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DESALINATION OF WATER

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HIGHLY EFFICIENT WATER DESALINATION TECHNOLOGY

In the context of a shortage of fresh water, the technology of desalination of saline waters of the World Ocean is of particular relevance.

Over the past 40 years, the amount of fresh water per person in the world has decreased by 60%. To date, more than 80 countries of the world are experiencing a lack of fresh water, located mainly in arid and arid areas and making up about 60% of the entire surface of the earth's land.

One of the most promising ways to provide fresh water is desalination of the saline waters of the World Ocean. The expediency of this path is confirmed by the fact that 60% of the world's population lives in a coastal strip 65 miles wide. In addition, large areas of arid and low-watered areas adjoin or are close to ocean shores.

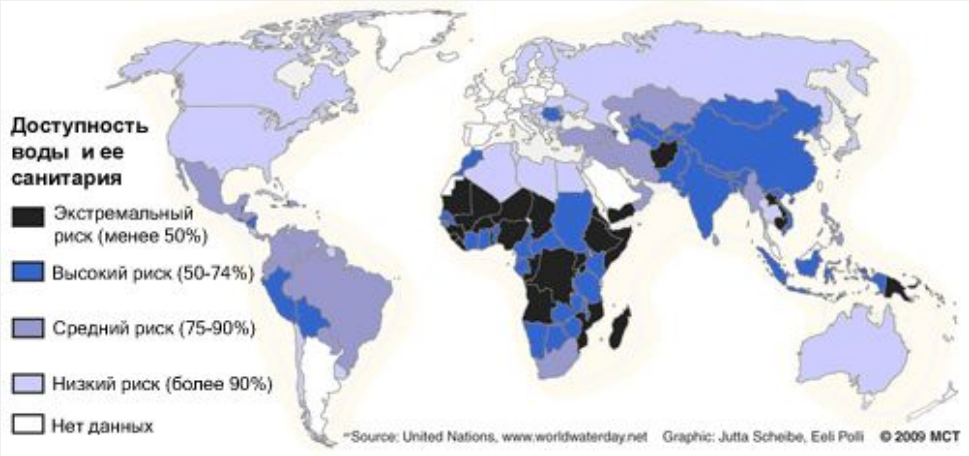
Thus, ocean and sea waters can become a valuable source of water resources for industrial use. Their huge reserves are practically inexhaustible. However, at the current level of technological development, the use of desalination technologies is not economically justified everywhere.

PROBLEM

A third of the world's population lives in countries with a tense situation with water. According to experts' forecasts, by 2025 this figure will increase to two-thirds.

The crisis will be triggered by the growing population of the planet. According to UN estimates, by 2030 it will increase from 6 to 8.5 billion people. Nowadays, 2.5-3 thousand liters of water are consumed annually to provide food for one person who has a diet traditional for industrialized developed countries. If the population increases by 2.5 billion, then an additional 2 thousand cubic meters will need to be found to feed them. km of water.

In such conditions of an acute shortage of fresh water, alternative technologies for replenishing water resources, including through desalination of seawater, acquire special relevance.



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WATER RESERVES

The total volume of water on Earth is approximately 1400 million cubic meters. km, of which only 2.5% (about 35 million cubic km) is fresh water. Seawater accounts for about 98% of all the planet's water resources.

Тип воды	Объем запасов, тыс. куб. км	Доля в общем запасе воды, %	Доля в общем запасе пресной воды, %
Соленая вода			
Океаны	1 338 000	96.54	
Соленые/солоноватые подземные воды	12 870	0.93	
Соленоводные озера	85	0.006	
Воды суши			
Ледники, постоянный снежный покров	24 064	1.74	68.70
Пресные подземные воды	10 530	0.76	30.06
Подземный лед, многолетняя мерзлота	300	0.022	0.86
Пресноводные озера	91	0.007	0.26
Почвенная влага	16.5	0.001	0.05
Водяной пар в атмосфере	12.9	0.001	0.04
Болота, переувлажненные территории	11.5	0.001	0.03
Реки	2.12	0.0002	0.006
Влага живых организмов	1.12	0.0001	0.003
Общие запасы воды	**1 386 000**	**100**	
Общие запасы пресной воды	**35 029**		**100**

Table 1. The world's largest water reserves (source: www.unep.org)

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Мировой океан- это водная оболочка Земли, окружающая материки и острова.
Континенты разделяют мировой океан на 4 океана.
Океаны включают в себя моря, заливы и проливы.

