CE 203
Group Assignment
Task 1 - Outline

Course Code: CE 203
Section: 1

Title: South Valley Development

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Introduction

Project Description/ Original Design:

The South Valley Development project was started in the 1980s to make one million feddans livable. This would relieve the population of the Nile Valley and increase the economy throughout Egypt.

The project is being developed in Toshka, East Oweinat and in the New Valley Governorate oases. In Toshka the Sheikh Zayed Canal was started. It is a concrete-lined canal and water is pumped through it from Lake Nassar. The pumping station was installed north of the lake.

Instead of having a pumping station, the South Valley Development will mainly rely on underground water and resources in East Oweinat.

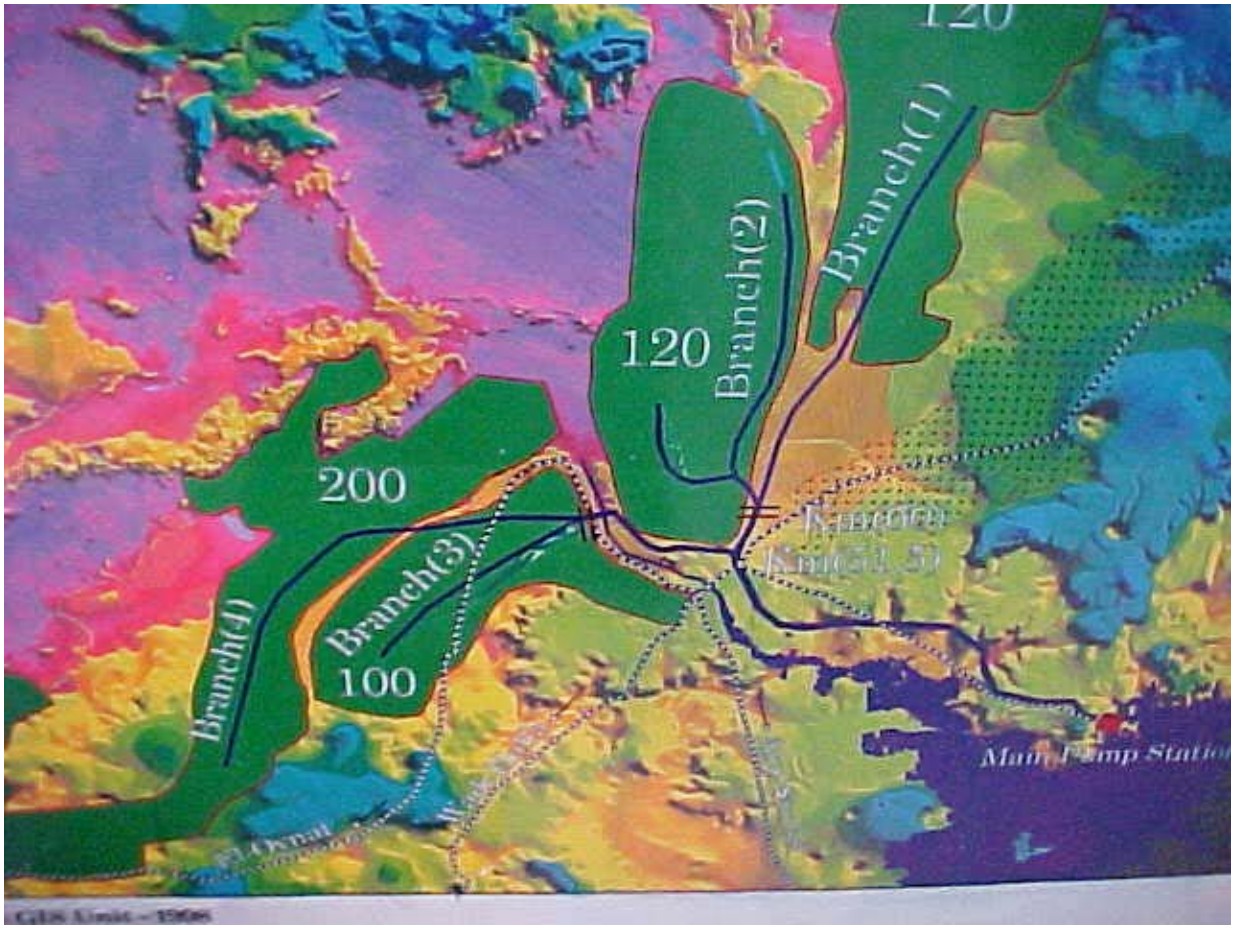
Problem:

The reason for the South Valley Development project was established to produce more habitable land. Most of Egypt is desert and therefore people move to wherever water is located, often overpopulating certain areas. This project will make more water resources available which in turn increase the economy.

