SOLAR DESALINATION

A Thesis
Submitted to the Faculty of Engineering
Ain Shames University for the Fulfillment
of the Requirement of M.Sc. Degree
In Civil Engineering

Prepared by

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Date: - ---/--/2015

Dedication

This thesis is dedicated to those who contributed to educating, raising and supporting me to be able to accomplish in this picture.

A special dedication to

my supportive parents

and to

My wonderful
Brothers, Sisters and Relatives

and finally
special dedication to

My lovely wife and child

for encouraging me to complete this work and for always being there for me.

STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University, from October 2012 to December 2014.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others

Date: - ---/-- /2015

Signature: - ----------

Name: - ***ALAA EL-DIN HISHAM MOHAMED NAGUIB ALI***

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ABSTRACT

Name *:* ALAA EL-DIN HISHAM MOHAMED NAGUIB ALI

Title*:* "SOLAR DESALINATION"

Faculty: Faculty of Engineering, Ain Shams University.

Specialty: Civil Eng., Public Works, Sanitary & Environmental Eng.

Abstract:-

For the shortage of water resources in Egypt and Arab countries, A need to develop low cost technology to deal with seawater as water resource are increased. The objective of this thesis is to study the possibility of producing potable water from seawater using low cost technique depends on concentrated solar rays by mirrors. The study chooses the worst climatic season in Egypt to measure the system capability.

The study erected a pilot plant in Faculty of Eng. pilots open site, ASU designed from acrylic as a low cost long life age and transparent material. The system used 3 concave mirrors and directed to let mirrors receives sunrays and concentrated it on the pilot for the whole sunny period. The measurements for quantities, temperature and TDS for the inlet and outlet waters were made with the measuring of air temperature and sunshine period among the day.

The tests covered three months between autumn and winter to be in the worst climate for the system operation that depends mainly on sun and temperature. The results were good for product quantity and quality in spite of the acrylic use prevent the temperature transfer for its low thermal conductivity which is 20% of glass that affects the product quantity.

The thesis shows that the fresh water quantity is proportional with air temperature and its TDS is between 20-40 ppm even how much the salinity of the influent seawater that ensure the system high efficiency to remove salts. Also, the results show the necessity of use glass instead of acrylic to increase the unit productivity and increase the benefits from the system.

SUPERVISORS

Prof. Dr. Mohamed El Hosseiny El Nadi,
Associate Prof. Dr. Nany Aly Hassan Nasr,
Assistant Prof. Dr. Aisha Zaki Maged Mostafa.

KEY WORDS

Water Treatment, Seawater Desalination, Renewable Energy Concentrating Solar Rays by Mirrors.

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INTRODUCTION

1-1 BACKGROUND

Without fresh water no society can function. Of all the water in the world a mere 1% is fresh water available for the needs of all plant, animal and human life. Around 97% of water in the world is in the oceans and approximately 2% of water is in ice stored in glaciers and in polar ice. As shown in figure (1/1) **[1]**.

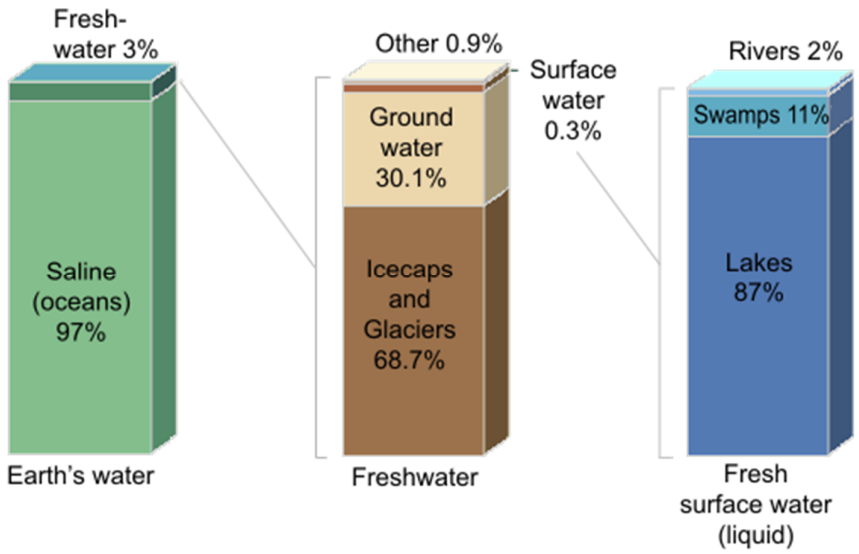

Figure (1/1) Distribution of Earth's Water [1]

