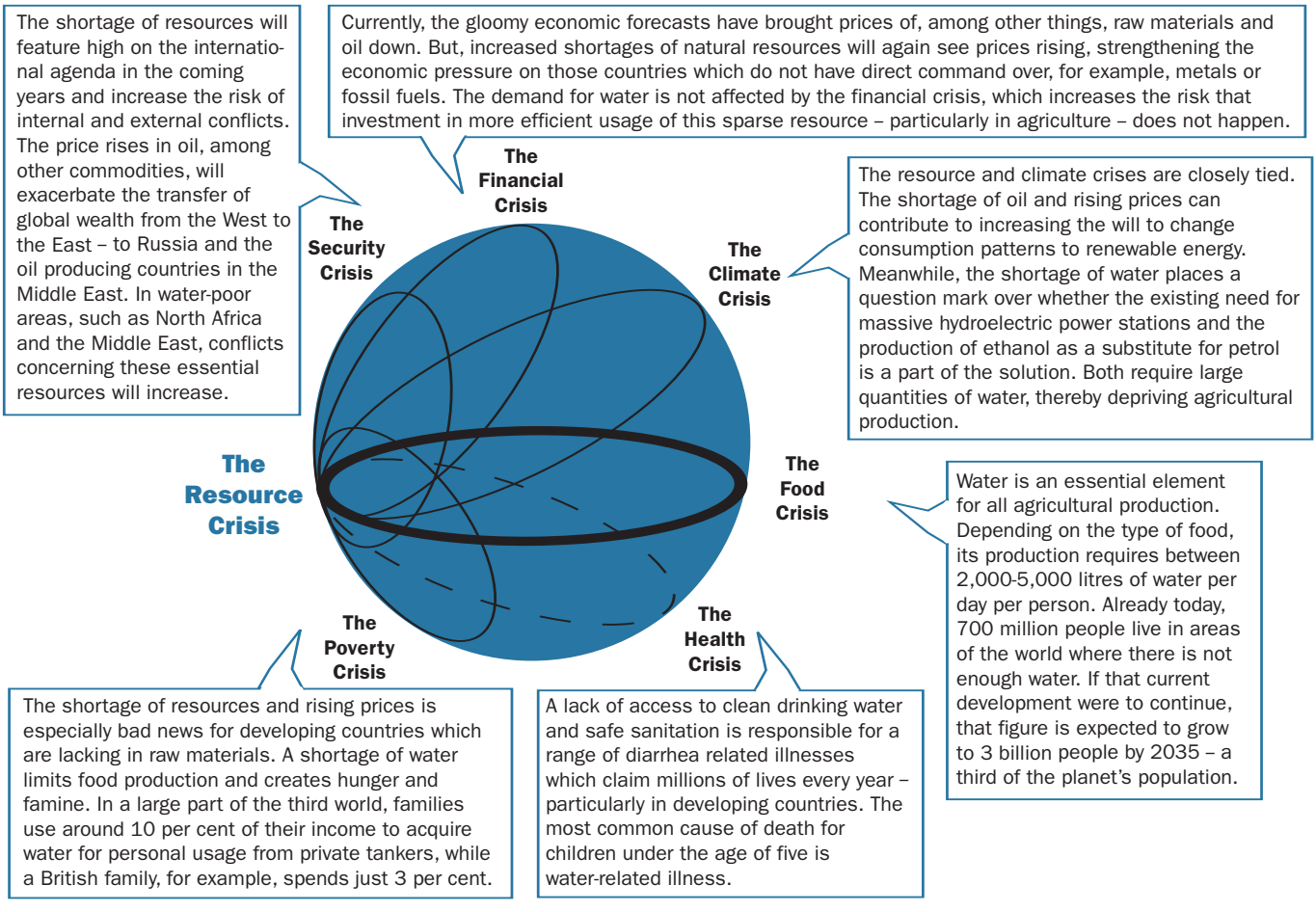
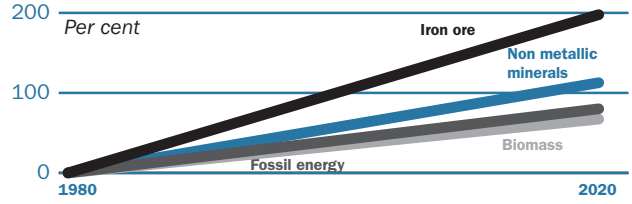
# 7 The New Oil – and the Old