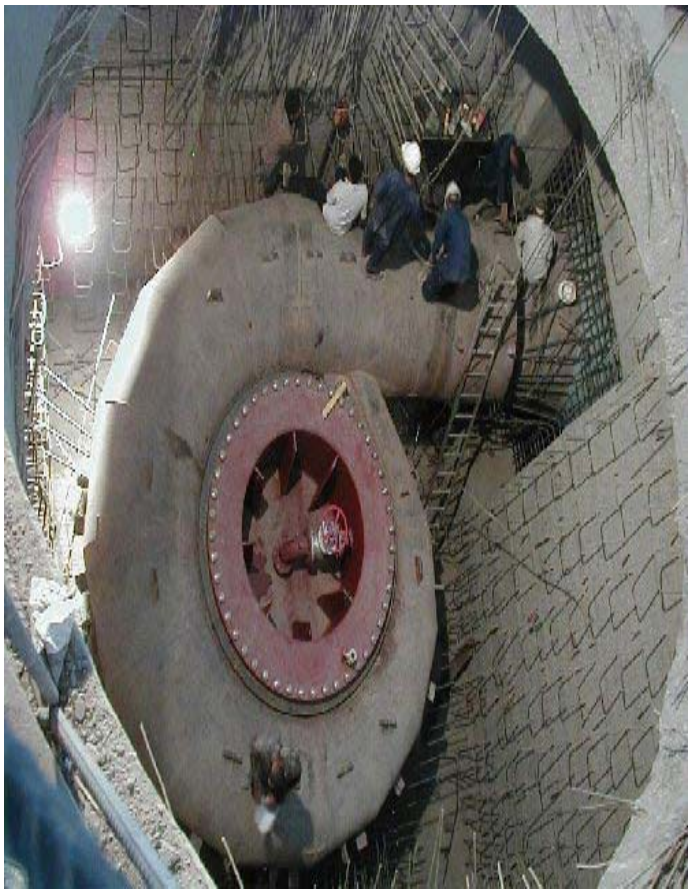
Technical data

Sheikh Zayed Canal is totally 310 km long and has four branches that pass through and irrigate four regions whose area is totally 540,000 acres. It can accommodate three million people to live in.

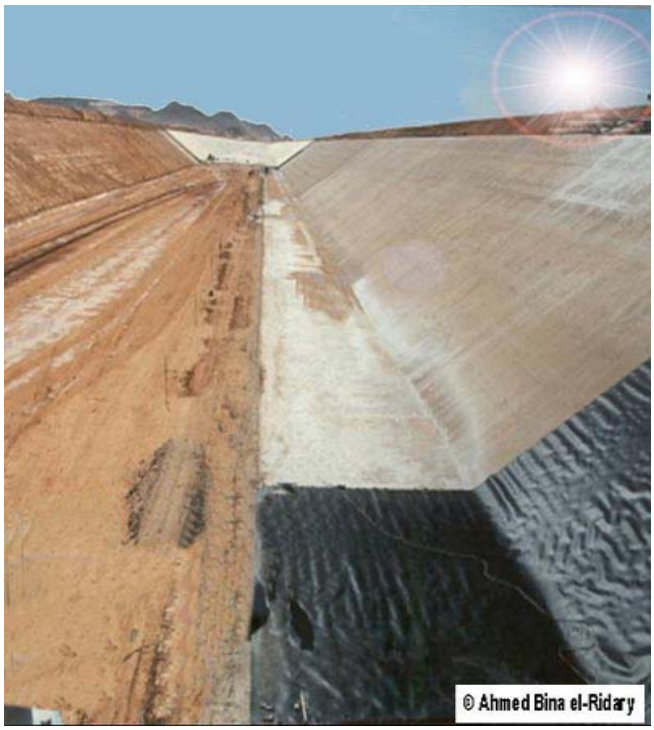
Sheikh Zayed Canal has two main canals which are divided into four branches.



