



National Centre of
Excellence in Desalination
Australia

Desalination Research for Regional Australia

Presentation to AWA SA Regional Conference, Adelaide 17 August
2012

Neil Palmer, CEO

The National Centre of Excellence in Desalination Australia Rockingham Pilot Test Facility



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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



14 Research Partners



University of Wollongong



NCEDA's 14 members collaborate with 50 Australian industry partners including:



NCEDA's 20 international partners include:



Funding over 5 years:

Source	
Australian Government	\$20m
WA Government	\$3m
Partners	\$7m
Sponsors	\$1m
Murdoch University	\$11m
Project Partners	\$28m
TOTAL	\$70m

NCEDA's Mandate:

The Australian Government provided three mandates to direct the Centre's research:

- ◆ To optimise and adapt desalination technology for use in Australia's unique circumstances
- ◆ To develop suitable desalination technology for use in **rural and regional areas**
- ◆ To improve efficiency and reduce the carbon footprint of desalination facilities and technologies

NCEDA vision for desalination:

- ◆ Efficient and sustainable augmentation of traditional water sources **to provide security** against the natural variability of rainfall and potential future impact of climate change





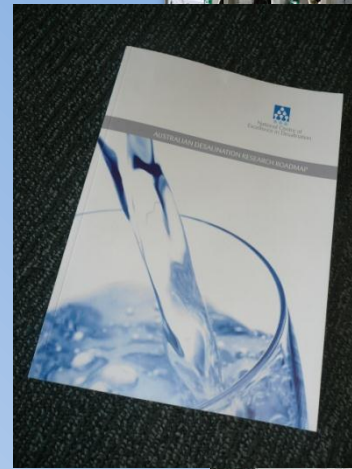
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Research Program



The *Australian Desalination Research Roadmap* developed priority research themes, validated by industry

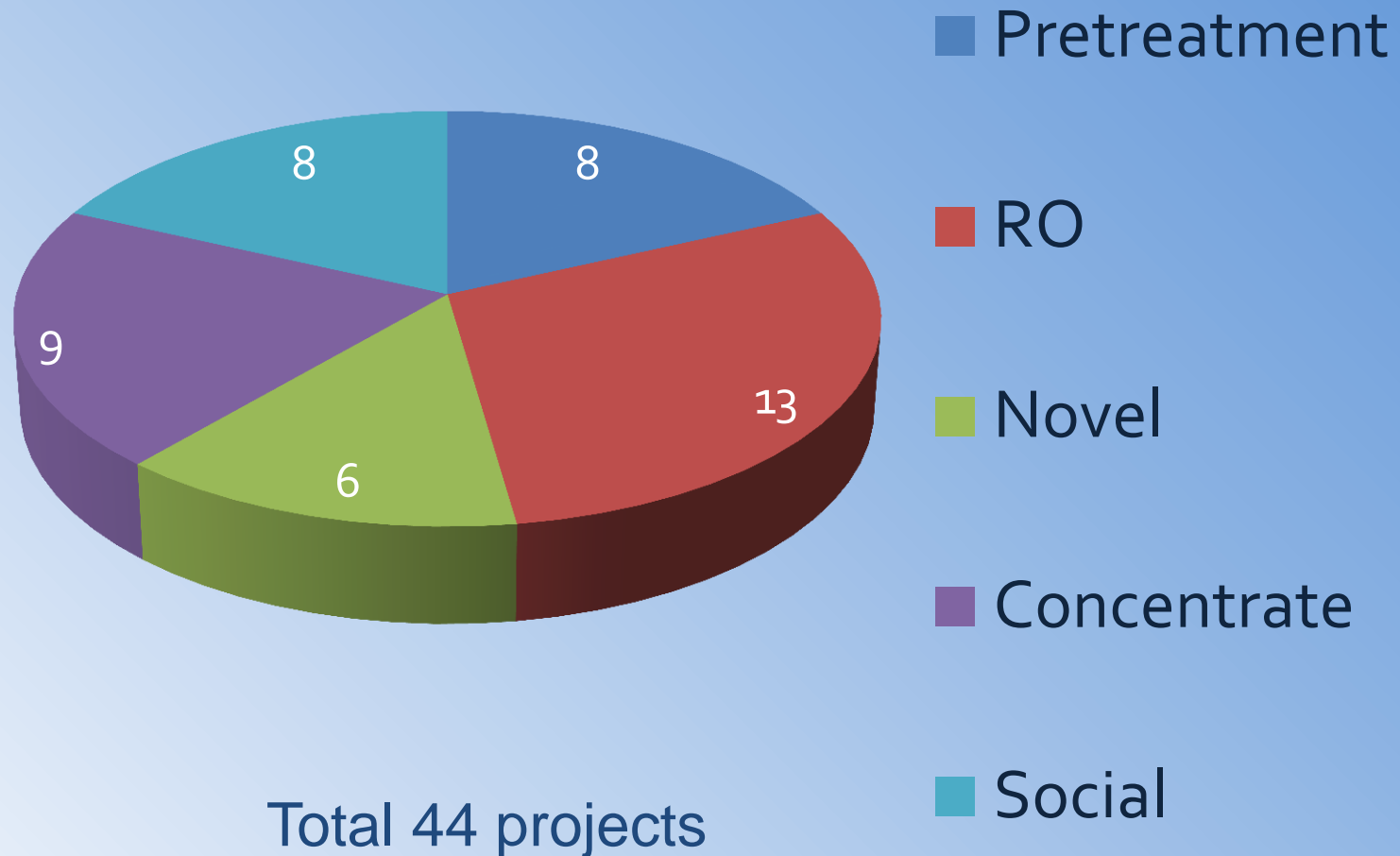
- ◆ Pre-treatment
- ◆ Reverse osmosis desalting
- ◆ Novel desalting
- ◆ Concentrate management
- ◆ Social, environmental and economic issues