**Natural resources, such as metals, fuels, wood, food, water and so on exist only in limited quantities. Over the coming years, a growing population and increasing wealth will lead to fierce battle for these resources. The most pressing fight for resources concerns oil, where production is lagging behind after demand has rapidly increased. Even if the world's leaders reach an ambitious agreement about climate goals, the demand from China and India, among others, will require increased production – with higher prices to follow. But the coming years' deepest resource crisis will concern the shortage of water, which affects every aspect of our lives. And unlike oil, there is no substitute. The link to food production is especially close, which is why the fight against water shortages must be won in agriculture where there are significant opportunities to increase water productivity. Increasing water shortages can also affect energy production, which is why the challenges of the next few years will also focus on using those scarce water supplies in a way that can increase both food and energy production. A lack of water could create global growth markets in, for example, energy efficient pumps, water cleaning and desalination.**

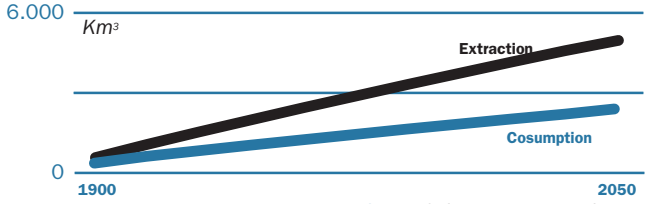


**MM | The Consumption of resources increases**

Growth in extraction of global resouces, per cent




The total extraction and consumption of water




**Source:** OECD and World Water Council.

## THE NEW OIL – AND THE OLD

In recent years, the increasingly tense fight for the world's natural resources has led to new concerns about shortages, securing supply and the damaging strain on the environment. But an even larger population, growing wealth, and the lifestyle and consumption changes they bring with them mean that the global demand for all resources – metals, fossil fuels, food, water, etc. – keep on increasing. As do the prices of a large number of sought-after goods.

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Natural resources are in limited supply and over the next few years, populations the world over will experience a fierce fight for them that could have decisive consequences for the outcome of the other interrelated global crises. The most pressing fight over resources concerns oil. Production of oil is simply not able to keep up with rapidly increasing demand from the global market. This has an impact on countries whose economies are founded on high consumption of fossil fuels. Over the last 100 years, oil has become the dominant energy source, but stocks won't last forever. According to estimates from the OECD, the known supplies of oil will be used up within the next 25-50 years – depending on the growth in consumption.

Over the last 50 years, oil production has grown from around 18 million to 85 million barrels per day – a growth equivalent to over 350 per cent. Today, many experts believe that productivity has reached its peak. Many oil fields have run dry, and the large, older oil fields in Saudi Arabia risk collapse. But the global demand continues to increase. According to the International Energy Agency (IEA), by 2030 we will need 106 million barrels of oil per day if we continue as we are. In a sense, this scenario poses a catch 22 situation because this would increase the release of green house gasses to a level that would double their concentration in the atmosphere by the end of this century, and increase the earth's average temperature by up to 6 ºC – way above the level that climate experts consider manageable. Among other things, this would alter the distribution of rainfall, and so increase the already significant problems with sourcing water in many areas of the world.

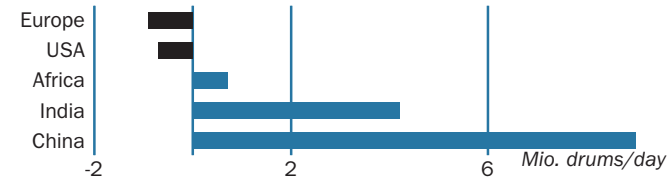
In the long term, the shortage of water is the deepest and most serious resource crisis. Water affects every aspect of our lives and, unlike oil, there is no substitute. Without drinking water the planet would be depopulated in a matter of days. Unclean drinking water and poor sanitary conditions cost millions of lives every year. A shortage of water is synonymous with food shortages and starvation. There is not a single commodity or good that does not either contain water, or rely on water for its production. Economic development and the production of energy depend on water. Water is, like oil, a vital lubricant in the global economy. While the demand for oil has, despite everything, dropped steeply in anticipation of the effects of financial crisis, there is no sign that it will be the case as far as demand for water is concerned. This is why many are talking in terms of water as the oil of the 21st century.

