*An-Najah National University*

*Faculty of Engineering*

*Graduation project*

*Water desalination system  
BY  
 Solar electric powered*

*Reverse osmosis*

By

Safa Ateeli && Nour Hannon

Supervisor

Prof. Dr. Marrwan Mahmud

**2010-2011**

**Introduction**

**1.1 Scope**

Water resources are essential for satisfying human needs, protecting health, and ensuring food production, energy and the restoration of ecosystems, as well as for social and economic development and for sustainable development [1]. However, according to UN World Water Development Report in 2003, it has been estimated that two billion people are affected by water shortages in over forty countries, and 1.1 billion do not have sufficient drinking water [2]. There is a great and urgent need to supply environmentally sound technology for the provision of drinking water.

**1.2 water and energy**

Water and energy are the major factors necessary for the development

Of social and economic sectors in rural areas .Palestine has a large number

Of rural villages lacking water and electricity networks connecting these

Villages with electric grids of the nearest cities is nearly impossible, at least

For another decade, due to their remoteness, low population count and low

Electric energy demands. On the other hand Palestine has one of the highest

Solar energy potential of all the countries in the world. It enjoys over 2800

Hours of sunshine every year; with an annual average daily solar radiation

Intensity amounting to 5.4kwh\m2-day brackish water is available in very

Large amount in some areas of Palestine, particularly in Jordan valley.

**1.3 Water Treatment Systems and Photovoltaic Power**

A water treatment system needs a source of power to operate. In general, AC powered system is economic and takes minimum maintenance when AC power is available from the nearby power grid. However, in many rural areas, water sources are spread over many miles of land and power lines are scarce. Installation of a new transmission line and a transformer to the location is often prohibitively expensive.

Today, many stand-alone type water treatment systems use diesel engines. However, they have some major disadvantages, such as: they require frequent site visits for refueling and maintenance, and furthermore diesel fuel is often expensive and not readily available in rural areas of many developing countries.

The consumption of fossil fuels also has an environmental impact, in particular the release of carbon dioxide (CO) into the atmosphere. COemissions can be greatly reduced through the application of renewable energy technologies, which are already cost competitive with fossil fuels in many situations. Good examples include large-scale grid-connected wind turbines, solar water heating, and off-grid stand-alone PV systems [3]. The use of renewable energy for water treatment systems is, therefore, a very attractive proposition.

**1.4 Energy Storage Alternatives**

Needless to say, photovoltaic are able to produce electricity only when the sunlight is available, therefore stand-alone systems obviously need some sort of backup energy storage which makes them available through the night or bad weather conditions.

Among many possible storage technologies, the lead-acid battery continues to be the workhorse of many PV systems because it is relatively inexpensive and widely available. In addition to energy storage, the battery also has ability to provide surges of current that are much higher than the instantaneous current available from the array, as well as the inherent and automatic property controlling the output voltage of the array so that loads receive voltages within their own range of acceptability [4].

The type of lead-acid battery suitable for PV systems is a deep-cycle battery [5], which is different from one used for automobiles, and it is more expensive and not widely available.

Battery lifetime in PV systems is typically three to eight years, but this reduces to typically two to six years in hot climate since high ambient temperature dramatically increases the rate of internal corrosion. Batteries also require regular maintenance and will degrade very rapidly if the electrolyte is not topped up and the charge is not maintained. They reduce the efficiency of the overall system due to power loss during charge and discharge. Typical battery efficiency is around 85% but could go below 75% in hot climate [3]. From all those reasons, experienced PV system designers avoid batteries whenever possible.

**1.5 project site**

Al-Maleh village is located directly on the main street connecting the

Town toubas with the Jordan valley .it is elevated at 12 m below sea level in

North part of Jordan valley .the village is known for hot summer months,

The monthly average of maximum temperature for six months, April –

September, amounts to 41° C, while the annual daily average is 22.4 ° C.

The chemical analyses of the **Zbaidat tank** are:

|  |  |
| --- | --- |
| Name | Feed(mg\l) |
| **NH4** | **0.00** |
| **K** | **13.10** |
| **Na** | **483.00** |
| **Mg** | **146.00** |
| **Ca** | **200.00** |
| **Sr** | **0.00** |
| **Ba** | **0.00** |
| **CO3** | **1.81** |
| **HCO3** | **305.00** |
| **Cl** | **36.00** |
| **F** | **0.00** |
| **SO4** | **157.00** |
| **SiO2** | **21.60** |
| **Boron** | **0.46** |
| **CO2** | **7.85** |
| **TDS** | **2566.15** |
| **pH** | **7.60** |

**1.6** **project Aims**

This project investigates the following:

* Determine the performance of reverse osmosis water desalination systems powered by solar electric energy under Palestine weather and environmental conditions.
* study the system design and sizing
* Determine the techno-economic feasibility of using solar electric systems.
* Identify the effects of desalination of brackish water on the environment, health and social conditions, in rural areas.

Water desalination technology

* Water treatment methods and the energy consumption.
* Application of solar energy in springs and underground water treatment.
* Building an integrated system consisting of suitable membrane that can be powered by solar energy.
* Determination of the quality of surface water treatment by autonomous solar-powered membrane cells under Palestinian weather and environmental conditions.