Workshop on Water Optimization in Thermal Power Plants

India Habitat Centre, Lodhi Road, New Delhi
IDE Technologies Ltd – Overview

Winner of ‘Desalination Company of the Year 2011’ GWI Award

- Established - 1965
- Headquarters - Kadima, Israel
- Employees - 400\(^{(1)}\)
- Subsidiaries - China, India, USA, Europe
- Installed units - 400 in over 40 countries
- Ownership:
  - ICL (50%)
  - Delek Group (50%)

\(^{(1)}\) Including subsidiaries
Another Milestone

IDE’s Carlsbad desalination project now going for the double.

The **Carlsbad Desalination deal** is now going for the double. Having just won Project Finance magazine’s North American Water Deal of the Year, we hope, with your help, it will also win the equivalent Global Water Award for 2013.

The project took a decade of preparation and tremendous tenacity by all participants, proving that large-scale desalination projects in the US can be financed. The innovative structure of the deal allows savings of an estimated $200 million and will serve as a blueprint for future large-scale desalination projects in the US.

Cape Preston plant shortlisted for Industrial Water Project of the Year in the Global Water Awards 2013

The **Cape Preston Desalination Plant** is truly groundbreaking.

This is the first time a pre-engineered modular plant has been built on this scale and represents a revolution in the desalination plant supply chain.
Corporate Offerings

Solutions & Technologies:

- Desalination
- Industrial Water Treatment
- Snowmaking & Refrigeration
Corporate History

- Company established in 1965
- Operation began as an Israeli governmental R&D entity in the early 1960s
- First commercial facilities deployed in Spain during 1967
- Became part of Israel Chemicals (ICL)
- Awarded the Larnaca contract in 1999

- Introduction of Multi-Effect Distillation (MED) in the 70s
- Introduction of Reverse Osmosis (RO) in the early 90s
Corporate History

2000-2004
- Comprehensive restructuring efforts to boost profitability

2005-2007
- Ashkelon facility granted “Desalination Plant of the Year” award 2006

2007-2010
- Completion of Hadera facility in 2010
- Commenced construction of Tianjin and Cape Preston in 2009
- Completion of Ashkelon facility in 2005
- Commenced construction of Reliance facility in 2008
- Awarded the Sorek contract in 2009
- Awarded additional Tianjin contract in 2010

50% of IDE acquired by Delek Group in 2000
Desalination: Solutions & Technologies

- Thermal Desalination
- Reverse Osmosis Desalination
- Water Sales

Tianjin, 200,000 m³/day
China’s largest MED desalination facility

Hadera, Israel 127M m³/year
The largest operating SWRO facility worldwide
Corporate

Desalination Solutions – Large Scale Projects

EPC Global Market Leader

- **Reduced Costs:**
  - Unparalleled optimization of Capex vs. Opex expenses

- **Expertise:**
  - Successful implementation of world’s largest, most complex mega-size thermal & SWRO facilities
  - Successful global BOT projects

- **Proven Track Record**
  - 400 Plants. 40 Countries. 4 Decades

Reliance, India 160,000 m³/day MED desalination facility

Ashkelon, Israel 118M m³/year Second largest operating desalination facility worldwide
Unique Value: MED, MVC - Thermal Desalination

Largest MED & MVC Facilities

- **Technology**
  Proprietary Multi-Effect Distillation (MED) & Mechanical Vapor Compression (MVC) technologies

- **Energy**
  Lowest MED & MVC desalination plant energy consumption

- **Cost**
  Optimized competitive cost performance

- **Plant Size**
  Largest MED sites & MVC units worldwide\(^{(1)}\)

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\(^{(1)}\) In accessible markets
Unique Value: SWRO – Membrane Desalination

Largest Operating SWRO Facilities Worldwide

- **Technology**
  - Intellectual Property (IP)
  - Innovation
  - Industry First
  - Setting global standards & trends

- **Energy**
  World leader in lowest desalination plant energy consumption

- **Cost**
  Continuously setting price benchmarks

- **Track Record**
  World’s largest, most complex SWRO projects
Setting the Industry Price Benchmark