Research Projects

Funding Round	Projects	NCEDA Funds	Partners Cash and In Kind	TOTAL
1	11	\$2.8m	\$8.1m	\$10.9m
2	12	\$3.0m	\$6.9m	\$9.9m
3	11	\$3.8m	\$7.6m	\$11.4m
4	10	\$2.7m	\$5.4m	\$8.1m
TOTAL	44	\$12.3m	\$28.0m	\$40.3m

Projects by priority research themes





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Pilot Scale Test Facility



Pilot Scale Test Facility



A large industrial facility with a high ceiling and white walls. The room is filled with a complex network of black pipes and valves, organized into several vertical columns. A central piece of equipment, possibly a pump or motor, is mounted on a stand. To the right, there is a metal frame holding various components, including a red box and white containers. The floor is concrete with a yellow safety line and a drainage grate. The ceiling has exposed wooden beams and fluorescent lights. There are several small square windows high up on the wall.

Pilot Scale Test Facility



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Desal Discovery Centre



Desal Discovery Centre



OSMOFLO



National Centre of
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Desal Discovery Centre





Desal Discovery
Centre at Chemfest
12 Nov 2011



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Australian Desalination

Major Australian desalination plants





Courtesy of Water Corporation

Perth 1 145 MLD



Perth 2 - 300 MLD

Courtesy of Water Corporation









Melbourne 450 MLD

Cost of major urban Australian desal plants

Desalination Plant	When Constructed	Cost \$Ab
Perth SDP (Kwinana)	2006	0.31
Gold Coast (Tugun)	2009	1.20
Brisbane Western Corridor Reuse	2009	2.80
Sydney (Kurnell)	2011	1.89
Perth SSDP (Binningup) 1 & 2	2012	1.40
Adelaide (Pt Stanvac)	2012	1.83
Melbourne (Wonthaggi)	2012	3.50
TOTAL		12.93

Includes plant and connecting water supply infrastructure

Source: ATSE: "Sustainable Water Management – Securing Australia's Future in a Green Economy" ARC April 2012 pp 53-55

Australia's current major desal plants

PLANT	MLD	MGD
◆ PSDP	145	38
◆ Gold Coast	125	33
◆ Sydney	250	66
◆ Adelaide	300	78
◆ SSDP	300	78
◆ Cape Preston	140	47
◆ Melbourne	<u>450</u>	<u>118</u>
TOTAL DESAL	1510	458
◆ Brisbane reuse	<u>230</u>	<u>60</u>
TOTAL CLIMATE RESILIENT	1740	518

Potential future plants (10 year horizon)

