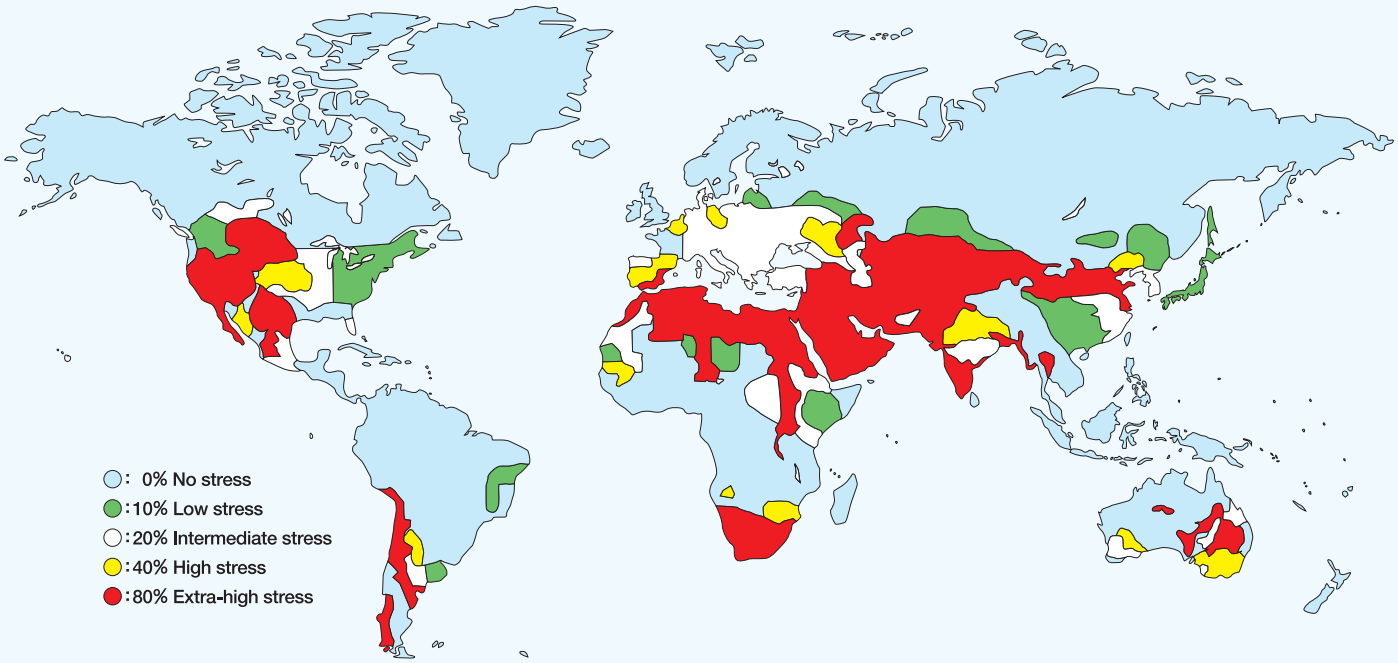
Nitto Denko Group's Involvement in the Water Business

We have up until now relied on the natural flow and circulation of water, where the sun causes the evaporation of water from the surface of the sea and returns it into the sea and over our land through rainfall and via our rivers. Freshwater (river water, well water, rainwater) has been used for agricultural purposes, daily life and industry. Now the human species is experiencing the problem of a shortage of freshwater resources. It is known that there is little hope of the human species maintaining a sustainable future without a solution to this problem.

There are two main factors responsible for the drying up of our freshwater resources. The first relates to changes in the environment resulting in increased salination of well water. This salination has resulted from the rising of sea-levels which has been triggered by global warming and the desertification and drying up of rivers as a result of climate change. The second is the increased demand and consumption of water resulting from the industrialization of developing countries, population growth on a global scale, improved living standards and increases in pollution resulting from industrial activities. Now approximately thirty countries are faced with water shortages. If the current trend continues, almost half of the world's population will encounter water shortages by 2025. It is expected that by the middle of the 21st century, approximately seven billion people will suffer water shortage. There is no room to doubt the significance and importance of this pressing issue concerning the human species. The challenge we face concerns not only how we are going to maintain our existing yet limited freshwater resources but also how we are to secure new water resources.

