# Solving water dilemmas

FROM the connection of the first homes to a basic sewerage system in the 19th century to the supply of high quality drinking water to 99% of the nation by means of an efficient and secure mains system, the Dutch have come a long way. Over the decades, the development of water technology has provided the Netherlands with sustainable systems for the production and supply of water for both private and public consumers and for the collection, treatment and partial reintroduction of 'used' water into the water system. In search of more sustainable, environmentally friendly and widely available solutions to the world's water problems, the Dutch water sector is researching, producing and applying some of the most cutting-edge products and services in the field of water resources management and sanitation.

### Production and treatment

At the heart of Dutch water technology expertise is the need to treat, purify and distribute various water flows in order to minimise pollution and risks to public health and to provide domestic, industrial and agricultural consumers with drinking and process water. Through an elaborate and highly efficient system of pipes, pumps, valves and mains, drinking water companies supply clean tap water to almost everyone in the Netherlands. They employ a variety of methods to make water safe - i.e. remove micro- and other organisms, chemicals and other unwanted substances and to improve its taste, smell and colour. From the established method of 'artificial recharge' (pumping surface water into the ground and using soil as a natural filter) to the more revolutionary application of membrane filters to remove pollutants and ions (salts), the production and provision of high quality water meeting the demands of a range of users is a constant drive for innovation. In the Netherlands, water supply and sanitation have long been linked. Wastewater and rainwater are collected and transported in a sewerage system to which almost the entire community is connected. Sewerage is conveyed directly to wastewater treatment plants. Almost all communal wastewater (98%) is treated before discharge into the rivers and canals that constitute the Dutch water system. Some industrial users provide their own treatment facilities. Experience of its own extensive sewerage and water supply system has made the Netherlands an important supplier of materials for the transport of water through pipes and piped networks. In the changeable and subsiding delta soil, the Dutch have constructed a reliable water mains system approximately 116,000 kilometres long and supported by some 233 pumping stations. Not only is a constant flow of water guaranteed - as pumping stations and water towers create mains pressure - but leakage losses are extremely low (some 4% on average).

### Frontrunner

From an international perspective, the Netherlands is a frontrunner in the development of water purification, pretreatment and treatment technologies, including membrane technology, anaerobic water purification (UASB) and Anammox technology. Membrane technology can be used simultaneously to soften water and to remove colour and pesticides. Water treatment using ozone, hydrogen peroxide and ultraviolet (UV) light is also practised, mainly as a primary disinfection method. This technology makes it possible to eliminate virtually all hazardous substances and organisms.

### Meeting MDG7

Shortages of fresh water, pollution of groundwater and surface water, lack of access to safe drinking water - people face the same range of problems world-wide.

And water is essential to life. The UN believes that access to safe water and sanitation, as described in Millennium Development Goal 7, is an essential precondition for the achievement of other development goals. The Dutch water sector endorses this view and aims to provide clean water and effective sanitation for 50 million people within a decade. The Dutch government, NGOs, and other Dutch water sector representatives are working together with local stakeholders around the world to establish the best options for both technological and institutional solutions. Low-tech, low-price facilities for water harvesting, water conservation and water re-use seem to offer the best potential.