APPLIED TECHNOLOGIES

Industrial desalination of seawater is carried out by one of the following methods: distillation, reverse osmosis, electrodialysis, freezing and ion exchange.

Let's consider in more detail the features of each of the technologies.

1. MSF (Multi-Stage Flash Distillation) - multi-stage flash evaporation (distillation).

In this type of installation, the source water, before being passed through a special nozzle into the large chamber, is pumped into the heater at a pressure at which boiling does not yet occur, i.e. the water is in an overheated state. A decrease in pressure entails an instant transformation of some of the water into steam. Then the water to be desalinated is passed through another nozzle into the adjacent "flash chamber", where the process of instant vaporization continues, and so on to the bottom of the installation.

2. MD (Membrane Distillation) - membrane distillation.

It involves heating water from one side of a hydrophobic membrane. Such a membrane allows only steam to pass through, which is cooled on the other side, forming fresh water, but does not allow water to pass through.

3. MED (Multi-Effect Distillation) is a multi-column distillation method.

Seawater is heated in the first column, and the generated steam is used for heating in the subsequent columns.

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4. MVC (Mechanical Vapor Compression) - mechanical vapor compression.
It consists in compressing the vapor produced in the normal distillation step before it condenses. The effect of vapor compression involves heating it to a temperature above the boiling point of the water supplied for desalination (from which it was obtained). The compressed vapor can then be returned to the same distillation chamber from which it was recovered and used to replace the primary vapor. The cycle repeats continuously. The use of compressed steam reduces the energy consumption of the process, but prevents the processing of large volumes of water.

5. FP (Freezing Process) - freezing method.
The sea water is cooled until moisture crystallizes. The resulting crystals are isolated and dissolved to produce fresh water.

6. RO (Reverse Osmosis) - reverse osmosis.
Provides for the use of a semi-permeable membrane that allows water to pass through under pressure and retains impurity molecules.

7. ED (Electrodialysis) - electrodialysis.
Two membranes are required: one allows only the cation to pass through, the other only the anion. A DC voltage is switched on between them, which makes it possible to remove, for example, sodium and chlorine anions from seawater.

According to experts, each of the indicated technologies has significant drawbacks, which include:

- significant deposits on heat transfer surfaces, membranes, etc.
- high specific energy costs
- the presence of a large number of replaceable materials, components, additional consumption of chemical reagents
- environmental hazard during the operation of installations
- the need for highly qualified service personnel.

In this regard, the issue of developing more efficient and environmentally friendly methods of seawater desalination remains topical.

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DECISION

Due to the existing shortage of drinking water on Earth and the urgency of this problem, our company has developed a mobile complex AQUATES - desalination mobil / 300 + for desalination of sea water, bringing it to the quality required by the standards for drinking water supply to the population, as well as as a technical (without the use of ultrafiltration technology).
The main task of the complex is to obtain mineralized water, safe for human life and health, with a capacity of 300+ m3 per day.
The complex consists of three stages, which are housed in one 45ft High Cube sea container, or an isothermal van of a truck tractor;

- line for water treatment and disinfection;
- desalination line;
- filtration / ultrafiltration line.

EQUIPMENT CHARACTERISTICS	QUANTITATIVE INDICATOR	UNIT
MODEL MODULE	AQUATES- desalination mobil/300+	
NUMBER OF MODULES IN THE INSTALLATION	1	
PRODUCTIVITY PER DAY AT WATER TEMPERATURE 25 ° C	300+	M^3
MINERALIZATION, NO MORE	45	g/l
ELECTRICITY CONSUMPTION WITH / WITHOUT ULTRAFILTRATION	0,8/1,3	кW/$м^3$
INSTALLED POWER	52	кW/$м^3$
SOLAR POWER PLANT MODULE (OPTIONAL), POWER	До 20	кW/$м^3$
POWER PLANT (gasoline, diesel), POWER	До 10	кW/$м^3$

Thus, the mobile complex solves the problem and provides 300,000 liters of drinking water per day with a full content of trace elements necessary for human life and health.