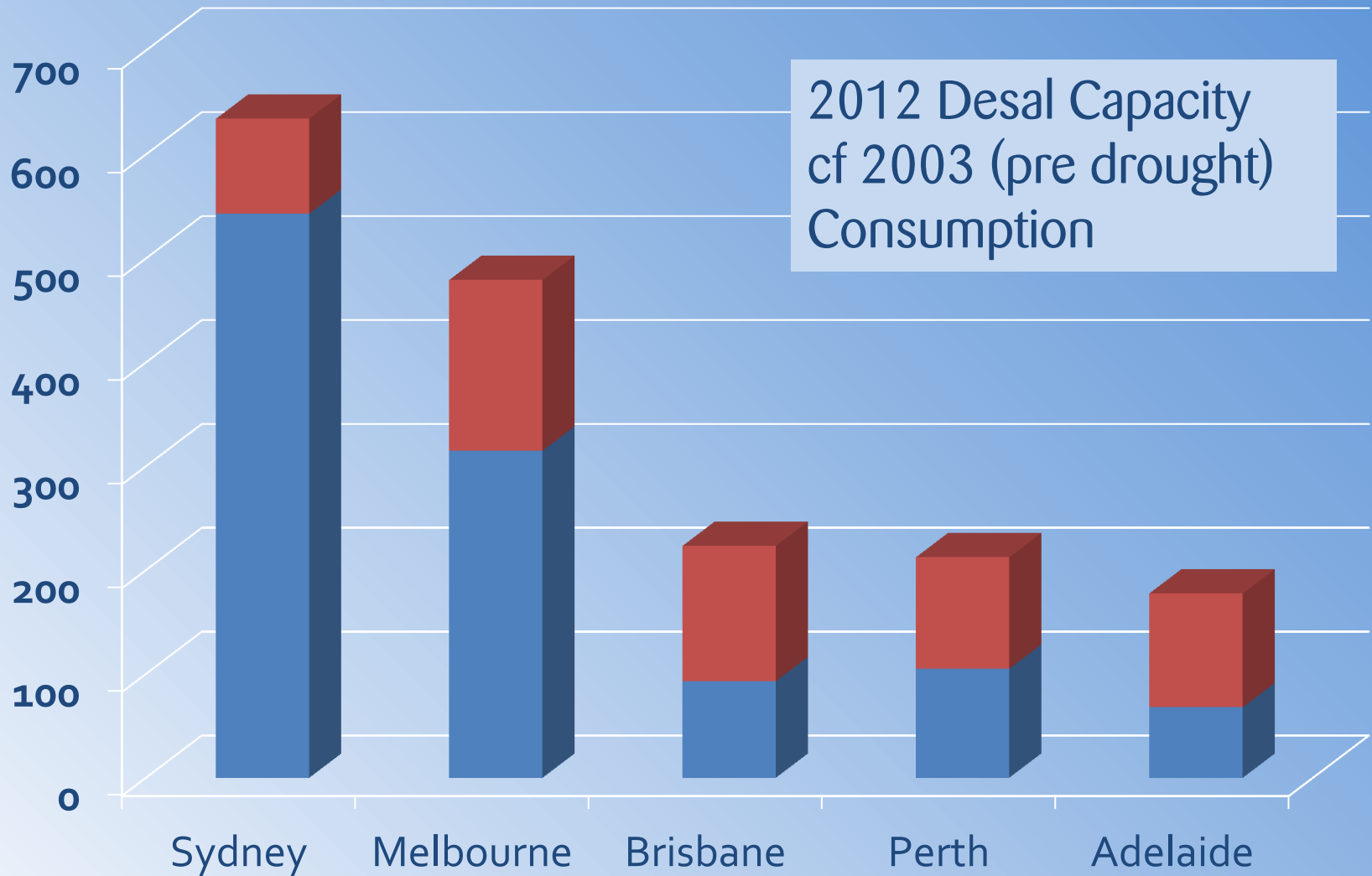
PLANT	MLD	MGD
♦ Whyalla (Olympic Dam)	280	73
♦ WA South Downs	35	10
♦ Perth Reuse (Beenyup)	80	21
♦ Aus Coal Seam Gas	200	52
♦ Aus Mining	200	52
♦ Aus Industry	150	39
♦ WA West Pilbara	30	8
♦ NSW Central Coast	50	13
♦ North Brisbane	150	39
♦ North Perth	<u>150</u>	<u>39</u>
♦ TOTAL	1325	346

Includes both seawater and brackish water desal

City	Water Consumption 02/03*, GL	Desal Capacity, ML/D	Desal Capacity GL/y	Percent Desal
Sydney	634	250	91	14%
Melbourne	479	450	164	34%
Brisbane SWRO	223	125	46	20%
Brisbane Reuse	223	232	85	38%
Brisbane Total	223	357	130	58%
Perth PDSP	212	144	53	25%
Perth SSDP	212	150	55	26%
Perth Total	212	294	107	51%
Adelaide	178	300	110	62%
TOTAL	1726	1651	603	35%