Mubarak Pumping Station is a pump house. There are 24 pumps and the total discharge can reach an average of five billion cubic meters per year that is, 360 cubic meters per second. This station gets a supply of electricity by a 230 kV line from the Aswan High Dam, about 240 km southwest of it. (http://www.gulfconstructionworldwide.com/bkArticlesTA.asp?IssueID=232&Section=1063&Article=5445#top)



Sheikh Zayed Canal is 30 meters wide at the bottom, 54 meters wide at the surface and 6 meters deep.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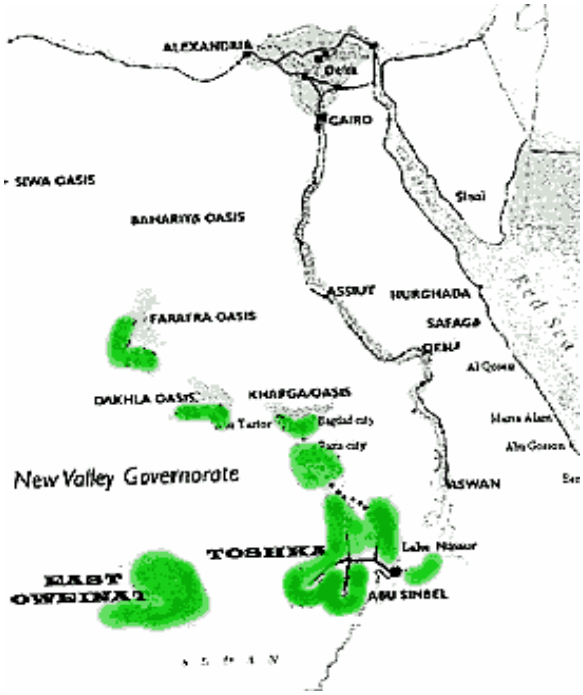
Non-technical data

South Valley Development Project, a 20 years project began in 1997, aims at changing 1 million acres desert into the inhabitable land in Egypt. Because of this, the project will allow 6 million people the availability to live in there in 2017.



South Valley Development Project contains four main projects. They are Toshka project, East Oweinat project, Northwest Gulf of Suez project and North Sinai Development

Project. Toshka project aims at making 540,000 acres of new land in southern Egypt; East Oweinat project aims at making 200,000 acres of new land in the southwestern desert; Northwest Gulf of Suez project aims at constructing a 140-square-mile port and industrial zone at the southern end of the Suez canal; North Sinai Development Project aims at making 400,000 acres of new land along the northern coast of the Sinai Peninsula. (http://www.presidency.gov.eg/html/projects.htm)

The 1997 Law:

"First, the law establishes that private companies cannot be nationalized or confiscated. Second, it states that there can be no government interference in company policies. Third, businesses have the right to possess and own buildings as necessary, regardless of the nationality or the residency of the shareholders. Fourth, a license granted to a company cannot be canceled except in case of infringing the license conditions. Finally, businesses can import whatever they need for their establishment, expansion, or operation."

This law attracted 56 Egyptian and foreign companies to invest the South Valley Development Project. Then, the government only needs to afford the 20 to 25 percent of total cost of the Sheikh Zayed Canal project (totally estimated at $1.6 billion).

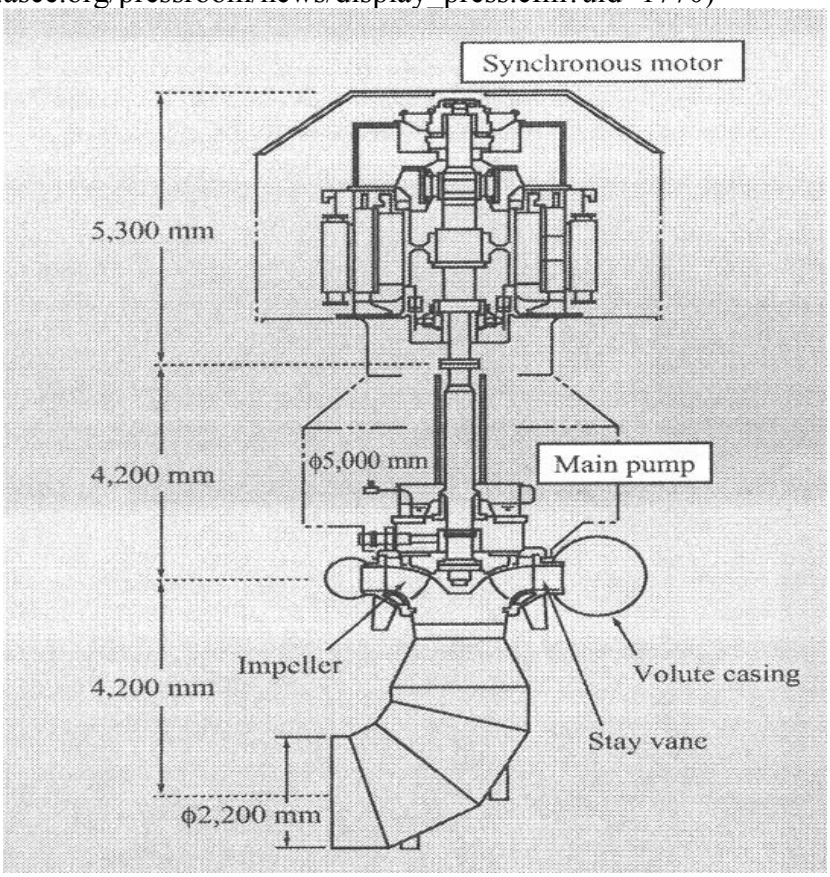
Toshka project will make the southern desert into modern cities and especially stimulate the tourism. It is said that 10,000 job opportunities on tourism will be provided for Egypt.

