Total Water Management in the Kingdom of Saudi Arabia

February 1, 2012

Takashi Kubota
President & CEO

CHIYODA CORPORATION
## Chiyoda at a glance

<table>
<thead>
<tr>
<th><strong>Name of Company</strong></th>
<th>Chiyoda Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date of Establishment</strong></td>
<td>January 20, 1948</td>
</tr>
<tr>
<td><strong>Description of Company</strong></td>
<td>Integrated Engineering &amp; Construction Service Provider</td>
</tr>
<tr>
<td><strong>Name of President &amp; CEO</strong></td>
<td>Takashi Kubota</td>
</tr>
<tr>
<td><strong>Number of Employees</strong></td>
<td>7,000 (Global Basis)</td>
</tr>
<tr>
<td><strong>Paid in Capital</strong></td>
<td>¥43 Billion (equivalent to US$ 520 Million)</td>
</tr>
<tr>
<td><strong>Revenues for FY2010</strong></td>
<td>¥247 Billion (equivalent to US$ 3 Billion)</td>
</tr>
<tr>
<td><strong>New Orders for FY2010</strong></td>
<td>¥235 Billion (equivalent to US$ 2.8 Billion)</td>
</tr>
<tr>
<td><strong>Head Office</strong></td>
<td>Tsurumi, Yokohama, Japan</td>
</tr>
</tbody>
</table>

1US$=77 Japanese Yen
Corporate Philosophy

Enhance our business in aiming for Harmony between Energy and the Environment and contribute to the sustainable development of a society as an integrated engineering company through the use of our collective wisdom and painstakingly developed technology.
Water Demand in Saudi Arabia

<table>
<thead>
<tr>
<th>Year</th>
<th>Industrial</th>
<th>Municipal</th>
<th>Agricultural</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>713</td>
<td>2,330</td>
<td>15,464</td>
</tr>
<tr>
<td>2014</td>
<td>930</td>
<td>2,583</td>
<td>12,794</td>
</tr>
</tbody>
</table>

- **Total water demand to decrease by 12%**
- **Agricultural demand to decrease by 17%**
- **Municipal demand to increase by 11%**
- **Industrial demand to increase by 30%**

Source: Ninth Development plan, Ministry of Economy and Planning
Water Supply in Saudi Arabia

<table>
<thead>
<tr>
<th>Year</th>
<th>Reclaimed Agricultural Wastewater (million m$^3$)</th>
<th>Reclaimed Wastewater (million m$^3$)</th>
<th>Desalinated Water (million m$^3$)</th>
<th>Renewable Groundwater (million m$^3$)</th>
<th>Non-renewable Groundwater (million m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1,048</td>
<td>5,541</td>
<td>11,551</td>
<td>5,000</td>
<td>325</td>
</tr>
<tr>
<td>2014</td>
<td>2,070</td>
<td>4,644</td>
<td>8,976</td>
<td>5,000</td>
<td>570</td>
</tr>
</tbody>
</table>

- Non-renewable groundwater to decrease by 22%
- Desalinated water to increase by 98%
- Reclaimed wastewater to increase by 75%

Source: Ninth Development plan, Ministry of Economy and Planning
Challenges towards Water Management in Saudi Arabia

**Energy**
- Consumption of large amount of energy and CO2 emission caused by desalination
- Energy consumption due to long-distance water supply and transport of wastewater
- Inefficient use of potential resources such as waste heat in plants

**Environment**
- Low recycle rate
- Emission of high salt concentrated sea water such as desalinated brine
- Subsurface contamination caused by well injection of untreated produced water

**Economy**
- High water production cost caused by desalination
- Construction and renovation cost for large water supply and drainage system
- Inefficient production and distribution of water due to high leakage rate
Chiyoda has abundant experiences in Water Treatment and Waste Water Treatment facilities (FS, FEED, EPC) for Petrochemical / Chemical Plant.
Chiyoda offers “Intelligent system” by means of “Integrated water and energy management”, and realizes “Innovation!” for non-conventional water resources, such as:
- Sea Water
- Wastewater
- GTL by-product water
- Produced water
A Potential Scheme in Middle East

- Reclaim Treated Water
- Less Energy
- Combine Renewable Energy

Low Power Desalination (LP Desal: RO)

PV CSP

PLANT

- Electricity
- RO Brine (dilution)

Treated Water Reclamation

Low Power Desalination System

Sea Water

Brine
Changing Water Management Approach

- EPC
- Cleaner Wastewater
- For Single Plant, Complex
- Down Stream

- BOO/BOT/JV
- Energy Saving
- Wastewater Reclamation
- For Industrial City
- Up Stream
On Going Study in Saudi Arabia: Al-Jubail Case

- Feasibility study for industrial wastewater treatment and reuse
- Power and Water Utility Company for Jubail and Yanbu (“Marafiq”)
- Al-Jubail Industrial City
- Technical and economic feasibility study for decentralized and centralized treatment of industrial wastewater
- Including pilot plant test
On Going Study in Saudi Arabia : Dammam Case