### Consumption Growing Faster than Population

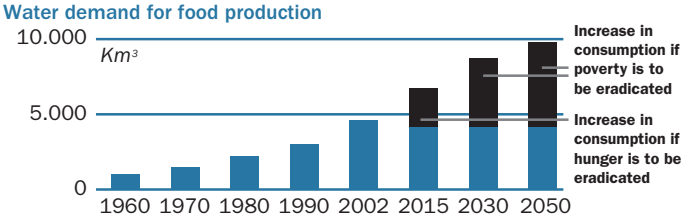
The most obvious explanation for the resource crisis is the growing population. During the 20th century, the planet's population has trebled – and by 2050 it will increase further from the current 6.7 billion people to 9.2 billion, according to UN predictions. Yet consumption of resources is growing even faster. Water usage is growing at around double the rate of population growth, while the OECD predicts that the extraction of metal ores and fossil fuels (oil, coal, natural gas and peat) will increase by 58 and 14 per cent respectively per person by 2020. This is due to economic growth which has led to increased wealth, changing lifestyles and new patterns of consumption. The large demand for raw materials is especially strong from the major developing economies, China and India, which have launched an intensive charm offensive to win African raw materials, and/or energy-producing countries such as Nigeria, Angola, Congo, South Africa and Sudan. In particular China's appetite for raw materials is virtually insatiable. The production of metal ore, for example, has grown so tremendously that, according to official predictions, known deposits are expected to run out during this century. Silver, lead and zinc mines are predicted to be exhausted within 15-20 years; aluminium and iron deposits will last for another 50 years. Increasing prices will be good news for the countries where the largest amounts of these deposits are to be found – which includes a num-

**MM | Great fureture needs**

Expected change in the demand for oil by business as usual




Water demand for food production




**Source:** IEA and Stockholm Environment Institute.

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ber of countries in Asia, Africa and South America – but bad news for those that need them for their manufacturing industries. Already today, recycling is a profitable business area. In both the USA and Europe over 50 per cent of all copper is recycled – and the potential is far from exhausted.

The wealthier countries of the West have been able to improve production efficiencies to some degree, so that a disconnect has occurred between the consumption of raw materials and economic growth. This applies only to a limited extent to oil, which set a new production record of 85 million barrels per day in 2007.

According to the IEA's latest "World Energy Outlook", the existing growth in worldwide demand requires an increase in production of up to 106 million barrels a day by 2030. Considerable investment is required as many oil fields are run-down and literally on their last legs. According to the IEA, 8,400 billion dollars will have to be invested in oil and gas fields by 2030, while the global energy sector must invest 17,600 billion dollars in upgrading declining infrastructure. The global financial crisis has made it much more difficult to raise this money. The result could be that oil production will reach its peak during the next few years, and send energy prices soaring – which, again, will amplify the imbalances in the real economy. Despite the sharp price falls to around 40 dollars a barrel last summer, the IEA is in no doubt that the "era of cheap oil" is over. The IEA expects prices to increase next year to around 100-110 dollars a barrel at 2007 prices. But there are many variables and risk factors. If oil demand increases as much as the IEA predicts, it will increase global $CO_2$ emissions from energy use by no less than 45 per cent by 2030. This could send the climate crisis completely out of control.

This increases the urgent need to speed up an energy revolution that could reduce our dependence on fossil fuels. The financial crisis could weaken investment in new oil fields and, together with growing oil prices, encourage the development of alternative energy solutions. But at the same time, the financial crisis makes it more difficult to find investment for the improved energy efficiencies that are vital to helping solve the climate crisis.

The most effective way to solve this dilemma is for governments to increase energy taxes in order to change economic incentives so that it becomes more expensive to use oil compared to investing in energy efficient technologies. Governments need to examine cap and trade approaches as well as straight carbon taxes.