Water stress forecast of 2025



Adapted from World Water Council (World Water Vision)

Membrane Business Spreading throughout the World

1 Serious Water Shortages

It is the Nitto Denko Group's goal to take on the task of developing membranes which produce pure, clean freshwater. We wonder how many people actually are aware of the seriousness of our current global freshwater shortage. About 97.5% of water on earth is seawater. Most of the 2.5% that remains can be found in Antarctica and in the form of glaciers. Actual raw water which can be used for sourcing clean fresh water makes up only about 0.01%, and we are only able to get it from underground sources or from rivers and lakes. Recent rapid development of our civilization has resulted in a considerable increase of water consumption in our daily lives, agriculture and industry. Although we are recycling wastewater, it is necessary to get water from seawater or wastewater in order to secure the amount of freshwater we need without exhausting the earth's natural supply. In fact, "pure water" is now being obtained from seawater in the Middle East and Europe, and from wastewater in Singapore. Japan and the USA should not be exceptions to this kind of resource mindfulness. We cannot afford to be complacent about our fresh water supply or lack thereof.

2 New Development in the Membrane Business

The Nitto Denko Group's membrane business has been a project which has been assiduously cultivated since 1973. As a result of combining external technologies with our own technologies (precision coating, anti-pollution, control of chemical reactions, surface analysis and evaluation and water analysis and evaluation) we have finally made it possible to use membranes as an element used within water treatment plants.

Producing clean freshwater was not our initial object, but we came across this application as we poured our efforts into producing the ultra pure water that was necessary in manufacturing semiconductors.

With the opening of our Shiga Plant in 1986 we saw for the first time in the world a manufacturing plant specializing in the production of water treatment membrane. Since that time the membrane business has advanced rapidly. In 1987 we acquired Hydranautics in the USA, and since then we have achieved remarkable breakthroughs. But with the overseas transfer of semiconductor manufacturers and the maturity of markets, business began to weaken.

As the market began to weaken the Nitto Denko Group developed a business transition strategy which involved applying the same advanced manufacturing techniques that we had been using for the production of ultra pure water for semiconductors, but instead adapting and developing it further to enable the production of membrane with a desalination function. At present this change in our business direction is proving to be fruitful with our manufacturing techniques used for the production of ultra pure water receiving great recognition.

3 Future of Wastewater Treatment Technologies

In 2008 Nitto Denko Corporation and Mitsubishi Rayon Engineering Co Ltd jointly entered into a Memorandum of Understanding relating to the development of a next generation wastewater treatment system with the Public Utility Board (PUB), a branch of the Singaporean government. Singapore is at the top when it comes to technological development relating to the recycling of black water. Although it is small in scale, this government pilot project if successful will serve to establish an international benchmark concerning the technological processes involved in producing pure water. Such next generation wastewater treatment technology is sure to be introduced worldwide within the not too distant future.

Signing ceremony with PUB

4 Development of Patented Technology for Reverse Osmosis Membrane

Pure water can be produced through either using a distillation method or a reverse osmosis filtration method using reverse osmosis (RO) membrane. In relation to RO membrane, both a flat sheet membrane and a hollow fiber membrane exist. The Nitto Denko Group is a front runner in flat sheet membrane technology. The production of "pure water" through using RO membrane is much more energy efficient than through using the distillation method, and reduces the environmental burden to a minimum. Despite of this further challenges still exist. Our flat sheet membrane is unique in its surface characteristics. We have made good use of our unsurpassed polymer and coating technology, which has been used in the development of the adhesive compound used in the production of our tape. By allowing our flat sheet membrane to crimp, we have been able to allow for a greater surface area of the film to be in contact with the liquid. In doing so we have been able to resolve the challenge of improving our desalination efficiency and can now maximize the amount of fresh water produced. We have a patent for this technology.

5 Feedback from Intelligence Sharing

A strong point of the Nitto Denko Group is not only our ability to develop technologies but is also our adoption of progressive methods of organizational operation. The Nitto Denko Group's membrane business relies on cooperation and coordination between Nitto Denko Corporation (Japan), Hydranautics (USA) and Nitto Denko (Shanghai Songjiang) Co Ltd. Despite our connection, as long as corporate status differs between each operation, the sharing of intelligence will not occur easily.

The source of our technology lies in Japan, manufacturing is undertaken by three companies and our sales initiative stems from the USA. Precious information relating to customers is managed by the sales department. In order to allow for more rapid and responsive feedback to our manufacturing and technological departments, it is necessary to rid ourselves of the cultural barriers that have supported that it is sufficient for small groups to hold onto valuable information without responsibly sharing it for the betterment of all concerned.

