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Necessity of sea water transfer and use of desalination plants in drinking water supply in arid and low rainfall areas of Iran

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Abstract:
Desert and semi-arid climates and the reduction of rainfall and frequent droughts have created a major water shortage challenge in the country's water-scarce areas, which is a threat to various sectors, including industry and agriculture. The need to transfer seawater to these areas is important and will have many benefits for the residents of these areas. Seawater desalination is a solution to water shortages in countries around the world. Due to the crisis of water resources in Iran, the use and development of this technology is very necessary to supply the water needed by the country.

In this article, first the necessity of using desalination technology and then different desalination methods such as reverse osmosis, evaporation, thermal and solar were discussed. Unbalanced distribution of population, resources and facilities is one of the consequences of water scarcity and water mismanagement in most arid regions of Iran, which has naturally caused macrocephaly and uneven growth, and therefore the need to transfer seawater to low rainfall and arid regions, for Managers are considered a completely strategic matter. In this descriptive-analytical article, the documentary-library method has been used to collect information.

Keywords: desalination, thermal desalination, membrane desalination, solar desalination, water crisis

Introduction

Durability and non-durability in an environment depends on various factors and elements. Climate and water resources constraints and the form of annual and seasonal rainfall, especially in mountainous environments, have posed serious threats to rural communities, as the close relationship between rainfall decades ago and rural and urban population growth and the impact on rural migration The laying has been remarkable. Decreased rainfall and drought or lack of surface water resources have been effective in creating the hardships of rural life, and despite the lack of services and areas of

activity, many villagers, especially in mountainous areas, have migrated extensively to cities. This incident has not only created problems for the origin of migration, ie the village, but also caused an unbalanced distribution of population, resources and facilities and has caused macrocephaly phenomena and uneven growth and و (Afzali, 1379)

Reduction of rainfall, drought, population growth, urbanization, industrialization of the south of the country, improper and inappropriate irrigation methods, reduction of common water resources, especially reduction of shallow groundwater resources that increase the depth of wells to reach water, and this in turn It has reduced water and reduced its quality. Poor management practices in maintaining limited and existing water resources and increasing demand for water in all sectors on the one hand and reducing the supply of water from limited and existing resources on the other hand have caused many problems for the country, especially arid and low water areas. In order to meet the growing demand and reduce the growth gap between supply and demand of water desalination processes can be one of the effective options. Seawater desalination is one of the major water production technologies worldwide. One of the centers of intense activity is the Persian Gulf desalination plant, and the GCC countries use this process as the main source of fresh water for their domestic sector (Dawoud, 2012).

Many of the potential environmental impacts of the desalination process in the GCC countries are similar to any other industry. However, the specific effects of desalination, such as collisions and the addition of bubbles from the marine organism, greenhouse gas emissions due to significant energy demand from fossil fuels, and the discharge of saline water to the marine environment, but mitigation measures have been taken to address these issues. Solar Composite Desalination Plants, Energy Efficient Development of Small Desalination Systems, Innovative and Innovative Energy Alternatives for Desalination Plants (Dawoud, 2012).

Iran is affected by climatic, environmental and demographic conditions with fresh water supply stress for drinking, industry and agriculture in many parts of the country. On the other hand, it has a high potential of solar energy with an average of more than 2800 hours of sunshine per year and radiation intensity of more than 1800 kWh per square meter per year. Therefore, solar water desalinators as a new and environmentally friendly process, can be used as a suitable solution for sustainable development and water supply for desalination of brackish and brackish water in the country. This system has a simpler, cheaper technology and is more compatible with Iran's climatic conditions than other conventional desalination processes (including nano-filtration and reverse osmosis, multi-stage distillation, etc.). Therefore, this study investigates the need for solar water desalinators to supply water needed by industries, agriculture and small communities (including sparsely populated areas and villages) (Mashkar, Farhadian and Motamedi, 2009).