### Water Crisis Now an Urgent Problem

The world is on the brink of a global water crisis. Around a billion of the world's population do not have access to, or can not afford, clean drinking water. There is a serious shortage of water in some areas because rivers and lakes are beginning to run dry, and because subsoil water levels are declining rapidly. In the worst scenario this could also exacerbate the global food crisis. There are several clear indications of a crisis:

- **DRY RIVERS.** In 2007, water levels on the Yangtze River in China fell to their lowest levels since measures were first recorded in 1877. For certain periods of each year major rivers, such as the Yellow River in China, the Murray-Darling in Australia and the Colorado River in the USA, run dry before they reach the sea.

- **DISAPPEARING LAKES.** The Aral Sea, in Central Asia, has reduced by 75% since 1960 because water from the rivers Amu Darya and Syr Darya have been used for irrigation. Its harbors are now deserted, while ships lie stranded on what was once the sea bed. Lake Chad in Central Africa and the Sea of Galilee in Israel are also at risk of disappearing. The same scenario is true with an incalculable number of lakes.

- **DECLINING SUBSOIL WATER.** Subsoil water levels in Northern China, Northern India and Southwest USA are declining rapidly because water usage is outstripping supply. Around Beijing, subsoil water is falling at a rate of roughly 3 meters per year and is now more than 1,000 meters beneath land levels. The city of Atlanta in the USA almost ran out of water in 2007, and in the summer of 2008 Barcelona was forced to import water via ships from France.

This critical situation is something of a paradox. In principle, there is plenty of water, and the hydrological water cycle (evaporation, rainfall, seepage etc.) is a closed system in which water can not be lost. Around 70 per cent of the world is covered in water, but only 2.5 per cent is fresh water, and the vast majority of it is beyond human reach – either because it is in the form of ice mass or glaciers, or is located in places that make it impossible to access. The basic problem with this remaining water is that it is irregularly placed and difficult to transport over long distances.

## WATER FOOTPRINT

Average direct and indirect water consumption in the production of different products:

| | |
|---|---|
| 1 sheet A4-paper | **10 litres** |
| 1 tomato | **13 litres** |
| 1 potato | **25 litres** |
| 1 microchip | **32 litres** |
| 1 cup of tea | **35 litres** |
| 1 slice of bread | **40 litres** |
| 1 apple | **70 litres** |
| 1 glass of beer | **75 litres** |
| 1 glass of wine | **120 litres** |
| 1 egg | **135 litres** |
| 1 cup of coffee | **140 litres** |
| 1 glass of milk | **200 litres** |
| 1 cotton-T-shirt | **2,000 litres** |
| 1 hamburger | **2,400 litres** |
| 1 pair of leather shoes | **8,000 litres** |

A water footprint is an indicator of water resources required for a given product. This includes not just the quantity of water directly used in the product or its production, but also calculates, for example, wasted water.

**Source:** Hoekstra & Chapagain (2006)

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There are many ways to determine the water shortage. A widely known rule of measure – the so-called Falkenmark indicator – estimating that there should be 1,700 cubic meters of renewable water resources available per person to cover the needs of households, agriculture, industry and energy production. Countries that exist beneath this level are said to suffer from "water stress". Today, 700 million people live in such a situation. The UN expects that number will grow to 3 billion by 2035 – almost a third of the world's population.

The greatest problems are found in densely populated areas with low rain fall in Central- and West Asia and North Africa, that are already experiencing "water scarcity" – defined as less than 1,000 cubic meters per inhabitant. In 20 countries – chiefly in the Middle East – there is "absolute scarcity", equivalent to less than 500 cubic meters per person. Just as with other resources, increasing water demand is caused by greater wealth and changing patterns of consumption. Richer countries tend to have more water-consuming installations, such as toilets and washing machines.

Globally, around 10 per cent of water used in private households is for drinking purposes and making food etc. 20 per cent goes to industry, while 70 per cent is consumed by agriculture. The real water crisis concerns the sourcing water for the production of food. Already the change in diet towards the consumption of more meat accounts to a large extent for the doubling in average use. The demand for meat is currently rising by 2.5-4 per cent per year – due, among other reasons, to the increased consumption in China. And if the rest of the world were to adopt a similar food consumption pattern to the West's, it would require 75 per cent more water than is currently used.