* WSAAfacts 03

■ Trad ■ Desal



Note: Brisbane desal capacity includes Western Corridor recycling



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Rural and regional research projects

Rural and regional projects

- ◆ Pre-feasibility investigation of water and energy options utilizing geothermal energy, multi effect distillation and reverse osmosis
 - ◆ Prof Klaus Regenauer-Lieb, UWA
 - ◆ CSIRO, Pilbara Cities Office, Water Corporation, WA Dept of Water
- ◆ Tjuntjuntjara remote inland indigenous community solar/waste energy groundwater desalination project
 - ◆ Dr Trevor Pryor, Murdoch University
 - ◆ UTS, WA Dept of Housing, Parsons Brinckerhoff, memSYS, IFTS and SMTC



Tjuntjuntjara

Tjuntjuntjara

Rockingham

1300 km

Canberra

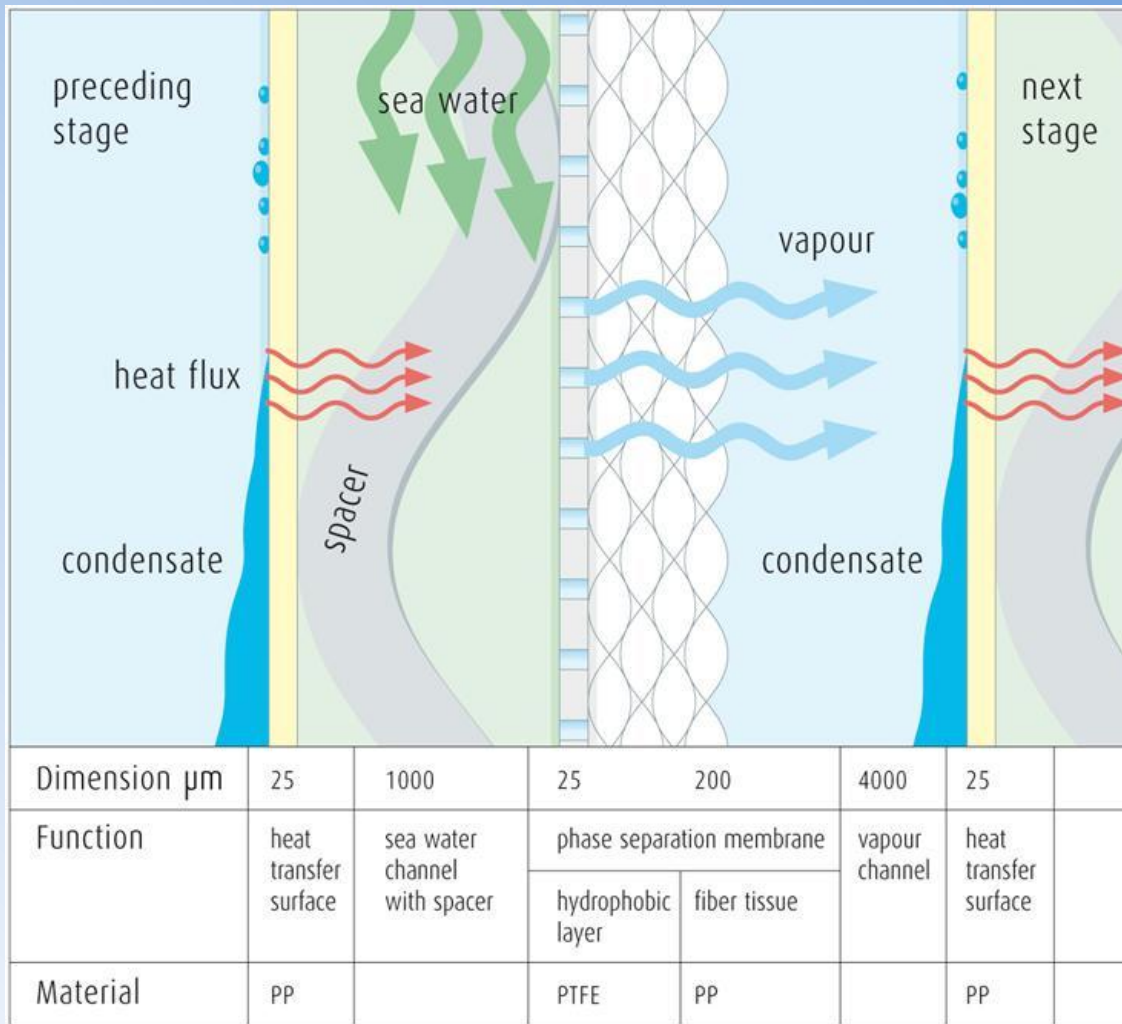
Google earth

