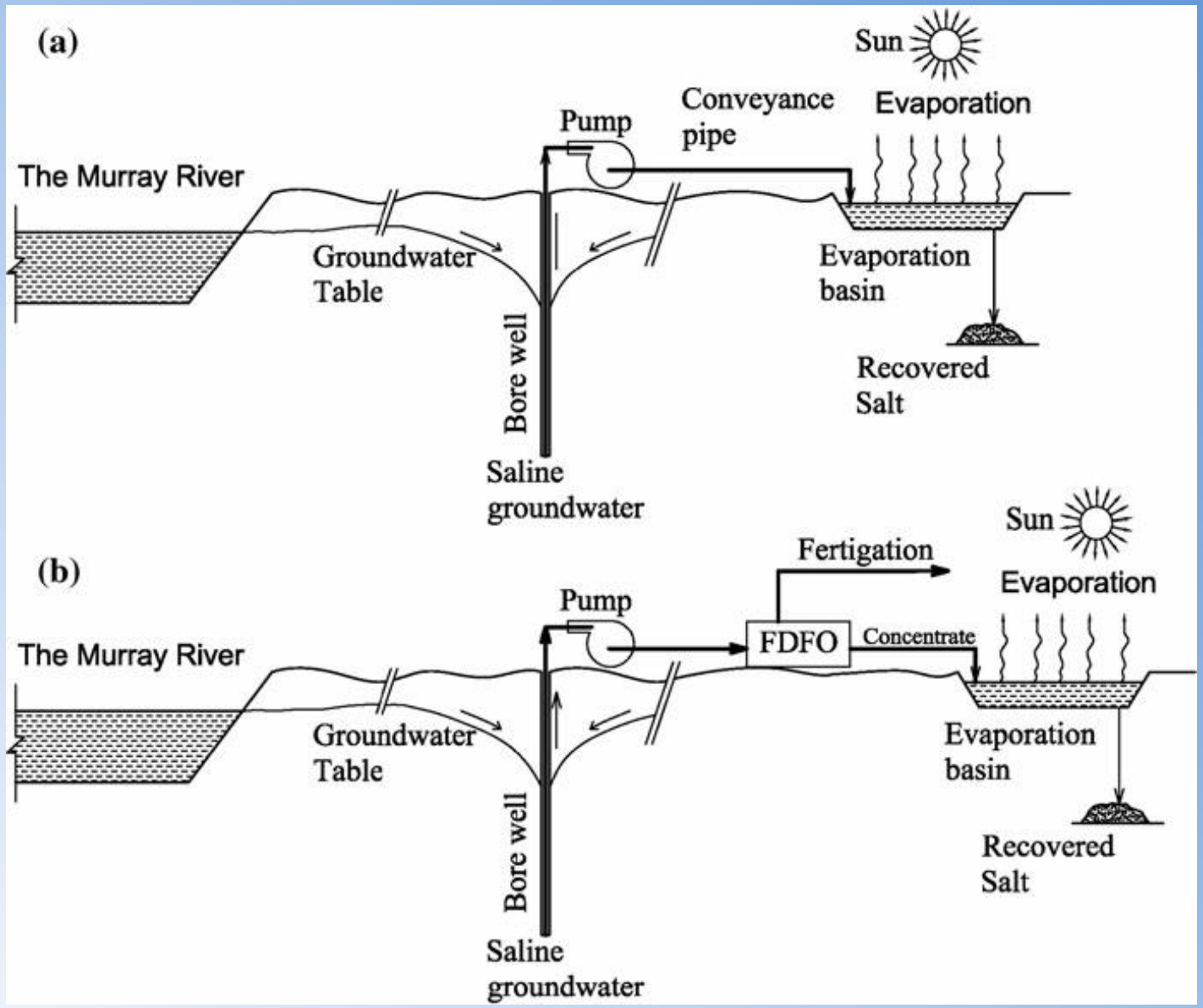
SIS scheme



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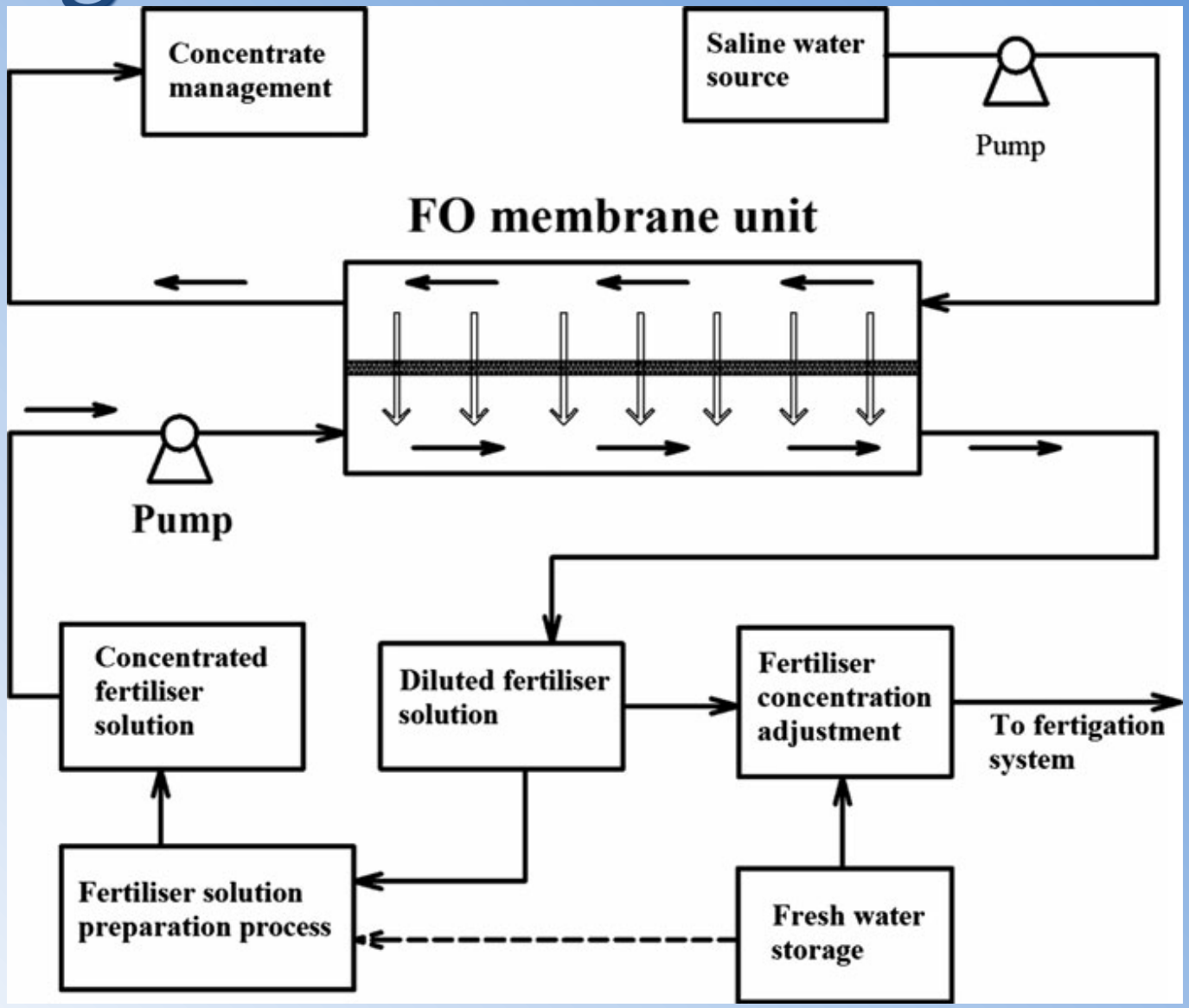
Fertigation



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Desal and Green Energy Research Projects

University of South Australia
SA Water Centre for Water Management and Reuse
Water Corporation
WA Department of Water
Industry Partner LT Green

- Novel CDI technology improves efficiency
- Full scale plant will:
  - provide drinking water for remote communities
  - use photovoltaic renewable energy

  2 projects:

  Graphene electrodes

  Mobile pilot study on remote site

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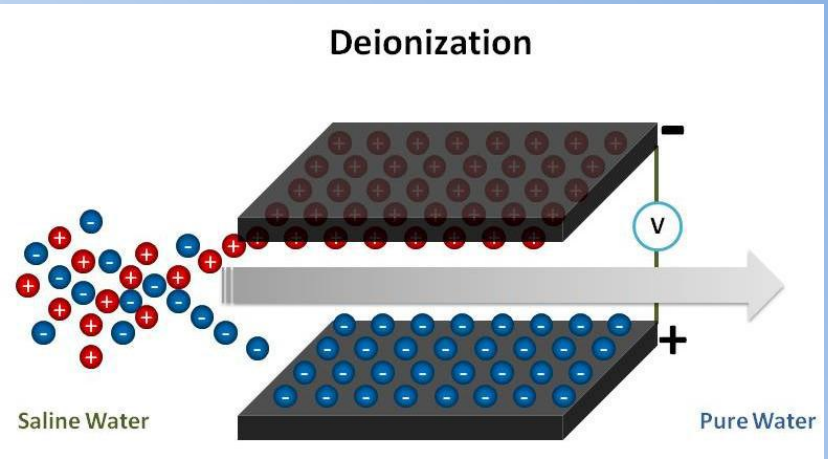
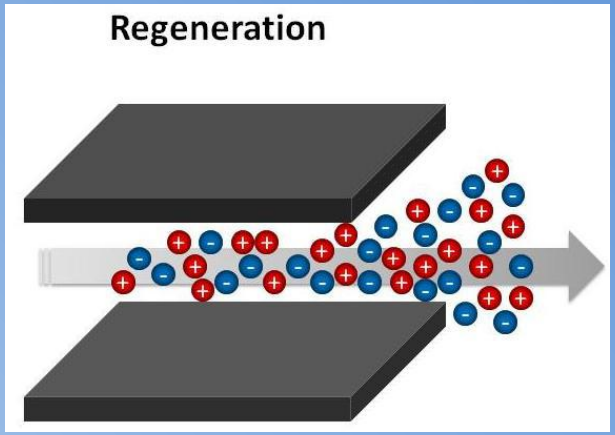
Capacitive Deionization (CDI)





Advantages:

- ✓ Low energy consumption;
- ✓ Easy regeneration of electrodes;
- ✓ Low maintenance requirements;
- ✓ Low secondary pollution;

Electrode materials are the most critical component of the CDI technology

Different carbon materials with porous structure

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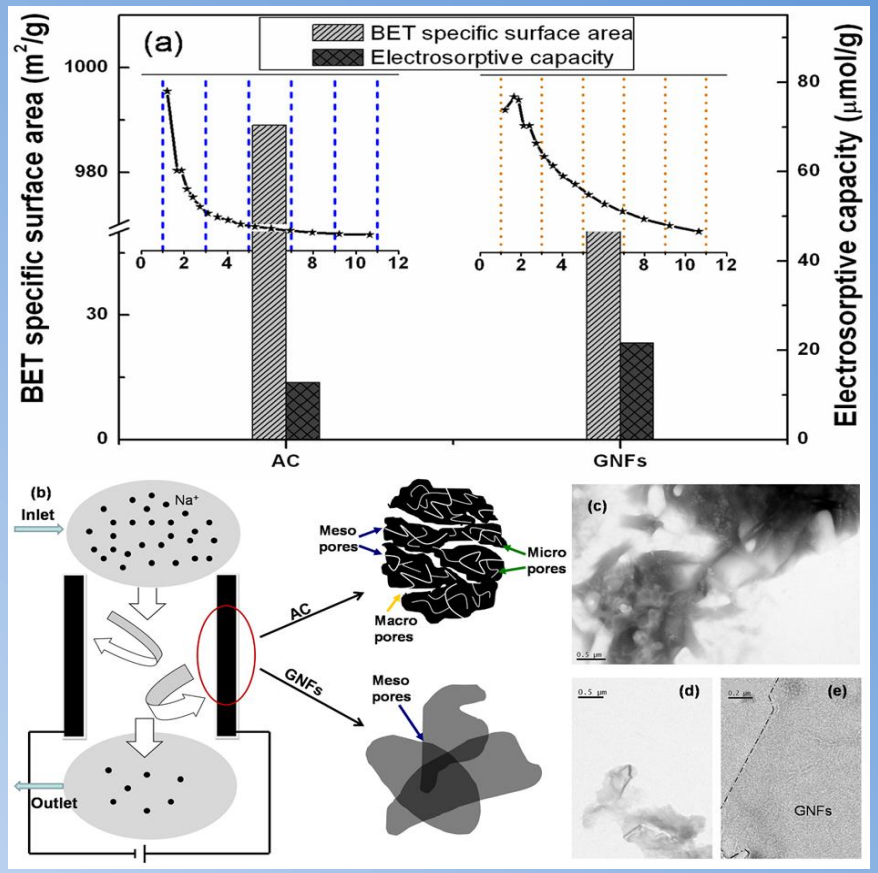
Graphene as CDI electrodes