In an effort to create a cultural shift, we have created a global virtual organizational management team which has a higher delegation than the individual corporations. The members of this team are seated at the heart of where our customers are. This new model has resulted in the centralizing of both authority and responsibility, thereby allowing the new management team to be much more responsive in its business operations. Some of the members of this team are not Japanese. This move has been seen as contributing to the creation of a more globalized Nitto Denko Group with decisions being made globally. The Nitto Denko Group embodies the principle that it wishes to globally work with our customers' agenda, where all efforts are made to meet customers' expectations.

6 What Enterprises Should Be Like in the Future

In 2007 we started up Kathyd Technology LLC in California, USA with Mitsubishi Rayon Engineering Co Ltd as a joint enterprise. We are searching for any potential business where the fusing of our water processing membrane technology and Mitsubishi Rayon Engineering's Micro Filtration (MF) membrane technology can be applied. In the future we hope to develop a water processing membrane that operates using less energy.

Water is our lifeline. The time has come for enterprises to pursue more than profits and the expansion of their businesses. The time will come for enterprises to embrace investing into future technical innovations that may allow for a more economical and sustainable future production of water.

We are going to construct a new plant in our Shiga Plant in 2009. Membrane production machinery will be in operation enabling an increase in production to take place. We hope that our endeavors to further our membrane business have provided an example of the importance of action being taken by enterprises if as a global business world we are to positively affect the necessary changes that are required for becoming less environmentally harmful and more environmentally sustainable. The Nitto Denko Group actively seeks to be involved in creating a safer and better future for our society, environment and enterprise.

A design illustration of the new plant (the third plant)

Nitto Denko Wins Prestigious Nikkei Award for Seawater Desalination Membrane "SWC5"

Delightful News Given Growing Freshwater Shortage

The seawater desalination membrane "SWC5", one of the main products of the membrane division of the Nitto Denko Group was awarded the "2007 Nikkei Superior Products and Services Awards/Nihon Keizai Shimbun Award for Excellence." These awards are given every year to new products and services deemed to be especially superior. The award winners are selected from among a total of some 20,000 products that have been covered by articles in four Nikkei papers (Nikkei, Nikkei Business Daily, Nikkei Marketing Journal and Nikkei Financial Daily) during the year.

The "Awards for Excellence" are chosen by comprehensively taking into account such factors as how technically developed the product or service is, how cost-effective it is, how much it has contributed to corporate financial performance, how much it can expect to grow in the market, how original it is, and how much impact it is expected to have on industry and society. In 2007, two other products from other enterprises with significant environmental benefits were also selected. They were hybrid vehicles (Lexus LS600h, Lexus LS600hL) and a wind power generator (MWT92/2.4).

Reverse osmosis membrane "SWC5" for seawater desalination

We regret that the "Comments from the Judges" cannot be posted on the website.

Qualities of "SWC5"

The awarded "SWC5" is the RO membrane for seawater desalination which allows for a demineralization rate of 99.8%, the highest level in the world. The RO membrane also allows for improving water permeability. The accumulated technological insight gained by the membrane division has enabled us to control chemical reactions and design at a molecular level allowing for higher performance.

The RO membrane relies on pressure produced by electricity to effectively desalinate water. The energy used to create the necessary pressure to effectively use the RO membrane is produced from petroleum, a resource which does not exist in an endless supply. Unfortunately petroleum in exchange for producing energy also discharges carbon dioxide which causes global warming. Improvements made to the water permeability characteristics of our RO membrane have resulted in the membrane now contributing to energy saving as less electrical energy is required for the same outcome.

Algeria, located in North Africa suffers from a chronic water shortage. Our RO membranes will be used in the largest plant of its kind which is located in Algeria. This plant will filter approximately 200,000m^3 of water per day. The Algerian plant will soon start operating. Significant orders for the same product also came in from Spain, Australia, Mexico and China.

Reverse osmosis membrane for seawater desalination

Minoru Kikuoka Explaining products after the award ceremony

Global Head of the Membrane Division
CEO, Hydranautics

Brett Andrews
COO, Hydranautics

"SWC5 delivers the highest level of salt rejection with the lowest energy requirement in the business. SWC5 is a next-generation product superior to the existing seawater RO membrane technology. With rapidly rising energy costs and ever stricter water quality limits, SWC5 will lead the way in desalination, keeping the Nitto Denko Group at the forefront of RO membrane technology".