Global Key Projects Water Prices

<table>
<thead>
<tr>
<th>Project</th>
<th>Completed</th>
<th>Contracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larnaca 1999</td>
<td>$0.75</td>
<td></td>
</tr>
<tr>
<td>Ashkelon 2001</td>
<td>$0.52</td>
<td></td>
</tr>
<tr>
<td>Hadera 2006</td>
<td>$0.57</td>
<td></td>
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<tr>
<td>Soreq 2007</td>
<td>$0.58</td>
<td></td>
</tr>
</tbody>
</table>

Source: Global Water Intelligence (2010), Company Information
Proven Leadership in Large Scale Projects\(^1\)

**MED/MVC**

<table>
<thead>
<tr>
<th>Location</th>
<th>Capacity m(^3)/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tianjin, China</td>
<td>200,000</td>
</tr>
<tr>
<td>Jamnagar, India</td>
<td>160,000</td>
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<tr>
<td>Las Palmas, Spain</td>
<td>36,000</td>
</tr>
<tr>
<td>Huanghua, China</td>
<td>20,000</td>
</tr>
<tr>
<td>Sicily, Italy</td>
<td>18,000</td>
</tr>
<tr>
<td>Sardinia, Italy</td>
<td>17,280</td>
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</tbody>
</table>

**MED**

**MVC**

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Source: Global Water Intelligence (2010), Company Information

(1) In accessible markets only
Proven Leadership in Large Scale Projects\(^{(1)}\)

**SWRO**

<table>
<thead>
<tr>
<th>Location</th>
<th>Capacity m(^3)/day</th>
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<tbody>
<tr>
<td>Sorek, Israel</td>
<td>500,000</td>
</tr>
<tr>
<td>Wonthaggi, Australia</td>
<td>444,000</td>
</tr>
<tr>
<td>Hadera, Israel</td>
<td>440,000</td>
</tr>
<tr>
<td>Ashkelon, Israel</td>
<td>390,000</td>
</tr>
<tr>
<td>Port Stanvac, Australia</td>
<td>300,000</td>
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<tr>
<td>Sydney, Australia</td>
<td>250,000</td>
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<tr>
<td>Kwinana, Australia</td>
<td>143,700</td>
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<tr>
<td>Valdelentisco, Spain</td>
<td>140,000</td>
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<tr>
<td>Cape Preston, Australia</td>
<td>140,000</td>
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<tr>
<td>Binningup, Australia</td>
<td>140,000</td>
</tr>
</tbody>
</table>

**Source:** Global Water Intelligence (2010), Company Information

\(^{(1)}\) In accessible markets only
Industrial Water Treatment & Recycling Solutions

- **Reliable. Sustainable. Economical.**
- **Proven Technology**
  - Thermal & Membrane based solutions
  - Successful operation for over 20 years e.g:
    - Tutuka, South Africa
    - Wintershall, Germany
- **Cost-Effective**
  - Unique horizontal modular design
  - Low field set up costs
- **Environmentally-Friendly**
  - Reduced energy consumption & footprint
  - Low chemicals consumption
Successful Global Leadership Over 4 Decades

Global Deployment. 4 Decades. 40 Countries. 400 Plants.

Israel
Total Capacity: 1,330,000 m³/day

Spain
Total Capacity 78,000 m³/day

Cyprus
Total Capacity 125,000 m³/day

Italy
Total Capacity 27,000 m³/day

USA
Total Capacity 2,000 m³/day

China
Total Capacity 200,000 m³/day

Caribbean
Total Capacity 106,000 m³/day

India
Total Capacity 198,000 m³/day

Latin America
Total Capacity 36,000 m³/day

Australia
Total Capacity 140,000 m³/day

Central Asia
Total Capacity 19,000 m³/day
# Blue Chip Customer Base

## Desalination Solutions

<table>
<thead>
<tr>
<th>Power Facilities</th>
<th>Refineries &amp; Industries</th>
<th>Municipalities/Governments</th>
<th>Industrial Evaporators</th>
<th>Refrigeration/Heating/Ice &amp; Snow Machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Customers</td>
<td>Top Customers</td>
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### Top Customers