Design

The Mubarak Pumping Station in Toshka, Egypt, built to reclaim desert land, is one of five finalists for the 2005 Outstanding Civil Engineering Achievement Award (OCEA), presented by the American Society of Civil Engineers (ASCE). This year's award winning project will be named at ASCE's 2005 Outstanding Projects and Leaders (OPAL) awards gala on April 13 at the Sheraton Premiere at Tysons Corner, Va. (http://www.asce.org/pressroom/news/display_press.cfm?uid=1770)

The Mubarak Pump Station, which was named after the President of the Arab Republic of Egypt, is a massive pump station with a pumping capacity of 334 m^3/s and a required power of 240 MW. In order to accommodate the desert's flat land shape and the large variation of the water levels of Lake Nasser, the pumping machine has been enhanced by 24 pumps to reach the discharge capacity of 1.2 million cubic meters per hour and claims to be one of the largest pumping stations in the world. The project's innovative design includes a pump-house completely surrounded by water, resembling an island in a lake.

The station's pumps are arranged in two parallel lines down either side of the island. This design, coupled with an open channel instead of a feeder canal and the elimination of a large concrete suction basin, reduced the overall size of the pump-house and both initial and maintenance costs. (http://www.asce.org/pressroom/news/display_press.cfm?uid=1770)



Main Pump

In the impeller design, the inlet angle of the blades has been improved by increasing the suction characteristic in the low flow range and thus achieving increased efficiency.

The station uses a self-cooling method by which cooling water for the main pump bearing, shaft sealing water, cooling water for the synchronous motor bearing, and cooling water for the air cooler are drawn from the main pump discharge side, and then returned to the suction side. Using this method, the need for an independent cooling water pump and accompanying operation facilities are eliminated, contributing to the simplification of the station.

1 Assembly and Installation of the Main Pump

The volute casing for the main pump, which is of a welded steel structure, was manufactured in Cairo and transported to the site in parts, with the stay vane

structure manufactured in Japan shipped separately from the external volute segment; the parts were welded together and machined at site, and then carried as a whole to the pump station. Rotating parts (including the impeller and shaft) and the casing cover were assembled inside a mechanical workshop located adjacent to the pump station, and carried to the pump station in one piece using a hoist.

SYNCHRONOUS MOTOR

In order to enable the combination with the variable speed drive equipment, Hitachi conducted repeated tests using a prototype motor to confirm its reliability. The following are the main features of this synchronous motor.

(1) Stator

In the past, frame designs were based on a round shape. This unit has a hexagonal frame, to reduce the number of man-hours required for manufacturing. The motor is driven by a variable-speed drive. In order to minimize torque ripple, two parallel coil connections were adopted at an electrical angle of 30° difference. The number of working man-hours was reduced by adopting a highly reliable one-shot varnish injection method.