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Tjuntjuntjara



Membrane distillation



Images courtesy memSYS



Membrane distillation

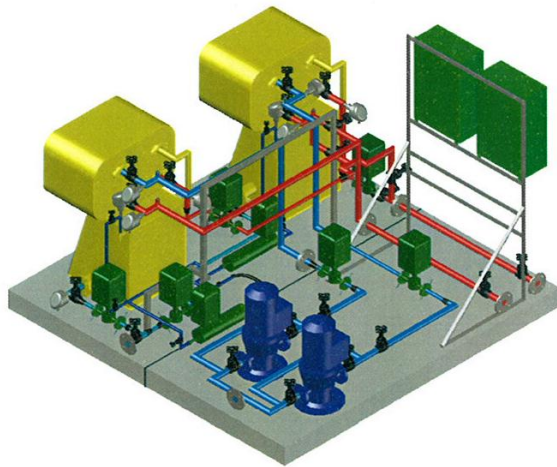
Rural and regional projects

- ◆ Extraction of water and minerals from coal seam gas produced water for beneficial use
 - ◆ A/Prof Long Nghiem, University of Wollongong
 - ◆ VU, AGL, Osmoflo, Colorado School of Mines, Sasakura, AquaStill
- ◆ Development of a novel low grade heat driven desalination technology
 - ◆ Prof Hui Tong Chua, University of WA
 - ◆ WA Geothermal CoE, Mining Industry

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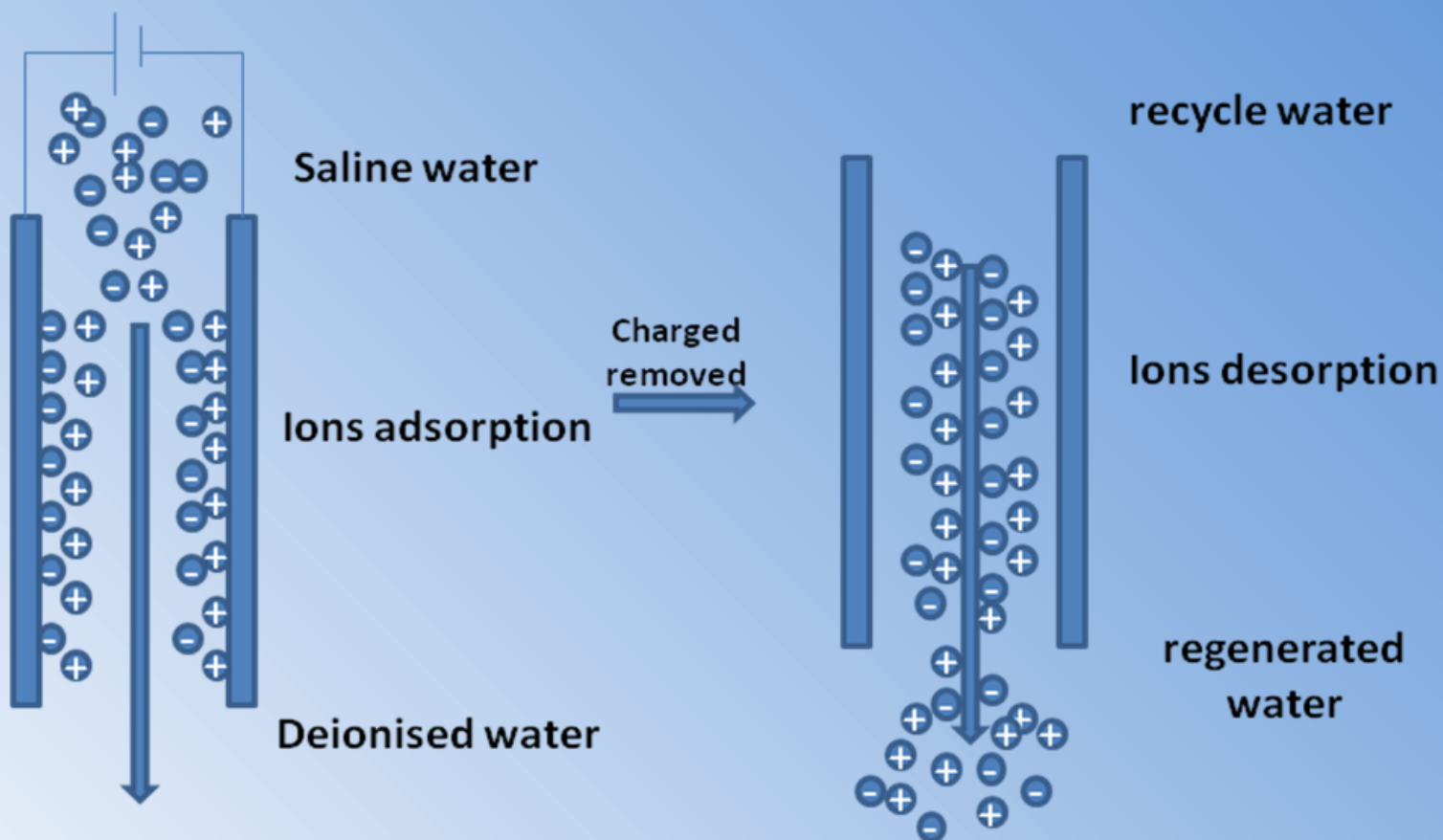
Pilot plant being developed for testing at Rockingham Pilot Test Facility before being relocated to site south of Perth.