water crisis

The water crisis is one of the most important environmental challenges of the modern age that different societies are facing, with more complex needs and increasing population growth and reducing the amount of available water resources. Given the importance of the issue, many parts of the world, including the Middle East, and Iran, are currently suffering from chronic water shortages. As far as the per capita renewable water in Iran is about 1800 cubic meters, which is approaching the crisis threshold,

ie less than 1700 cubic meters, and it is predicted that due to the increase in population (up to 90 million) in 1404, the amount of modern water Iodized will be reduced to 1530 cubic meters. Comparing the growth rate of Iran's population with the world over the past 65 years, shows a greater acceleration of population growth in Iran than in the world. This demographic pressure has many effects on the country's natural resources and will have environmental effects such as air pollution, global warming and the crisis of water resources due to rising consumption levels. The escalation of the water crisis means a further reduction of the per capita renewable water resources in the country; Therefore, with the increase of population growth and as a result of water demand in different economic sectors, the water crisis has intensified and as a result economic growth has decreased and finally with the decrease of production growth in the country, inflation rate has increased and also with the growth of employment in different economic sectors. In different sectors, it decreases and the unemployment rate increases (Nik Roush and Khorasani, 1399).

Desalination

About 70% of the earth's surface is flooded, but there is still a problem with drinking water. Sea water and many groundwaters are salty and contain a variety of salts and minerals that make it unusable, although countries use Desalination technology has been able to solve this problem to some extent. Desalination or desalination of water becomes a room process that separates the types of salts from the water. And the development of this technology is very necessary for the country to supply the water it needs.

Desalination technologies

RO / UF / NF membrane water sweeteners

• MSF / MED thermal desalination plants

New MD / FO / ZLD desalination technologies

Methods of desalination or desalination of brine and seawater can be distinguished on the basis of thermal processes and membrane processes or their combinations. Studies show that by 2020, more than 90% of the capacity of brackish water desalination plants will be allocated to the reverse osmosis process.

of desalination plant

Freshwater production requires the use of mechanical and thermal processes and special devices. Separation of salt from water should be done in a strong bed. There are currently two types of desalination plants.

Reverse osmosis desalination and another thermal desalination or HTH. Each of these mechanisms works with a specific mechanism, and each has its own advantages and disadvantages.

Reverse osmosis or membrane desalination water

Reverse osmosis is one of the most advanced water purification methods that has a very high efficiency and maximizes water quality. This method is also called membrane desalination. Membrane desalination actually uses one or more porous membranes to desalinate the water. A membrane is placed in water. A membrane that is very thin and has very small nano-sized holes on it. Due to their weight and small size, water molecules can pass through these tiny holes. But the salts in the water are much larger. Although they are dissolved in water and cannot be seen with the naked eye, they are still larger and the membrane can block it, thus desalinating. But these holes are not the only reason for sweetening. Some water purifiers use electricity to break the bond between the ions that react with the water and prevent them from entering the water. This electric current causes the free

electrons to react with the positive ions, increasing the size and volume of the reacted salt molecules and not passing through the membrane. This is the membrane desalination mechanism. Reverse osmosis is one of the most widely used methods. The most important thing about a membrane desalination plant is that it requires very little electricity and does not require high voltage and current power at all. A semi-permeable or semi-permeable membrane is usually used that can well control the flow of water and the flow of salts. Of course, the membrane method used inside these devices is expensive and the manufacturing technology must be very strong. But it is a widely used method and these devices are used in most industrial and domestic freshwater production centers.

Thermal water desalinator

Thermal water desalination also has a very advanced mechanism that is done by evaporating water and then water condensate, but to heat water requires a lot of energy that can evaporate water, so mechanical engineers suggest several methods to do this. Have. One of these methods is MSF or Multi-Stage Flash Distillation. That is, water that is evaporating is passed through a chamber of sudden evaporation. As the water pressure decreases, a large part of the water suddenly turns to steam. This steam is separated from the water in a separation chamber and enters the cooling and distillation devices. This method requires less energy and can produce a large volume of water in a short time. These methods are still being developed. The number of pressure change chambers becomes more and more to get more water vapor at a certain temperature level. This method is used in marine desalination. The heat needed to heat the water is also provided by the ship's engine. Because the ship's engine rises to 300 degrees. You can use this waste heat and always produce fresh drinking water. They are also installed on oil tankers and marine watchtowers. Tankers have much higher heat and fresh water production occurs much faster. Home reverse osmosis uses more reverse osmosis. Because it does not need much heat or energy. It is quiet and low risk and has a very high water quality. However, for special processes where the desalination capacity must be high, the use of HTH or MSF thermal desalination is recommended. Provided, of course, that there is a heat source for water to evaporate. Otherwise, it is better to use reverse osmosis devices.