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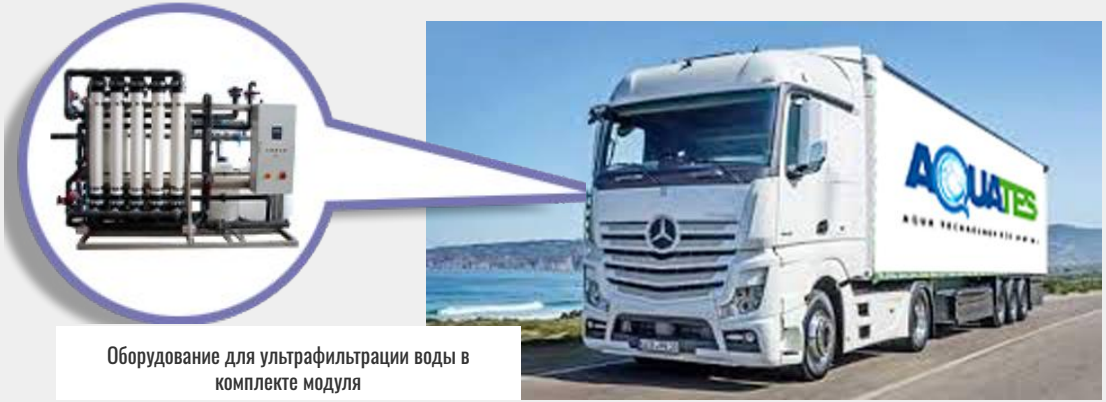
When designing the AQUATES - desalination mobil / 300 + complex, the weather conditions in the region of its use were taken into account and to reduce heat heating from exposure to direct sunlight, integration into the complex of a solar system (solar panels) is envisaged, which will create a shade zone, exclude overheating of engineering equipment and allow the generation of electrical energy to partially cover energy costs.

No p / p	Product name	Description Modifications	Specifications
1	**Water treatment line, desalination line, filtration / ultrafiltration**	The line is placed in a sea container with technological equipment placed inside: - PVC piping, air conditioning, supply and exhaust ventilation, power equipment and grounding, control and monitoring system;	Overall dimensions (LxWxH), m: 13.72 x2.5x2.896 Weight (transport / working), kg 12600/24000 Power supply: 50Hz, 1ph, 220V 10-14 kWh (power), power consumption



Оборудование для ультрафильтрации воды в комплекте модуля

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MARKET

As of the end of 2009, there were 14,451 desalination plants with a total capacity of 59.9 million cubic meters in the world. m per day. Compared to 2008, the increase in capacity was 12.3%. In addition, 244 desalination plants (additional 9.1 million cubic meters per day) are under construction.

In total, seawater desalination technologies are used in 150 countries of the world. The average production of fresh water is about 38 million tons per year.

The market for salt water desalination technology is growing rapidly. About 62.4% of the total industrial production of fresh water is made up of the waters of the World Ocean.

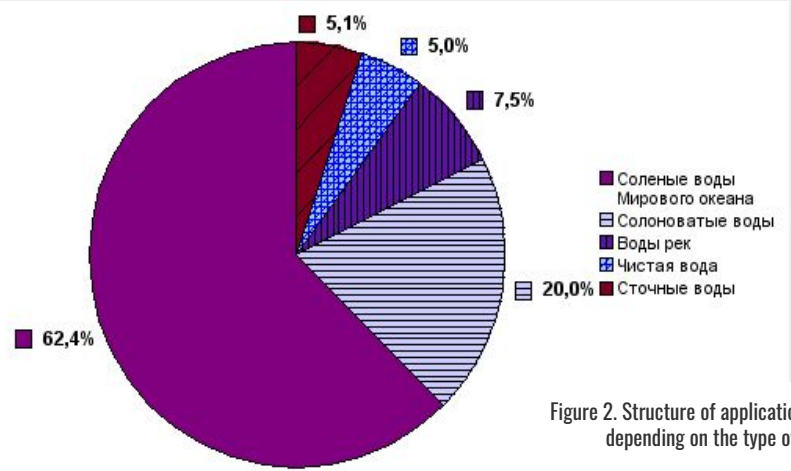

Figure 2. Structure of application of technologies for obtaining fresh water depending on the type of water resources used (source: IDA)

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The structure of consumption of industrially obtained fresh water is distributed as follows:

- municipalities - 66.2%;
- industrial facilities - 23.5%;
- power facilities - 5.5%;
- agriculture - 1.7%;
- others - 3.1%.

Reverse osmosis technology is most in demand on the market.