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<tr>
<td>NPCIL</td>
<td>India</td>
<td>Reliance</td>
<td>India</td>
<td>WDD</td>
<td>Cyprus</td>
<td>Nestle</td>
<td>Thailand</td>
<td>Anglo Gold</td>
<td>South Africa</td>
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<tr>
<td>SDIC</td>
<td>China</td>
<td>HAR</td>
<td>Greece</td>
<td>WDA</td>
<td>Israel</td>
<td>Integral Technologies</td>
<td>Germany</td>
<td>Sanken</td>
<td>Japan</td>
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<td>Endesa</td>
<td>Spain</td>
<td>PDVSA</td>
<td>Venezuela</td>
<td>Poseidon Resources</td>
<td>California, US</td>
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<td>CFE</td>
<td>Mexico</td>
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<td>AES</td>
<td>Chile</td>
<td>Oil Refineries</td>
<td>Israel</td>
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<td>Kazatomprom</td>
<td>Kazakhstan</td>
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World Water Availability, 2025

m³ / person / yr available

- >1,700 No Stress
- 1,000-1,700 Moderate Stress
- 500-1,000 High Stress
- < 500 Extreme Stress

(1) Global Water Intelligence (2010).
IDE MED Solutions

- **Technology**
  Proprietary Multi-Effect Distillation (MED) & Mechanical Vapor Compression (MVC) technologies

- **Energy**
  Lowest MED & MVC desalination plant energy consumption

- **Cost**
  Optimized competitive cost performance

- **Plant Size**
  Largest MED sites & MVC units worldwide

- **Efficiency**
  The Low Temperature Multi Effect Distillation (LT-MED) is one of the most efficient thermal desalination processes in the world currently in use
IDE MED Technology

- The thermal desalination process requires the following:
  - Constant source of raw water
  - Constant source of energy
  - Evaporation - condensation in a vacuum environment

**Technological Advantages:**

- High thermal efficiency – low cost Materials of Construction (MOC)
- Large wetting areas - avoiding scaling & fouling
- Falling film wetting areas – reliable, non-clogging wetting operations
- Backpressure MED – enabling the use of waste heat as a driving force
- MED using flue gases from FGD or Diesel as a driving force (using a Flash Chamber)
Multi Effect Distillation (MED)
Typical MED 6000 Plant Design Mass Balance 6000 m³/day

- Steam: 38.5 T/hr
- Seawater: 760 T/hr
- Cooling water (summer): 400 T/hr
- Brine: 510 T/hr
- Product: 250 T/hr
- Condensate: 38.5 T/hr
Condensation (inside) + Evaporation (outside)

- Water vapor Loses Heat > CONDENSES
- Seawater Receives Heat > EVAPORATES
- Seawater Receives Heat > EVAPORATES

Tube
The MED can operate between 40%-110% capacity under variable steam pressures and temperatures.
Back Pressure
MED Diesel

Diesel Engine

Waste Heat Boiler

Heat Exchanger

Flash Chamber
Reliance - India’s Largest Desalination Plant
160,000 m³/day
Reliance Plant Benefits

- **Technology**
  - Continuous successful operation with high reliability > 95%
  - Low energy consumption
  - Low temperature process for high safety and low maintenance

- **Robust customized design**
  - Optimized for customer needs
  - Low O&M costs

- **Easy operation**

- **Minimal pretreatment required**
Additional IDE Thermal Solutions in APAC

- Tianjin, China
- Essar, India
- Parry, India
- Sanghi, India
- NPCIL/Kudankulam, India
SDIC Tianjin – China’s Largest Desalination Plant
200,000 m³/day
Essar, Jamnagar, MED – 65,000 m³/day
E.I.D. Parry (Chennai) MED-1,560 (1994)
Sanghi Cement (Hyderabad) MED-5,500 (1996)
NPCIL (Nuclear Power Corps of India (Kudankulam)
4 x MVC - 2,560 (2006)
NPCIL, India 4 x MVC - 2,560 (2006)
One of the largest SWRO desalination plants worldwide

- **Capacity**
  150 M m³/year, 624 MLD (max. 26,000 m³/hr): ~ 20% of the potable water consumption of Israel

- **Technology**
  Reverse Osmosis (RO)