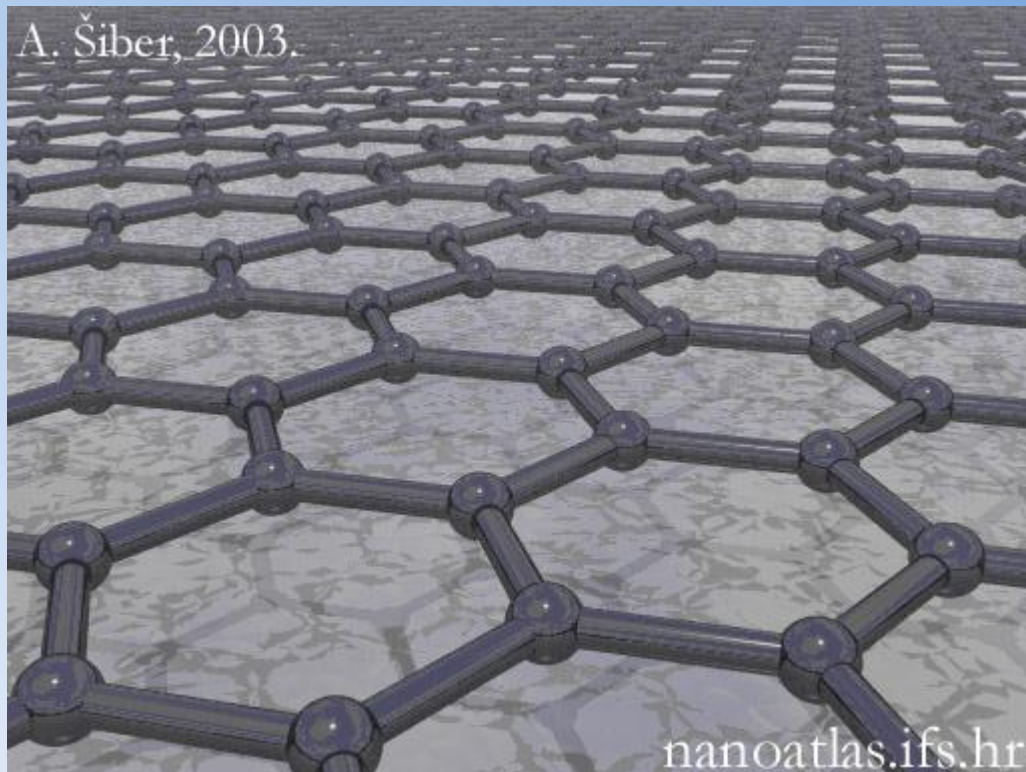
Rural and regional projects

- ◆ Developing highly conductive graphene electrodes for capacitive desalination
 - ◆ Prof Linda Zou, University of SA
 - ◆ SA Water
- ◆ Application of capacitive deionisation in inland brackish water desalination
 - ◆ Prof Linda Zou, University of SA
 - ◆ Power and Water Corporation, SA Water, WQRA, LT Green Energy

