Sea Water Cooling System For Jubail 2

December 2007
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- Jubail 2 Sea Water Cooling
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Royal Commission Mission

- Strategic Master Planning of the development and the future growth
- Provide land and utilities for industrial development.
- Promote industrial, residential and commercial investment.
- Develop, operate and maintain public facilities and services.
- Comprehensive Management of the two cities.
Achievements (In Jubail)

- Produces 7% of the world’s petrochemicals.
- Contributes 11.5% of the Kingdom’s non-oil GDP.
- Creates 70% of the Kingdom’s non-oil exports.
- Annual growth is sustained at 6%.
- Jubail has attracted over 50% of the Kingdom’s total foreign investment.

Jubail is the Best City in attracting foreign investment, award by Financial Times, 2005
RC & Industrial Sector Capital Investment
(SR Billion)

1:4

Industrial Capital Invest.

RC Capital Invest.

JUBAIL 1

193

JUBAIL 2

240

1:15

Industrial Capital Invest.

RC Capital Invest.

JUBAIL 1

47

JUBAIL 2

16
Project Life
(Gate Process)
## CFR Report

### CATEGORY/CONTRACT NO./ DESCRIPTION

<table>
<thead>
<tr>
<th>Category/Contract No./ Description</th>
<th>STAGE 1</th>
<th>STAGE 2</th>
<th>STAGE 3</th>
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<td>Contract Initiating Meeting</td>
<td>Planning Committee Approval (Start of Eng)</td>
<td>Complete 30% Package Review</td>
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<td>Engineering Design for Roads</td>
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<td>26-Nov-06 P</td>
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<td>Site Development Works in Community Area (Farouk North Area)</td>
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<td>Rehab and Improvement of Shorelines in all existing Community areas</td>
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### Standard Days

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**Sea Water Cooling Need**

- Heat rejection from industries.

- Cooling media is required to absorb heat.

- *The System provide Sea Water to be the cooling media to absorb heat from industries and dissipate into the Sea.*

- The System provides as a proper environmental control for industries discharge.
Looking at J 1, Canal System was Selected because:

- **Favorable site location – near Gulf**
- **Level topography permitting canals**
- **Ideal arrangement of Industrial Port Causeway to separate intake from outfall.**
SWC System in Jubail 1 (1 m m³/hr)

- **Sea Water Intake Channel**
- **Pump Station**
- **Canal System**
  - 3 Canals segments with 3 Compartments (Supply, Supply / Return, Return)
  - Inverted Siphons between canals segments
  - Industries Off-Take Structures and Laterals Pipes
  - Outfall Structure
Intake Channel & Pump Station
Canal System

Legend:
- LATERALS TO P & Q SECTION
- SUPPLY
- SUPPLY/RETURN
- RETURN

Canal 1
Canal 2
Canal 3
Pump Station
Outfall
Off-Take Structure
Outfall
<table>
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<tr>
<th>STAGES</th>
<th>AREA (KM²)</th>
<th>GOVERNMENT INVESTMENT (SR BILLION)</th>
<th>PRIVATE INVESTMENT (SR BILLION)</th>
<th>COMPLETION DATE</th>
<th>NO. OF INDUSTRIES Lots</th>
<th>PRODUCTION CAPACITY (KTPY)</th>
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For J 2 many option were studies

- Canal for once through found not feasible due to location and crossing KRT and topography (+ 7 m E-W, + 3 N-S)
- Cooling Ponds required large space.
- Dry cooling, High cost and not in large scale.
- Advanced technology of using Gases such as Ammonia. Limited to small scale
- *Make Up water for Cooling Towers found most feasible.*
Make Up Concept For J 2

\[ Q_m = (6 - 10\% ) \times Q_{rec} \]

\[ Q_m = Q_b + \text{Loss} \]
Cooling Towers

Heat rejection device

20% Convective Heat Transfer

80% Evaporative Cooling, Mass Transfer (1.5% Loss of water)

Mechanical Draft

Fan Assisted Natural Draft
Scope of SWC System for J 2

- Headwork and demolish end of canal 2
- 200,000 m³/hr Pump station (4 + 2 Pumps)
  50,000 m³/hr each, 23 m head, 4 MW
- 5 Pipes configuration (2 S, 1 S/R, 2 R)
- Distribution Manifolds
Overall System

EXISTING SWC CANAL

SWC PUMP STATION

KRT

EXISTING SWC CANAL 2

Stage 3

Stage 2

Stage 1

12.0 km
Headwork: Cofferdam
Headwork : Demolish
Headwork : Rebuild
J 2 Pump House Layout
J 2 Pump House Construction
Piping

• 4 m for East West Piping **55 km**

• 3 m for North South Laterals **21 km**

• **2 m for industry connection**

• **Valves 4 m (31) / 3m (21) / 2m (66)**
Piping Configuration
Under Aramco Pipes
At Stage 1, Air-Vent valve 500mm
Manifold 3D

Below Ground

N

E

Below Ground
Manifold
Trenching Detail

TYPICAL TRENCH FOR 5 - DN 4000 SWC PIPES
UNPAVED AREAS
Industry Connection
Thank you