- GNF(222 m^2/g) has electrosorptive capacity of 23.18 µmol/g
- AC (989 m^2/g) has electrosorptive capacity of 13.73 µmol/g
- GNFs have an interlayered structure which is more accessible for ions
- AC has a large fraction of inaccessible small micropores.



(Li and Zou et al Environ. Sci. Technol., 2010)

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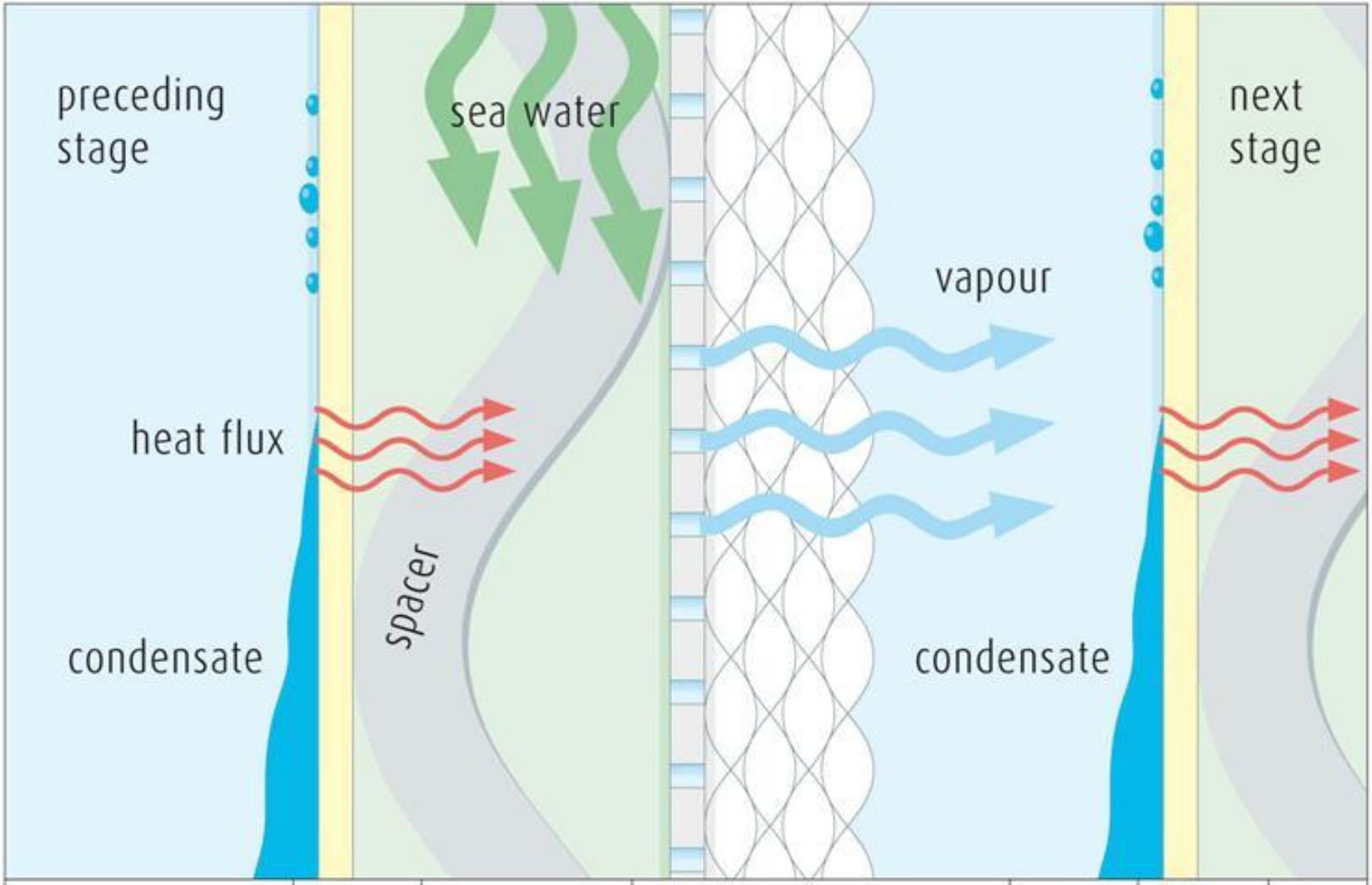
Solar Energy Membrane Distillation for Remote Community