- NEDO Model Project
- Energy Saving Wastewater Reclamation System with Membrane Technology
- Saudi Industrial Property Authority (MODON)
- Dammam 1 Industrial Estate
- Completion of F/S

→ EPC → Demonstrative Operation
On Going Study in Saudi Arabia: Dammam Case

Scope of Work for this NEDO Project

Seawater desalination Plant

Industrial Wastewater Treatment

Industrial Water

(Conventional)

Seawater

Industrial Water

(Reuse)

MBR

RO

Sludge & Brine

Wastewater Reclamation Plant

Energy

Industrial City

Wastewater Treatment

(Conventional)
Chiyoda’s Activity in Saudi Arabia over 40 years

**YANBU**
- Arabian Industrial Fibers Company (IBN RUSHD)
  - 375,000 T/Y Paraxylene Plant
  - 349,000 T/Y Benzene Plant
  - 1998

- Petromin Lubricating Oil Refining Company (LUBEREF)
  - 2,000,000 B/Y Lube Base Stock Refinery (Grass-Roots)
  - 1997

- Petromin Mobil Yanbu Refinery Co., Ltd.
  - 263,000 BPSD Export Fuels Refinery (Grass-Roots)
  - 1984

- Saudi Arabian Oil Company (SAUDI ARAMCO)
  - 170,000 BPSD Domestic Fuels Refinery (Grass-Roots)
  - 1983

**RIYADH**
- Saudi Arabian Oil Company
  - 200,000 BPSD Crude Stabilization Unit
  - 1981

- 100,000 BPSD Petroleum Refinery (Expansion)
  - 1981

- 15,000 BPSD Petroleum Refinery (Grass-Roots)
  - 1974

- Petromin Lubricating Oil Company (PETROLUBE)
  - 175,000 B/Y Lube Oil Blending Plant
  - 1981

- Ministry of Defense & Aviation (MODA)
  - Airport Water & Waste Treatment Facilities
  - 1982

**JEDDAH**
- Petromin Lubricating Oil Refining Ltd. (LUBEREF)
  - Stack & VDU Heater for Lube Oil Plant (Modification)
  - 1991

- Petromin Lubricating Oil Refining Ltd. (LUBEREF)
  - 1,000,000 B/Y Lube Oil Refinery
  - 1977

- Saudi Arabian Oil Company (SAUDI ARAMCO)
  - 33,000 BPSD Petroleum Refinery (Expansion)
  - 1974

  - 12,000 BPSD Petroleum Refinery (Grass-Roots)
  - 1967

**DAMMAM**
- Ministry of Defense and Aviation and Inspectorate General
  - King Fahd International Airport Utility Plants and Distribution System
  - 1991

- Saudi Arabian Fertilizer Company (SAFCO)
  - 20,000 T/Y Melamine Plant
  - 1985

**DHAHRAN**
- University of Petroleum and Minerals (UPM)
  - UPM Laboratory
  - 1986

**RAS TANURA**
- Arabian American Oil Company (ARAMCO)
  - 250,000 BPSD Two Stage Crude Distillation Units
  - 1986

**AL-JUBAIL**
- Petromin Shell Refinery Company
  - 272,000 BPSD Export Fuels Refinery (Grass-Roots)
  - 1985

- Arabian Petrochemical Co., Ltd. (PETROKEMYA)
  - 100,000 T/Y Polystyrene Plant
  - 1988

- 500,000 T/Y Ethylene Plant
  - 1985

- Eastern Petrochemical Company (SHARQ)
  - 300,000 T/Y Ethylene Glycol Plant
  - 1985

  - 450,000 T/Y Ethylene Glycol Expansion
  - 1993

- National Industrial Gases Company (GAS)
  - Air Separation Plant
    - N2: 10,000 Nm3/Hr
    - O2: 17,500 Nm3/Hr
  - 1985

- Saudi Arabian Fertilizer Company (SAFCO)
  - 1,500 T/D Ammonia Plant
  - 1,800 T/D Urea Plant
  - 1992

- Saudi Chevron Petrochemicals Company Ltd.
  - 480,000 T/Y Benzene Plant
  - 220,000 T/Y Cyclohexane Plant
  - 1999

- Jubail United Petrochemical Company
  - 1,000,000 T/Y Ethylene Plant
  - 2004

- Jubail United Petrochemical Company
  - 200,000 T/Y x 2
  - 2006

- Saudi International Petrochemical Company (United)
  - 966,000 T/Y Methanol Plant
  - 50,000 T/Y Butanediol Plant
  - 2004

**NOTE:**
Saudi Arabian Oil Company (SAUDI ARAMCO) has merged Saudi Arabian Marketing and Refining Company (SAMAREC) which is formerly called General Petroleum and Mineral Organization. (PETROMIN)
شُكْرًا جَزِيلاً
Thank you