Australian Desalination Plan: PPP Models & Solutions for the Environment
2 Case Studies

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France/Spain

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THE AUSTRALIAN EXPERIENCE
Australian Desalination Plants: 2004 - 2012

<table>
<thead>
<tr>
<th>Desalination Plant</th>
<th>When Completed</th>
<th>Capacity m3/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perth SDP (Kwinana)</td>
<td>2006</td>
<td>145 000</td>
</tr>
<tr>
<td>Gold Coast (Tugun)</td>
<td>2009</td>
<td>142 000</td>
</tr>
<tr>
<td>Sydney (Kurnell)</td>
<td>2011</td>
<td>250 000</td>
</tr>
<tr>
<td>Perth SSDP (Binningup) Stg 1&amp;2</td>
<td>2012</td>
<td>300 000</td>
</tr>
<tr>
<td>Adelaide (Pt Stanvac)</td>
<td>2012</td>
<td>300 000</td>
</tr>
<tr>
<td>Melbourne (Wonthaggi)</td>
<td>2012</td>
<td>450 000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>1 587 000</strong></td>
</tr>
</tbody>
</table>

56% of Australian SW Desalination

- Perth: 445 000 m³/day
- Melbourne: 450 000 m³/day
Water Security For Australia’s Mainland Capital Cities

The Big Six Australian Desalination Plants

Perth 1, Perth 2, Gold Coast, Sydney, Adelaide, Melbourne
PPP MODELS IN AUSTRALIA: BOT & ALLIANCE
Built Operate Transfer

An integrated approach:
Developer and sponsor for the long run
Experts in project Financing
Technology Management Specialist
Designer and Construction Manager
Expert in Services

structure - details
risks - details
balanced risk allocation profile
Why a BOT?

**Clients issues**
- Financing development of **infrastructure**
- Performing & **durable** assets
- Optimized & **affordable** tariff
- Delivery certainty of a **complex** project

**Environment for a success**
- **Strong contractual framework**
- Stability
- Existing ‘PPP’ legal framework
- Acceptable guarantee conditions for lenders and investors
- **A viable project in the long run**
- Affordability
- Creditworthiness of client
- Project ‘bankability’
- Commitment to the development process

**BOT Benefits for the client**
- **Low risk, No capex, known tariff, control (kept)**
- The private **investor absorbs** a large part of **risk**
- Strong incentive to deliver the **project on time**
- A **stable price** for the contract whole-life
- **Transfer of expertise** to the local community
- **Reduced balance sheet pressure**
- **Freedom** to pursue other essential projects
- **Control** possibilities of the client of **quality** in all phases

**Why a BOT?**

- “Known” technical risk
- Strong partners (O&M, Construction,...)
Fundamental principles of Alliance are:

Interests of the Alliance rather than the interests of the parties.

Honesty and Confidence, with a commitment of open communication and shared information.

On a best-for-project basis.

Open book policy and transparency in all the operations and transactions.

All results will be shared, benefits and losses.

“No blames” policy.

Audit of economic accounts for all the project results

Reward payment (shared by all parties) will be in line with performance and degree of achievement of objectives.

Risk payment (shared by all parties) will be in line with performance and degree of achievement of objectives.

All decisions shall be, as far as possible, fair and equitable for all parties.

Break down of organizational barriers

Encouragement of innovative ideas
The Alliance Risk & Reward Model

A transparent system between the client and the JV, sharing the decisions and risks

WC: Water Corporation
ALT: Alliance Leadership Team (2WC+ 2 JV)
  Take decisions: Invoice payment, Change decisions, Variation of contract, Application Risk & Reward Model....
AMT: Alliance Management Team (WC-JV)
  Invoice production, Actual Cost Report to ALT.....
PT: Project Team (JV)

Two Contracts of Alliance:
Design & Construction
Operation & Maintenance

Risk & Reward Model

- Reward
  - Project Target Cost
  - Over run
  - Under run

- Risk
  - CAP
  - 50/50

Two Contracts of Alliance:
Design & Construction
Operation & Maintenance
The Alliance Selection Process in a glance

Diagram of Selection Process

EOI

Proponents

RFP Stage

Initial Shortlist

Final Shortlist

Alliance Development Agreement (ADA)

Alliance Agreements

Alliance Agreements

Detailed Design & Construction

Operations and Maintenance

World Bank Group

Valoriza

SUEZ

CMi
CASE STUDIES:

PERTH

&

MELBOURNE
Perth (Western Australia)
Perth Water Supply Security

- 1958: 92% Dams, 8% G/water
- 1980: 65% Dams, 35% G/water
- 2004: 38% Dams, 62% G/water
- 2014: 7% Dams, 42% G/water, 50% Desal, 1% GWR
Perth I SWRO: 144,000 m³/day
PSDP: Perth Seawater Desalination Plant
PERTH I, PSDP– 144 000 m³/d

In operation from Nov 2006
# Perth I Desalination Plant

<table>
<thead>
<tr>
<th><strong>OWNER/PROMOTER</strong></th>
<th><strong>WATER CORPORATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Kwinana, Perth Western Australia</td>
</tr>
<tr>
<td><strong>PPP Contract</strong></td>
<td>Alliance</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>144,000 m³/day</td>
</tr>
<tr>
<td><strong>D&amp;C Joint Venture:</strong></td>
<td>Suez-Degrémont / Multiplex/Worley Parsons/WaterCorp</td>
</tr>
<tr>
<td><strong>O&amp;M Joint Venture:</strong></td>
<td>Suez-Degrémont / WaterCorporation</td>
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</tbody>
</table>