The lack of water concerns both quantity and quality. Excessive use of subsoil water can, for example, mean that salt water is drawn into reservoirs causing contamination and damage. Poisonous waste, sewage and flood water in rivers can reduce water's usefulness – both to households and agriculture. Today, water pollution is a growing problem in densely populated developing economies such as China and India. Five of China's seven major flood systems are dangerously polluted.

Agriculture is indirectly responsible for a large part of the pollution because of the rinsing through of nitrogen and pesticides. The processing of corn into ethanol, which requires a high usage of fertilizers, can exacerbate the situation – also in terms of the finely balanced ecosystems in rivers and estuaries.

The impacts of climate changes, which are already being felt, make a bad situation worse. They have already affected rainfall patterns, so that some experience more droughts and others more floods. Furthermore, higher temperatures have caused mountain glaciers and snow masses to melt earlier in the spring, a problem which has brought with it a reduced amount of water in the rivers during the summer, at precisely the time when there is greatest need for it. This has happened in a number of rivers in China, India and Pakistan upon which millions of people depend, including the Yangtze, Indus, Ganges and Brahmaputra.

The global challenges are so sizeable and urgent that, in the coming years, they could well be an impetus for massive growth in research for solutions and technologies that can solve the water crisis. Companies with specific competences within water treatment facilities, pumping stations, supply systems and so on, have a great market potential both overseas and in the developed western economies.

Currently, the global water market has a turnover of 500 billion dollars per year, and is expected to grow to at least 688 billion dollars by 2010.

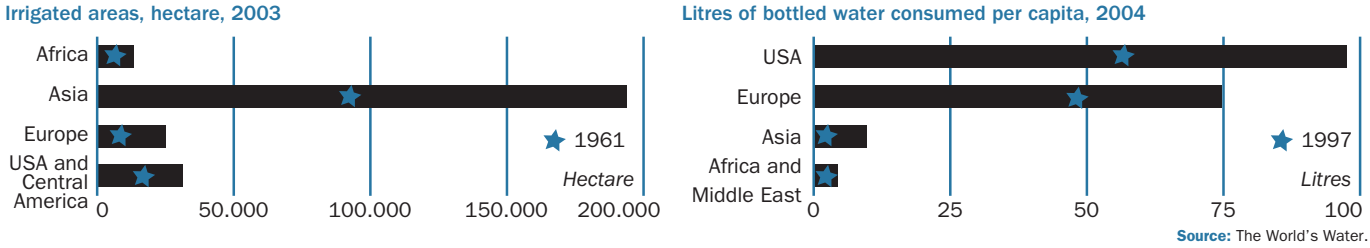
### No Water, No Food

Shortages of natural resources will take a prominent place in the coming years' international agenda. The shortage of oil and the fight for access to oil reserves has already caused numerous wars and conflicts during this century. A shortage scenario in the coming years could increase the imbalances and security risks. It is a given that shortages lead to shifts in economic power. The high oil prices leading up to the summer of 2008 transferred colossal economic power from the west to the east, namely to Russia and the oil producing countries in the Middle East.

Already today dizzying sums of money are being transferred from western countries to the OPEC countries – over 1,000 billion dollars in 2008 – and a significant proportion of the coming years' oil demand, from developing economies in particular, will be supplied by Saudi Arabia and other OPEC countries. The IEA's most optimistic scenario, which entails a global warming of only 2 °C, means that the OPEC countries must increase production by 12 million barrels per day in 2030.This is more than the world's largest oil exporter, Saudi Arabia, delivers today.

Water is also a potential area of conflict. Israel's conflict with its neighboring countries, including, among others, the Palestinian

**MM | Irrigation and bottled water**




**Source:** The World's Water.

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Autonomy areas and Jordan, is partially fuelled by their dependence on water from the River Jordan. The situation is perilously poised in the water-poor Middle East and North Africa. Egypt has threatened its southerly neighbour, Sudan, with war if it cuts off a significant part of the Nile's water supply with a dam. Similarly, both Syria and Iraq have come close to conflict with Turkey because of a dam project that could reduce the water-flow to the Euphrates.