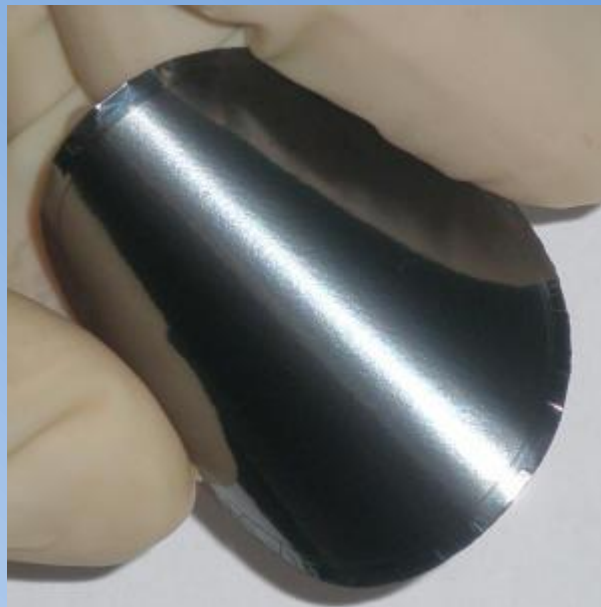
Capacitive deionisation



Graphene



<http://www.legitreviews.com/images/news/2012/graphene-paper.jpg>



Rural and regional projects

- ◆ High water recovery inland desalination using membrane distillation with ceramic membranes
 - ◆ Prof Joe da Costa, University of Queensland
- ◆ Silica removal from groundwater for reverse osmosis water recovery enhancement and waste brine volume reduction
 - ◆ Dr Peter Sanciolo, Victoria University
 - ◆ Hatch, Origin Energy, Minara Resources, UTEP

Desal plant concentrate management



Evaporation Ponds, QNI Yabulu Refinery, Townsville

Rural and regional projects

- ◆ Transverse vibrational motion enhanced submerged hollow fibre membrane crystalliser
 - ◆ Prof Vicki Chen, University of NSW
 - ◆ SMTC
- ◆ Evaluation of vibratory shear membrane technology for concentrate minimisation and brine recovery/recycling
 - ◆ A/Prof Anna Heitz, Curtin University
 - ◆ Orica, Water Corporation, Monash Uni, New Logic Research, UTEP



Rural and regional projects

- ◆ Reverse osmosis brine management by membrane distillation crystallisation
 - ◆ Prof Stephen Gray, Victoria University
 - ◆ CSIRO, GWM Water, Siemens and Osmoflo
- ◆ Management of brine disposal into inland ecosystems
 - ◆ A/Prof Ray Froend, Edith Cowan University
 - ◆ Rio Tinto, Water Corporation, WA CoE in Ecohydrology, WA DEC

Rural and regional projects



Rural and regional projects

- ◆ Brine management using E Cube accelerated evaporator
 - ◆ A/Prof Junde Li, Victoria University
 - ◆ Avivapure
- ◆ Brine management guidelines
 - ◆ Dr Peter Sanciolo, Victoria University
 - ◆ Smart Water Fund, Integrated Elements

Rural and regional projects

- ◆ Development of cleaning guidelines for desalination membrane users
 - ◆ Dr Marlene Cran, Victoria University
 - ◆ Integrated Elements, Nalco
- ◆ Web based public interface tool for climate resilient water sources
 - ◆ Dr Shiroma Maheepala, CSIRO
 - ◆ Bureau of Meteorology, Australian Water Recycling CoE