**Densadeg: Sludge Thickening**

**Posttreatment & DW Tank**

**24 DM filters**

**Energy Recovery ERI™**

**RO Building**
Perth I Desalination Plant
Process Diagram

Low energy Consumption
SWRO 1st pass: 2.2 kW.h/m3
Overall plant: 3.45 kW.h/m3 average/year
(3.20-3.75) including DW pumping
Southern Seawater Desalination Plant (SSDP): 306,000 m3/day
SSDP, Australia—306,000 m³/d

Global Water Awards 2012
Desalination Plant of the Year
## Southern Seawater Desalination Plant (SSDP)

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<tr>
<td>Location</td>
<td>Binningup, Western Australia</td>
</tr>
<tr>
<td>PPP Contract</td>
<td>Alliance</td>
</tr>
<tr>
<td>Capacity</td>
<td>306,000 m3/day</td>
</tr>
<tr>
<td>Joint Venture: Southern Seawater Alliance (SSA)</td>
<td>Valoriza Agua / Tecnicas Reunidas / Worley Parsons / AG Lucas / Water Corp</td>
</tr>
</tbody>
</table>
SSDP Desalination Plant
Process Diagram

Built in 2 phases (2009-11 / 2013)

Pretreatment: UF without chemicals

Reduced energy consumption

2.7-3.1 Kw-h/m3

+ 0.58 Kw-h/m3 pumping station
MELBOURNE, Australia—450 000 m³/d

Largest SWRO plant in Asia-Pacific Region
3rd largest SWRO in the World
In operation from November 2012
Largest Water BOT in the World
The “greenest” Desalination Plant
# Melbourne Desalination Plant

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<th>OWNER/PROMOTER</th>
<th>WATER CORPORATION</th>
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<tbody>
<tr>
<td>Location</td>
<td>Wonthaggi, Melbourne, Victoria State</td>
</tr>
<tr>
<td>PPP Contract</td>
<td>BOT</td>
</tr>
<tr>
<td>Capacity</td>
<td>450,000 m3/day (exp.to 600,000)</td>
</tr>
<tr>
<td>D&amp;C Joint Venture:</td>
<td>Suez-Degrémont-Thiess</td>
</tr>
<tr>
<td>O&amp;M Joint Venture:</td>
<td>Suez-Degrémont</td>
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</table>
Melbourne Desalination Plant
Process Diagram

38 hectares,
29 buildings,
3 streams,
51 RO racks,
55000 RO Memb.,
72 DM Filters,
2 tunnels,
85km water transfer pipeline...

An ecological space with “zero nuisance”: 225 hectares coastal park with more than 40 000 plants on the green roof

Wind powered to have “0 Carbon Footprint”
ENVIRONMENTAL ASPECTS
Sustainable source of energy
Control of marine environment
Control of non autochthonous species
Mammal observer during marine works
Possum corridor
Landscape and architecture integration
Specific training for operators in handling of snakes and spiders
Technology of non invasive marine works (micro-tunneling)
No chemicals policy – UF backwash water discharged directly to the sea (brine)
Protection of dune system – tunnels

2 intake towers
2 intake pipes 2.4 m HDPE
1 brine pipe 2.2 m HDPE with diffusers
Melbourne Desal Plant, Marine Environment Protection:

Tunnels for Intake & Outfall: 4 m Ø, 1150 m long, -3% slope

SW intake > 25 m deep

Intake works > 60 m deep
Control of marine environment
Perth I - PSDP

Software - Hydraulic Models – Real Tests - Monitoring

The Challenge:
EPA instructions → intake and discharge in the same lane works.
Max. length 800 m.
10 m. max. depth

Modeling the discharge and monitoring

Dye Release Tests at Commissioning Phase to confirm the results (EPA)
Brine Discharge Challenges:

- Quick salinity dilution (< 50 m.)
- Keep Oxygen level
- Minimum Suspended Solids

Cockburn Sound

It should be noted that this diagram is intended to schematically portray the processes associated with the discharge of seawater concentrate into Cockburn Sound. This diagram does not reflect the scale or intensity of the actual processes expected within Cockburn Sound.
Discharge Monitoring: 4 years of follow up, 24h/24h, EPA

Survey (buoys) of the brine discharge impact on the environment of Cockburn Sound 24h/24h

Conclusions:
- No effect of desalination discharge on stratification in the deep waters of the Sound
- No impact of desalination discharge on dissolved oxygen in the Sound
- Environmental dilution > 1000 times
- **No adverse environmental impacts monitored** in Cockburn Sound

Marine growths around diffuser

Average density difference
## Renewable Energies feeding Desalination

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<tr>
<th>PERTH I - PSDP</th>
<th>PERTH II - SSDP</th>
<th>MELBOURNE</th>
</tr>
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<tr>
<td>Emu Downs <strong>Wind Farm</strong>, near Cervantes, 300 Km North of Perth</td>
<td>Mumbida <strong>Wind Farm</strong> near Geraldton 400 Km North of Perth Verve Energy- Macquarie Capital; 22 turbines, <strong>55 MW</strong> Greenough River 10 MW <strong>Solar Farm</strong> (expandable to 40 MW). 80 Has; 150,000 PV panels – largest photovoltaic array in Australia</td>
<td><strong>Plant guaranteed Energy Consumption:</strong> 90 MW <strong>Energy provided by two Wind Farms of AGL power company:</strong></td>
</tr>
<tr>
<td>Stanwell/Griffin JV: 40 turbines, <strong>83 MW</strong></td>
<td></td>
<td>- Oaklands Hill Wind Farm: <strong>63 MW</strong> from 32 Turbines</td>
</tr>
<tr>
<td>272 GW.h/year to the grid in average</td>
<td></td>
<td>- Macarthur Wind Farm: <strong>420 MW</strong> from 140 Turbines</td>
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THANK YOU FOR YOUR ATTENTION

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