(2) Rotor

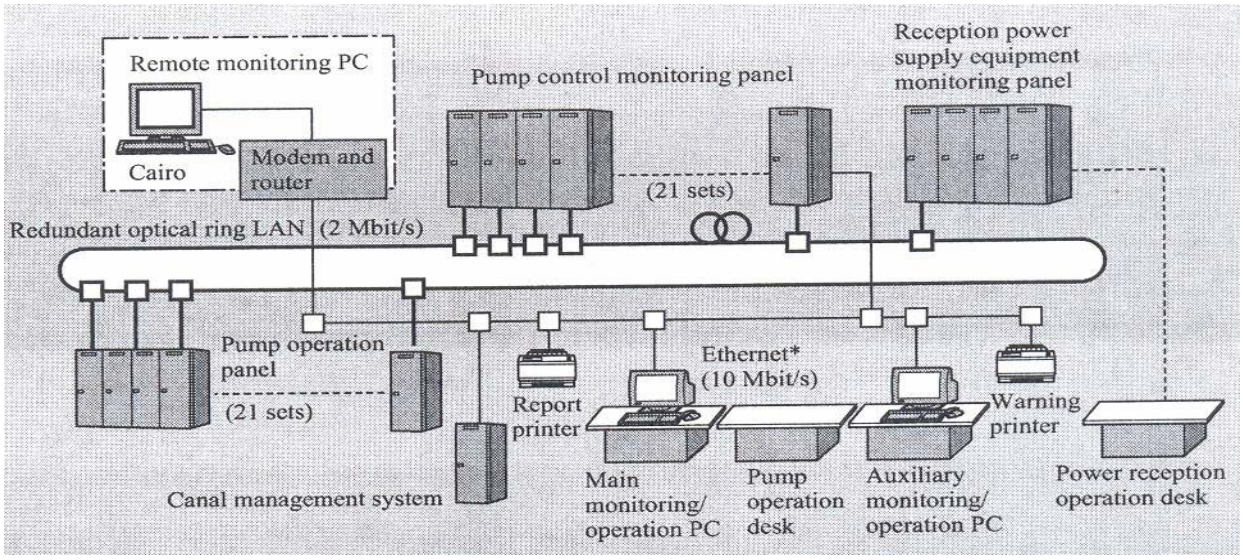
The conventional method applied to rotor coils is the “edigewise” method, in which a continuous conductor is pulled and wound into shape. This rotor coils use a butt brazing method, in which the coil is wound using high-frequency brazer to a conductor that has been cut into specified lengths in advance. The centrifugal force on the rotor poles themselves is very small, so a bolt tightening method was used to simplify the assembly process.

(3) Bearing lubricant cooling

A heat pipe was used for cooling the lower guide bearing lubricant, and air cooling was adopted to reduce the amount of piping for bearing coolant water.

(4) AC exciter/rotating rectifier

In order to achieve brushless and variable-speed operation to enable maintenance-free running, Hitachi adopted an AC exciter that uses a wound rotor induction machine. Factory operation tests were conducted combining the synchronous motor, variable speed drive, static exciter, AC exciter, and rotating rectifier, and obtained good results.



System Configuration

Due to this pumping station will be operation non-stop for 24 hours per day, special devices have been selected to ensure the machine run in high reliability.

Programmable logic controllers (PLCs) have been installed for each of 21 pumps to enable independent operations. Redundant PLCs have also been implemented in the power receiving control and monitoring system to further increase reliability. Two human interface (HMI) units have been installed to enable continuous 24-hour operation. An additional HMI unit has also been installed with connections via a phone line to enable remote monitoring of operating conditions at the Ministry of Water Resources and Irrigation, Mechanical and Electrical Department, located 1,000 km away in Cairo.

A redundant “optical ring LAN” was adopted as the PLC LAN to prevent noise from the inverter, and a standard LAN Ethernet was adopted for the HMI LAN. A common PLC was installed for overall operation guidance and interlock management.