The development of industries has forced the increase of population and reduction of human water resources to desalinate saline waters, while this requires energy and high costs. On the other hand, different desalination methods due to the use of fossil fuels reduce non-renewable resources and lead They have increased environmental pollution while failing to meet all of the world's needs. Desalination of water by new energy sources such as solar and wind, which are more environmentally friendly, can be a solution to these problems, albeit in abundance. And the freeness of renewable resources The use of these resources is at the beginning of the path of lighting and economic application (Goodarzi and Hosseinzadeh, 1393).

Solar desalination plants

Considering that we have the golden opportunity of "abundance of solar energy" in Iran, the replacement of fossil energy with solar energy in order to reduce and save energy consumption, control the supply and demand of fossil energy and reduce polluting gases has been highly welcomed. Iran is located between the orbits of 25 to 45 degrees north latitude of the earth, this geographical region is in the top ranks in terms of receiving solar energy between parts of the world. The amount of solar radiation in Iran is

estimated between 1800 to 2300 kWh per square meter per year. Clean air and safe drinking water are two basic and very important pillars for the health of life, and since many parts of the country suffer from a lack of drinking water, for such areas should look for appropriate technology to desalinate water, which of course Unfortunately, various methods of desalination, such as reverse osmosis, electric, etc., do not have the necessary answers despite many problems.

The amount of water produced by each desalination unit is 5 to 11 liters, and due to the high solar energy in this region, their production is almost twice as much as the desalination plants available in the world market. One of the measures taken in the country is the production of the largest desalination plant in the country with a capacity of one million cubic meters per day in the Persian Gulf industrial town in Bandar Abbas. This project is sea water intake units with a capacity of 4.8 million cubic meters per day, water desalination with a capacity of 595,000 cubic meters per day and power plant units with a capacity of 1,068 MW. Water desalination and transfer from the Persian Gulf to the province Hormozgan, Kerman and Yazd and meeting the water needs of Hormozgan in the drinking, industrial and agricultural sectors has been one of the goals of building this desalination plant. Hormozgan province is one of the arid and low rainfall provinces of the country and about 60% of the runoff from rainfall in an average year, due to the presence of polluting formations, especially salt domes, is salty and unusable. In Hormozgan province, there are about 600 villages without drinking water, which usually consist of 10 to 60 households, and their needs are met by a maximum of one cubic meter of water per day. For this reason, the use of conventional desalination plants is not cost-effective for villages due to their high costs (Mahoushi, 2016).

The Arab countries of the Persian Gulf have relied on three main sources to supply their water needs, namely groundwater and desalinated seawater and treated wastewater for use in agriculture and electricity generation. Rainwater surface water sources are the main source of groundwater supply. Of course, 85% of these ponds are located in arid areas and their water is very salty and can not be used in agriculture. Groundwater is the main source of fresh water in Bahrain, Kuwait, Qatar and Saudi Arabia. Surface water is a common source of fresh water in Oman and the UAE. Demand for water consumption in the Persian Gulf region has increased by 140% over the past decade, with the agricultural sector accounting for 85% of water. Gulf countries consume 26.5 billion cubic meters of water annually, which is 3.5 times more than groundwater resources, according to analysts at Varst Andesolivan Market Consulting and Research. For this reason, the desalination process plays an important role in supplying the water needed by the Arab countries of the Persian Gulf and water supply in other sectors, so that the GCC countries alone account for 60% of the desalinated sea water in the world. Produce. With a production of more than one billion and six million cubic meters of water per year, or 18% of world production, Saudi Arabia is one of the top freshwater producing countries in the world and is the largest desalination plant in the world. Saudi Arabia owns the Ras al-Khair desalination plant, which cost more than 27 billion Saudi riyals to build, and is the largest desalination plant in the world. The UAE allocates approximately $ 800 million annually to build, operate and repair desalination plants. According to UNESCO, Arab countries are expected to establish dozens of desalination plants using nuclear energy within the next 20 years, of which

Saudi Arabia alone will have 16 desalination stations by the beginning of 2030. IRNA News Agency, 2016).

Desalination problems

One of the biggest problems with reverse osmosis desalination plants is biofouling. Solving such a problem requires spending energy and chemicals and on the other hand causes the production of effluent and sludge that needs proper disposal or treatment and the inability of vendors of these systems to carefully design and use substandard equipment to make more profit than Other problems are reverse osmosis, which will cause great harm to consumers of this technology.