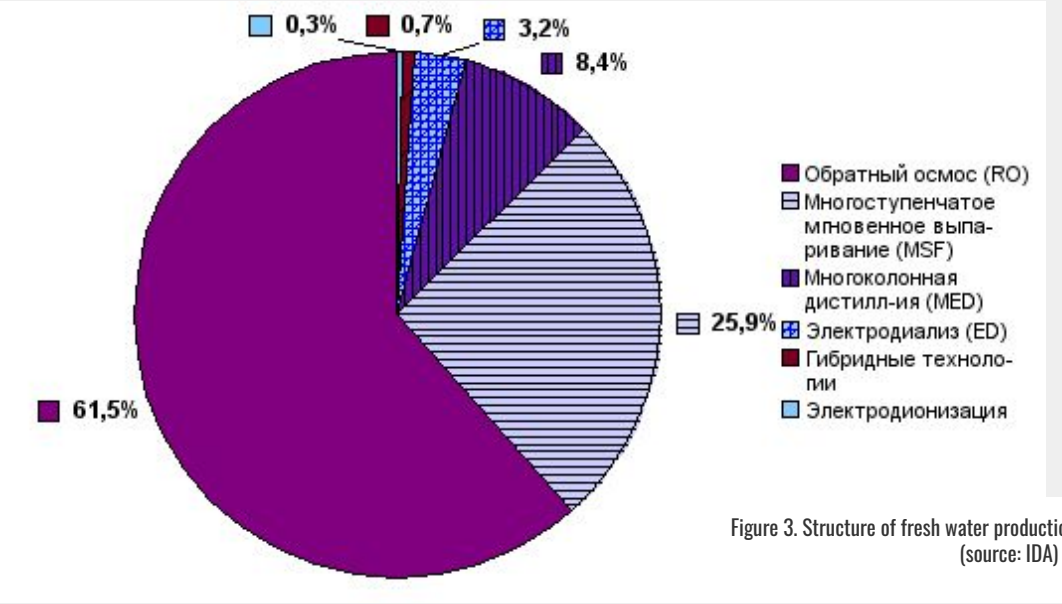

Figure 3. Structure of fresh water production by type of technology used (source: IDA)

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The most powerful desalination plants are located in the Middle East. An example of the largest desalination system is Shoabia 3 (west coast of Saudi Arabia), producing 880,000 cubic meters. m of fresh water per day. Also in the region are under construction 7 plants with a capacity of more than 400,000 cubic meters per day for each.

At the same time, the trend of recent years has been the expansion of the geographical scope of the seawater desalination market. The Middle East is still the largest consumer of freshwater from the oceans. However, massive government support programs for the industry have spurred demand for technology in regions such as Australia, Algeria and Spain.

Регион	Консолидированная мощность, млн куб. м в день	Доля рынка, %
Саудовская Аравия	7.4	20.6
Объединенные Арабские Эмираты	7.3	20.3
Испания	3.4	9.4
Кувейт	2.1	5.8
Катар	1.4	3.9
Алжир	1.1	3.1
Китай	1.1	2.9
Ливия	0.8	2.3
США	0.8	2.2
Оман	0.8	2.2

Table 2. Top 10 countries by installed seawater desalination capacity in 2019 (source: IDA)

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According to experts, in the next 10 years the market for seawater desalination technologies will grow by 60%: from the current $ 19 billion to $ 30 billion in 2030. The main growth drivers will be Algeria, Spain and Australia. In addition, demand growth is expected in the emerging markets of China, India and the USA.

The proposed desalination technology is a know-how in terms of water purification and the desalination method itself. All stages of the technological process have been worked out practically on pilot equipment and in laboratory.

OFFER TO INVESTOR

The purpose of the search for investments in size is the creation of a research and production company in the European Union, on the basis of which industrial samples of equipment for mobile desalination stations will be created, which, in turn, will be certified and patented. To do this, you need to take the following steps:

- opening a company;
- purchase of an office with the possibility of creating a showroom;
- purchase of production space;
- purchase of equipment for production;
- purchase of materials and components for the production of equipment;
- team building (engineering and manufacturing);
- certification and patenting of equipment;
- marketing and advertising;
- search for potential customers for the proposed equipment with its further sale;
- conducting the Initial Public Offering (IPO) procedure;
- creation of a network of dealerships and service centers.

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