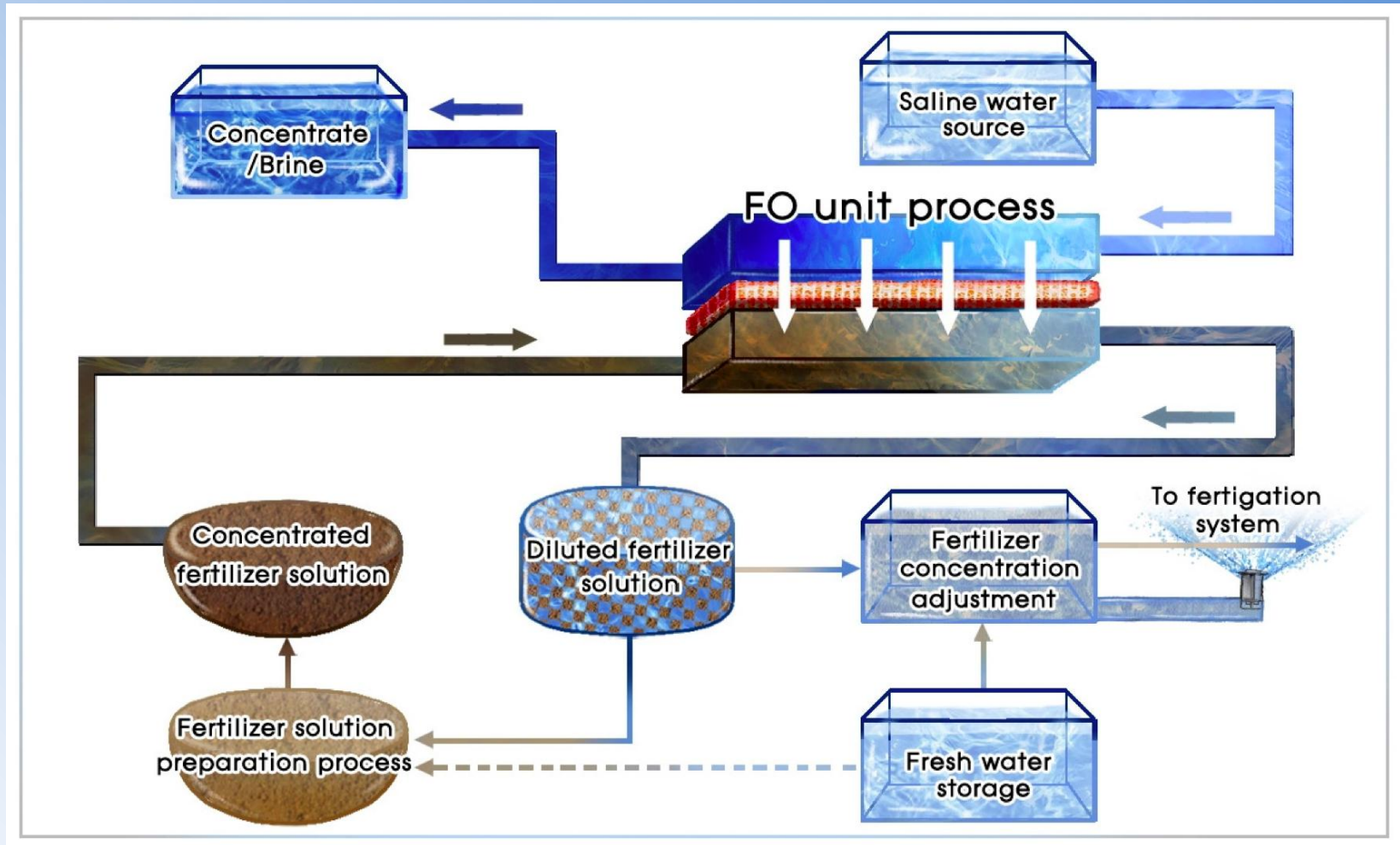
Rural and regional projects

- ◆ Desalination within supply networks: exploring and communicating the bigger picture for water, technology and economic development
 - ◆ Prof Michael Porter, Deakin University
 - ◆ Griffith University, UTS, Curtin University and UWA
- ◆ Optimal water supply sources of resilient urban and remote communities: a review of current Australian and international governance arrangements
 - ◆ Prof Jennifer McKay, UniSA
 - ◆ Valoriza, Acciona, Ernst and Young, Hatch

Rural and regional projects

- ◆ Opportunities for desalination in Australian agriculture
 - ◆ Dr Olga Barron, CSIRO
 - ◆ Valoriza Agua, University of Alicante
- ◆ Fertilisers as draw solutes for forward osmosis desalination: a novel approach for fertigation in the Murray-Darling Basin
 - ◆ Dr Hokyong Shon, University of Technology Sydney

Rural and regional projects



Fertigation

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
 - Oil circuit heats to 160°C
 - Steam for power and desalination
 - Multi stage flash distillation for hydroponics
- Tomatoes, capsicums and cucumbers grown and sold in Adelaide markets
- \$A30m expansion approved
- 60 new jobs will be created

(NOTE THIS IS NOT AN NCEDA PROJECT).





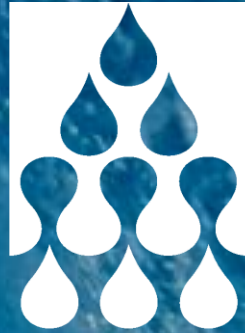
Wingham Kent

PRODUCT/
VARIETY
PACKED
ON

GROWN /PACKED BY:
PRODUCE OF AUSTRALIA

COUNT
NETT
WEIGHT





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THANK YOU

www.desalination.edu.au

Neil Palmer
CEO