Multi-stage evaporation (MSF), multi-stage distillation (ME) and reverse osmosis (RO) are used to desalinate saline water, many of which require heat energy. Energy is mainly from fossil fuels, and more recently, solar energy and thermal energy from nuclear facilities have been used. Numerous combined methods have been used, all of which try to reduce the costs and environmental problems of desalination plants. High energy costs and installation and maintenance of systems and their depreciation on the one hand and environmental damage caused by rising temperatures and salinity of effluents on the other hand are major problems to meet the essential water needs. Extensive scientific research is being carried out in various countries to reduce these problems, especially the environmental problems. Disposal of hot and highly saline effluents from desalination plants is a major problem that leads to severe environmental hazards such as salinization of land and sea areas around these facilities and the extinction of many species and the disruption of the natural balance of these ecosystems and Eventually the problems spread to the environment.

Conclusion

Water has a sacred and vital place and importance in Iran and the development of Iranian regions and cities. The seas are an important, strategic resource for Iran and the countries of the region. Intervention in the nature system in the form of projects and plans such as the construction of water transfer facilities from the sea to low-water cities and water desalination facilities, in addition to economic and operational costs, will reproduce various environmental, safety and security issues over time. شد. Analysis of water transfer plan to low-water provinces with passive defense approach is an inevitable necessity, of course, considering the threats and vulnerabilities related to environmental, economic, political and international consequences, disruption of the transmission network, air strikes, water pollution in the area. Sensitive coastal, forest, mountain range, desert ... desalination facilities are also recommended (Molaei, 1398)

Drought is one of the climatic phenomena and including catastrophic events that always cause great damage to human societies. Drought or depletion of available water can be observed in various forms such as lack of rainfall, reduction of river discharge and reduction of water resources. Drought occurs in all climatic regimes of the country with different intensities and weaknesses.

Iran is a country vulnerable to the phenomenon of drought and this phenomenon will be repeated with different periods of return with the possibility of occurrence of different intensities in the future. Now, due to the growing need and demand in society for access to water resources and climate vulnerability in Iran, the country's water resources management will face serious challenges in various aspects due to the possibility of drought. Therefore, considering the importance of the issue, basic, decisive and far-

sighted measures should be common at the national level along with appropriate management strategies in order to make the necessary preparations in this regard (Abbaspour and Sabet Raftar, 2004).

Asia, with 60 percent of the world's population, has only 36 percent of renewable and usable water resources. For this reason, several methods have been developed for desalination of seawater. Iran, with 1% of the world's population, has only about 0.36% of usable fresh water. According to forecasts, the per capita water consumption per person in 1404 is about 1000 cubic meters per year, which is in the critical range in terms of international indicators. All these issues indicate the inevitability of extracting water from the salty waters of the sea and the salt lakes and groundwater of the country, which requires a lot of investment (Sohrabipour, 2014).

Freshwater production from brackish water is a sustainable source of water production and at the same time as a solution to the world's water shortage. Most desalination plants installed in many countries with water shortages run on fossil fuels, however, since desalination processes require considerable energy, their operation is costly. And it will be expensive and has undesirable external effects from the environmental point of view. The use of renewable energy sources in desalination plants has been considered and although the cost of water production in this method is in some cases much higher than other conventional methods, but due to the lack of negative effects on the environment, the cost is reduced. The technologies used in renewable energy in recent years and, most importantly, the role of renewable energy in the sustainable development of the use of these methods are still expanding. Using fossil fuels for desalination is not economically feasible.

The main purpose of this article is the necessity of using desalination plants and seawater transfer for different uses for dry and low rainfall areas. Recently, due to the high energy consumption in industrial desalination processes and the more serious issue of air pollution, desalination systems are being developed in which energy saving is a very important issue. The problem of water scarcity can be solved with the help of desalination of seawater, although the separation of salt from such waters requires huge amounts of energy. In conclusion, considering the long-term development strategies of the country's water management as well as related legal materials in the fourth plan (including Article 17 of the Fourth Plan Law and Article 12 of the long-term development strategies of the country's water resources), preparation and implementation of appropriate management plans and readiness to reduce The effects of drought as well as public awareness in this regard seem necessary.

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