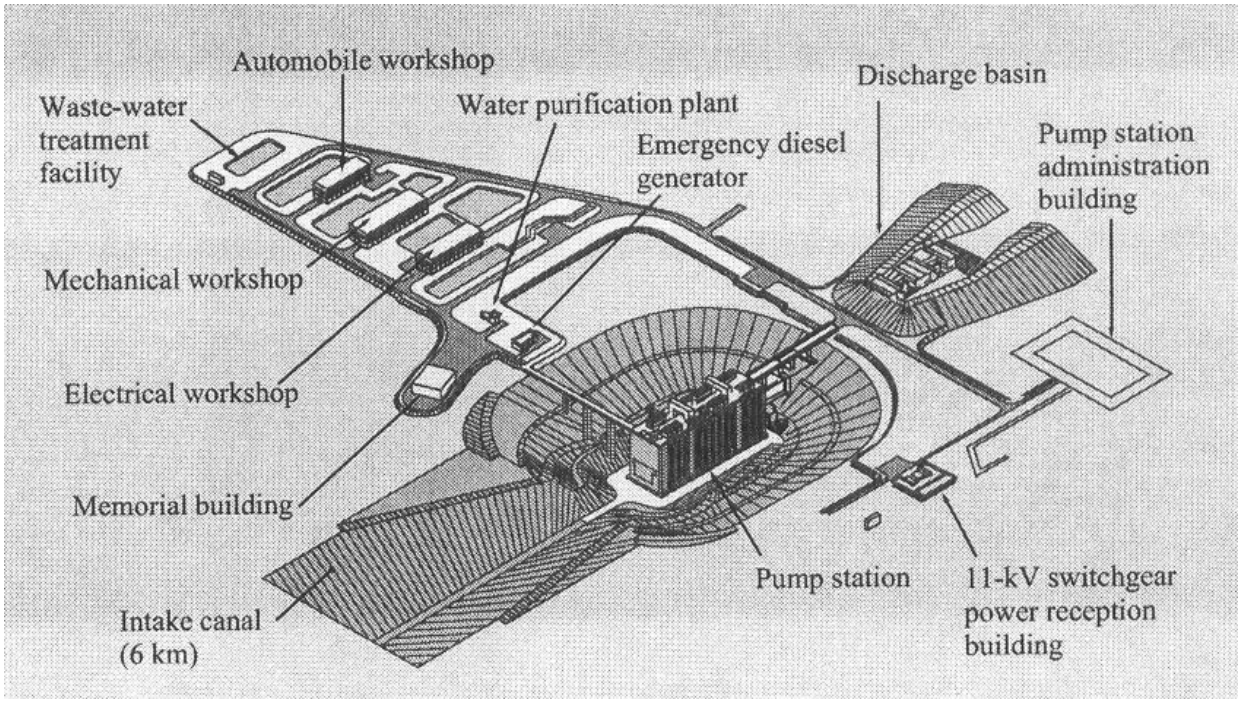
System Functions

The following are just a few of the functions adopted to ensure stable operation of the 21 pumps, and to lessen the burden on operators and maintenance personnel.

(1) Pump operation guidance functions
(2) Automatic pump operation monitoring functions
(3) Pump operation preparation monitoring functions

(4) Inlet and outlet water level monitoring functions
(5) Operation status and trend monitoring
(6) Failure monitoring and notification functions
(7) Energy management functions; and (8) daily / monthly report creation functions

The pump operation guidance functions enable operations in keeping with the water volumes required downstream, as well as a flexible response to changes in the water level of Lake Nasser. These functions also make it possible to provide the operators with information regarding which pump to start up and which to shut down, depending on factors such as optimum number of pumps running, operating speeds for maximum energy efficiency, and equalization of maintenance requirements. The operation preparation functions display the status of complex preparatory tasks for each pump, and the failure monitoring functions identify locations in need of repair that enables operation and maintenance can be conducted with ease.



To avoid using costly concrete piles to support the structure in an earthquake and resist the effect of lateral seismic forces, a system of steel mini-piles connects to a foundation raft, which avoids their loading in compression, yet allows them to react in tension caused by seismic loads. These mini-piles around the base of the station will act to restrain any overturning forces. The pump house, subjected to temperatures ranging from 0ºC to 55ºC, had to be watertight, but the efficiency of water-stops used in normal expansion and contraction joints was questionable, so the pump house excludes joints below the normal high water lake level, and provides joints above it. This joint elimination necessitated a complex analysis to address thermal effects in the overall

structural design. (http://www.asce.org/pressroom/news/display_press.cfm?uid=1770)

Problems and costs of implementing

(1) The total investment of the project:
$90 billion ("Toshka, East Oweinat, new valley oasas")

(2) Building period
20 years (from 19997~2017)

(3) The sources of investment
20% was financed by the government
The rest funds is raised by the individuals and companies

(4) The projects and areas of costing money:
$422 million for installation cost
East Oweinat: 500,000 acres
The investment to Toshka region ($1.6 billion project)
1 A pumping station
2 It has invested $239.6 million(E£I 480 billion) + E£300million in1998
3 Estimation: $436 million
4 "Sheikh Zayed Canal"
5 70 km (finished in2001)
6 Infrastructure
7 $550million

5 Problems of implementing
4 For the big-scale project need a long building period, the investing companies required have the powerful abilities to waiting the return.
5 So much money needed for reclaiming, the government must ensure the assart be using perfectly.
6 In terns of the detailed budget and plot, annual cost is necessary.
7 Tax's of investors will be free.
8 $ 3.7 billion/yr

Reference

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