Water resources in Egypt are limited to the Nile River, rainfall and flash floods, deep groundwater in the deserts and Sinai, and potential desalination of sea and brackish water. Each resource has its usage limitation, whether these limitations are related to quantity, quality, space, time, or exploitation cost **[2]**.

The Nile River supplies 55.5 BCM per year according to the 1959 agreement with Sudan, but it's a main concern that this amount will drop after the construction of Ethiopian Renaissance Dam. Groundwater in the Western Desert, in the Nubian sandstone aquifer and Sinai supplies 2 BCM per year. Rainfall along the coastal area supplies 1.3 BCM per year.

Groundwater in the Nile valley & delta (cannot be considered a separate source of water) supply about 6.5 BCM per year. The non-conventional water resources such as reuse of agriculture drainage water and reuse of treated sewage water is about 0.3 BCM per year but they cannot be added to Egypt's fresh water resources. Desalination of seawater in Egypt has been given low priority as a water resource because the cost of treatment (construction and operation) is high compared with other sources **[2]**.

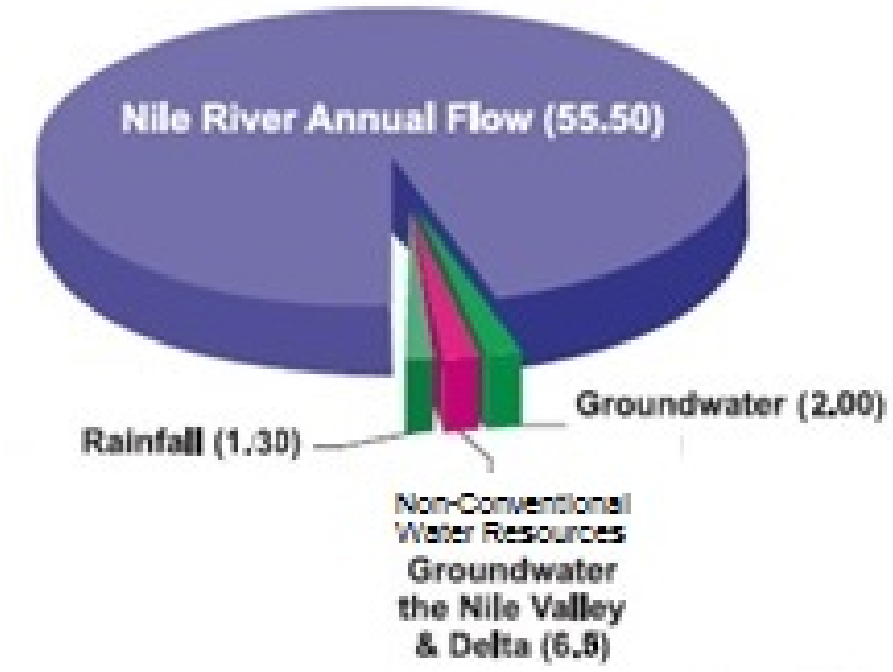

Figure (1/2) Conventional Water Resources (BCM)

Water requirements for different sectors (agricultural, municipal water requirements and industrial) is about 79.5 BCM per year, Egypt suffer a water shortage about 20 BCM per year and by the year 2020 the water requirements is expected to be increased by 20% (about 15 BCM per year) **[2]**. Egypt's water supply is equivalent to an allocation of 663 cubic meters per capita per year by 2013, below the water poverty line of 1,000 cubic meters per capita a year and predicted the allocation would fall to 582 cubic meters per capita per year by 2025 if action was not taken to reverse the downward trend **[3]**.