- **Project Type**
  BOT (Build, Operate & Transfer) - 25 years

- **Location**
  Sorek, Israel

- **To be Commissioned**
  2013

Currently under construction - to be operational in August 2013
Hadera Seawater Desalination Facility

The largest SWRO operating desalination plant worldwide

- **Capacity**
  127M m³/year

- **Technology**
  Reverse Osmosis (RO)

- **Project Type**
  BOT (Build-Operate-Transfer) - 25 years

- **Location**
  Orot Rabin Power Station - Hadera, Israel

- **Commissioned**
  2009
Ashkelon Seawater Desalination Facility

The second largest SWRO operating desalination plant worldwide

- **Capacity**
  118M m³/year

- **Technology**
  Reverse Osmosis (RO)

- **Project Type**
  BOT (Build-Operate-Transfer) - 25 years

- **Location**
  Ashkelon, Israel

- **Commissioned**
  2005
Larnaca Seawater Desalination Facility

Among the largest SWRO desalination plant worldwide

- **Capacity**
  21.5M m³/year (expansion)

- **Technology**
  Reverse Osmosis (RO)

- **Project Type**
  BOOT (Build-Operate-Own-Transfer), 10 year contract water sale

- **Location**
  Larnaca, Cyprus

- **Commissioned**
  2001/2008 (expansion)
The largest desalination plant in the western hemisphere upon completion

- **Capacity**
  54 MGD (204,412 m³/day)

- **Technology**
  Reverse Osmosis (RO)

- **Project Type**
  Engineering, Procurement and Support Services + Operation and Maintenance (O&M)

- **Location**
  Carlsbad, California, US

- **To be Commissioned**
  2016
# Water Sale Concessions (BOT)

<table>
<thead>
<tr>
<th>Site</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Larnaca, Cyprus</strong></td>
<td>- 10 year concession, since 2001&lt;br&gt;- Operation began in 2001&lt;br&gt;- Capacity of 21.5M m³/year&lt;br&gt;- Expansion recently completed</td>
</tr>
<tr>
<td><strong>Ashkelon, Israel</strong></td>
<td>- 25 year concession, since 2002&lt;br&gt;- Operation began in 2005&lt;br&gt;- Capacity of 118M m³/year&lt;br&gt;- GWI Award – ‘Desalination Plant of the Year’ in 2006</td>
</tr>
<tr>
<td><strong>Hadera, Israel</strong></td>
<td>- 25 year concession, since 2006&lt;br&gt;- Operation began in 2009&lt;br&gt;- Capacity of 127M m³/year&lt;br&gt;- Euromoney Project Finance ‘Deal of the Year Award’ in 2007</td>
</tr>
<tr>
<td><strong>Sorek, Israel</strong></td>
<td>- 25 year concession, from end of 2013&lt;br&gt;- Operation expected in 2013&lt;br&gt;- Capacity of 150M m³/year&lt;br&gt;- Expected to be the largest SWRO plant in the world upon completion</td>
</tr>
</tbody>
</table>

Source: Company information
Main Plant Features

- Double Line Intake
- Three Pressure Center design concept (HP, RO, ERS) as implemented in Ashkelon and Hadera
- Large diameter (16") membrane elements in an innovative vertical arrangement of membrane PV
- Membrane based Boron removal system
- Self-Generating Energy Supply System
Pipe Jacking Intake and Outfall
Pipe Jacking Shafts
Pipe Jacking Shafts
Three pressure center design

High availability - pump maintenance do not affect actual production
High flexibility – stop of RO train do not affect actual production
Mega Units Pressure Center Design

1 HP pump + 3 RO trains + ERD = 1 Unit

1

2

3

4

5

6

7

8

9

10

11

12

Stand by
High Pressure Pumps-Ashkelon
Vertical Pressure Vessel Arrangement
16” vertical Membrane arrangement
16” Vertical Pressure Vessels
### Annual plant availability

Yearly plant availability is about 96%
### Yearly plant availability is about 96%
IDE’s Design Philosophy: Optimization

Cost Differences, USD

- OPEX
- CAPEX

Cost Differences:
- Decreased Recovery
- Nominal Recovery
- Increased Recovery

IDE Technologies Ltd.
Thank You
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