Great Victoria Desert, WA



Dimension µm	25	1000	25	200	4000	25
Function	heat transfer surface	sea water channel with spacer	phase separation membrane: hydrophobic layer	phase separation membrane: fiber tissue	vapour channel	heat transfer surface
Material	PP		PTFE	PP		PP

Image: memSYS

Tjuntjuntjara

Industrial waste heat driven multi-effect distillation

University of Western Australia
CSIRO
Pilbara Cities Office
Water Corporation
WA Dept of Water

- Hot brackish groundwater in WA at depth
- Currently used for pool heating in Perth
- Large reserves:
  - beneath Perth (3 km)
  - the Pilbara – mining area of WA
- Potential for commercial desalination

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University of Western Australia
WA Geothermal Centre of Excellence
Industry Partner (alumina refinery)

- Novel MED technology
- Improves MED efficiency by 30%
- Uses waste heat from the refining process
- Full scale plant will:
  - provide recycled water for the refinery
  - reduce fresh water demand
  - reduce tailings water balance

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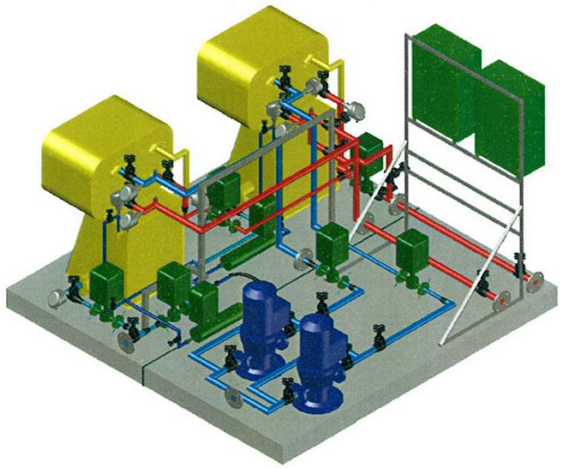
Pilot plant being developed for testing at Rockingham Pilot Test Facility before being relocated to site south of Perth.



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Geothermal Energy, Multi Effect
Distillation and Reverse Osmosis

Other projects of interest

- Desal opportunities in Australian Agriculture
- Public perception of desalination
- Analysis of project delivery methodologies
- Biofouling control/prevention/additives/membrane surface modification…
- Hot standby management
- Environmental impacts
- Smart materials for corrosion control
- …

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Sundrop Farms – Growing Tomatoes from Seawater and Sunshine

Sundrop Farms, Port Augusta, South Australia

- Hypersaline ground water used as feed
- Source: Spencer Gulf
- Approx 57 ppt (normal seawater 37 ppt)
- Parabolic solar collector
- Steam for power and desalination
- Multi stage flash distillation for hydroponics
- Tomatoes, capsicums and cucumbers grown
- Sold in Adelaide markets
- $A30m expansion approved
- 60 new jobs will be created

(NOTE THIS IS NOT AN NCEDA PROJECT).


PRODUCT/ VARIETY
PACKED ON
GROWN /PACKED BY:
PRODUCE OF AUSTRALIA
COUNT
NETT WEIGHT

International collaboration

International collaboration

International Workshops in Australia

Adelaide Intakes and Outfalls Workshop May 2012

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THANK YOU

www.desalination.edu.au

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