### Small-scale

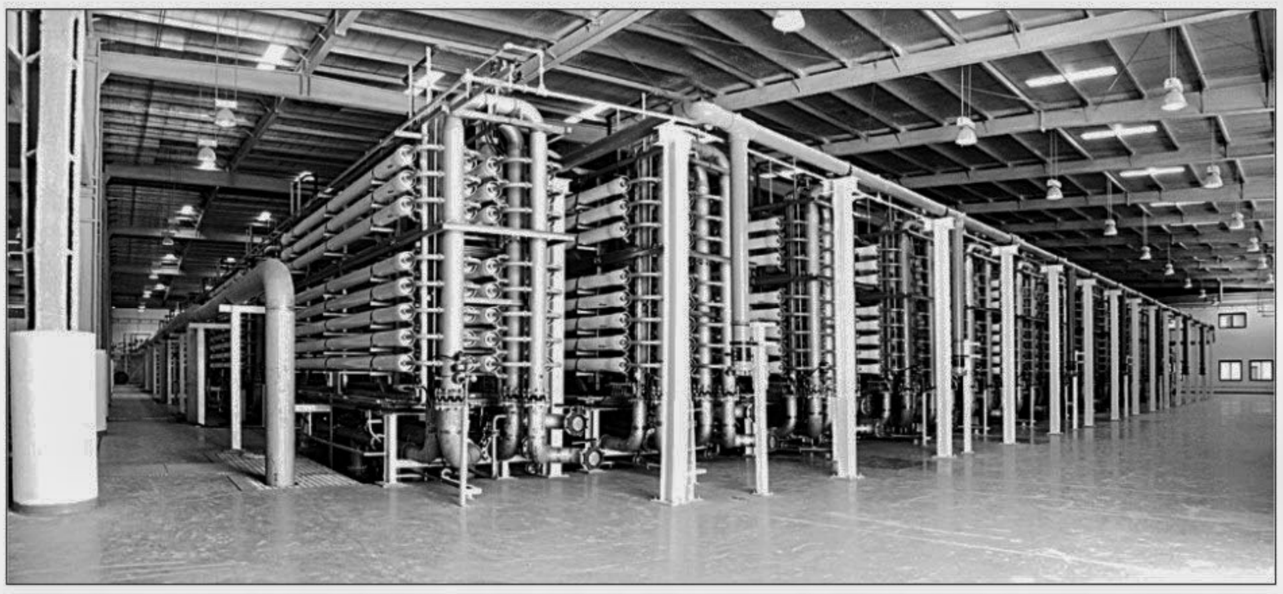
Countries lacking basic infrastructure can benefit from small-scale, stand-alone facilities for water harvesting, purification, treatment or recycling. Various sustainable technologies and products are being developed to offer potable water to the many at low cost. These include mobile water purification units such as the Perfector-E, which produces high quality potable water from polluted surface water. Another example is the Naïade unit, which uses solar energy to do the same. The Dutch Rainmaker uses wind energy to condense potable water out of air or to turn salt, brackish or polluted water into drinking water. On a domestic scale, various sanitation concepts have been developed to reduce the need for fresh water through the re-use of household wastewater. Separating the different types of water flow in the home can enable household wastewater to serve as a source for energy and nutrient recovery or simply to be re-used to reduce household water consumption. 'Grey water' (water discharged from washing machines, showers, baths, sinks and kitchens) has a relatively low concentration of pollutants and can therefore be recycled relatively easy (for household, irrigation and infiltration purposes). 'Black water' (faeces and urine) can be treated and used as the basis for the recovery of nutrients and for bio-energy production. New sanitation concepts developed by the Dutch water sector are based on separation at source and community on-site transport and treatment. They include a range of low-cost, de-centralised applications suitable for use world-wide.

### Precious energy

The Dutch water sector is putting great effort into the development of so-called Blue Energy. This hinges on the difference in salt concentration between seawater and river water. By mixing seawater and river water and separating positive and negative ions by the use of ion-specific membranes, it is possible to generate energy. The advantages are obvious: no fuel costs and no emissions other than brackish water. In order to advance the development of Blue Energy and desalination technology, the Dutch public and private sectors have recently set up WetSalt, a joint research site dedicated exclusively to this purpose.

### Coordination

Dutch efforts to develop and apply solutions to water problems in the Netherlands and abroad are driven by two desires. Firstly, the desire to manage water resources efficiently and sustainably, while constantly improving the methods and means by which this is done. Secondly, the desire to share and apply Dutch expertise around the world in order to improve local living conditions (in particular to reduce the number of people without access to safe drinking water and basic sanitary facilities). The Dutch water sector believes that its efforts in this direction will be most sustainable if the introduction of technology goes hand in hand with capacity-building and local entrepreneurship. To achieve this, all parties - government, the private sector, knowledge organisations and NGOs - need to coordinate their efforts and complement each other's abilities. This is an area in which the Netherlands has broad experience. The Dutch water sector is keen to use this experience in the future and to apply its expertise to the solution of waterrelated dilemmas around the world.



Completed in 2004, the Sulaibiya Wastewater Treatment plant in Kuwait is one of the largest of its kind in the world (Source: Norit)

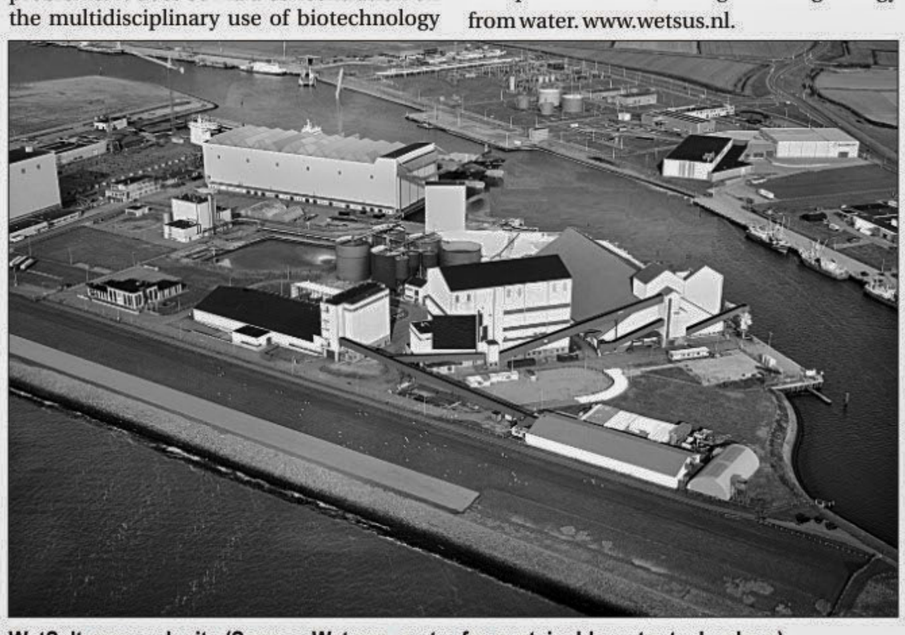
## MBR

Membrane technology is fast becoming both a standard option for wastewater treatment in the Netherlands and a major export product. A highly innovative approach to wastewater treatment is the combination of membrane technology with biological treatment methods. Because the membrane filters out the sludge, the biological system can cope with greater throughput: the membrane bioreactor (MBR) can therefore be smaller. The effluent is much cleaner than that from a conventional biological treatment system. MBR combines small scale with high quality.

Biological wastewater treatment, Carrousel Geestmerambacht (Source: DHV)

## Research for better technology

To promote the development of water technology, Dutch private and public sector partners have initiated a Technological Top Institute for Water Technology. The research institute focuses the combined strengths of industry and renowned universities on the search for practical answers to global water problems. It does so via a concentration on the multidisciplinary use of biotechnology and separation technology. The current research programme includes themes such as desalination and re-use of salts, improving the performance of membrane bioreactors, preventing the biofouling of membranes for the preparation of drinking and process water, and generating energy from water. www.wetsus.nl.



WetSalt, research site (Source: Wetsus, centre for sustainable water technology).

## Sustainable solutions

The sustainability of wastewater collection and treatment is being improved by differentiating levels of pollution and re-using both treated water and by-products. A huge research and development effort has focused on the search for more nvironmentally friendly, sustainable and widely accessible treatment technologies and expertise. At the same time, new ideas about water recycling and re-use are being turned into valuable applications that can help meet some of the world's water challenges. Seawater desalinisation, the use and re-use of groundwater and wastewater, and the use of water to produce energy are subject to a similar trend.

# Solving delta dilemmas

CONTINUED FROM PAGE 22

of flood protection simply by increasing the height of the dikes. This is now seen as ineffective. The new policy is to increase the capacity of river basins by positioning dikes further away from rivers or by deepening washlands to reduce river levels at times of peak discharge. More space can also be created by enlarging the river channel within the dikes. In addition, action is being taken to prevent activities which increase peak river discharges, such as the building of houses and recreational facilities on flood plains. The aim is to strike a balance between present and future spatial requirements, seizing every opportunity both to enhance flood protection and to improve the environment. In other words, to work with, rather than against, nature.

## Flood control 2015

Companies and knowledge institutes have joined forces in the Flood Control 2015 programme to maximise the world's ability to prepare for flood events. Model data, continuous monitoring and real-time information provision are coupled to provide a basis for superior risk assessment, enabling effective short-term decision-making and hence improved disaster management. Data on water levels, dike strength, meteorological expectations and forecast consequences of expected flood events are combined to produce an integrated picture, on the basis of which accurate predictions can be made and appropriate measures taken: all a question of the right information at the right time.