A good example of how a shortage of water can lead to death and destruction is the conflict in Sudan's Darfur region. One of the most significant causes of this year-long civil war is thought to have been the tussle over water between Arabic cattle breeders and African farmers. The fact that water can, like oil, increase the chances of conflict shows that it is a fundamental requirement for life – whether as drinking water in the fast growing number of large cities; as a basic requirement for food production in rural districts; and as an unavoidable requirement for nearly all forms of industrial production, including energy.

The link with food production is especially close. While on average we drink four litres of water a day, 3,000 litres are required for the production of our food.

According to the International Water Management Institute in London, if the world is to be ready in the future to support its population, it will require nearly a doubling of production by 2050. Technically speaking, this is possible with a more sophisticated use of irrigation. But the problem in many parts of the world – including the largest corn producing countries such as the USA, China and India – is that the water simply isn't there. The situation is especially serious in Northern India where 56 per cent more subsoil water is used than is regenerated. If this trend continues, the water-poor parts of the world will be faced with an almost impossible choice. Which shall they prioritize – the countryside or city? And how ought they to consider the demand for water in energy and industrial production which, in the long term, is the driving force behind economic development? It is a choice that is not just politically difficult, but one that also requires a considerable understanding and awareness of how the water problem is interconnected with other crises.

For example, gigantic hydro-electric power stations would appear to be a good answer to both energy shortages and climate problems. But these mega stations are responsible for damage to both water and food supplies, because the gigantic artificial reservoirs which dam up waters in rivers increase evaporation significantly. And even though the water ends up as rainfall in one way or another, it is far from certain that it will fall at the particular time, and over the particular area, where there is most need for it.

### Agriculture is The Key

Developments over recent years give some cause for optimism. First and foremost, because awareness is growing – among international organizations such as the UN and The World Bank, national governments, research institutes, NGOs and private businesses. Knowledge and experience are being shared across borders, and even though there is a continuous need for a stronger economic and political effort, a great deal of expertise and know how already exists in this area.

If one looks only at the water goals detailed in the UN's Millennium Development Goals, there has been quantifiable progress towards the goal of securing drinking water supplies to a large part of the world's population: since 1990, at least 1.6 billion people have had secure access to drinking water. The goals have been particularly effective in Eastern Asia – namely China – where the access has grown by 20 per cent. Things haven't gone nearly as well in sub-Saharan Africa, which is now home to more than a third of the world's population without secure access to drinking water. The problems are greatest in rural areas, but also affect slum areas around major cities.

New, innovative solutions are needed to these challenges. A good example is the Danish invention, Life Straw, a drinking straw with a filter which can purify even very dirty and polluted water to make it drinkable. Forbes Magazine named it one of its ten life-changing inventions.

Efforts should, primarily, be targeted towards agriculture, which needs to be reorganized to increase productivity with less water. The technical possibilities to increase production are within reach. The largest proportion of water used never ends up with the crops. Irrigation is mainly used to flood fields which results in only between 25 and 40 per cent of water being utilized effectively. On its own, repairing of the worst leaks in irrigation systems would bring major savings and relatively simple technologies, such as sprinklers or drip watering systems, can increase water efficiency by 70 to 80 per cent. As well as this, even cheaper solutions – for example, night watering and increased capa-

## INTEGRATED WATER RESOURCE MANAGEMENT

Developing integrated water resource management (IWRM) plans were agreed at the world summit for sustainable development in Johannesburg in 2002. IWRM aims to protect and optimize water resources as well as ensuring a prioritized distribution among users. According to the Global Water Partnership, IWRM is defined as "a process which promotes a coordinated development and management of water, land and related natural resources in order to maximize resulting economic and social welfare in a fair way without compromising sustainable and vital ecosystems". IWRM sees water as a limited and vulnerable natural resource which needs holistic, cross-sector management. Its four main principles are:

- Water is a limited and vulnerable resource.
- Water management should operate at the lowest possible level (watercourse plan) and must involve citizens in the decision making process.
- Water has economic value and ought to be considered as an economic good.
- Women play a central role in procuring, managing and protecting water.



city for gathering and saving rain water in closed tanks to minimize evaporation, can make water last longer. According to the International Water Management Institute, some parts of Africa would require only marginally more water to double their harvest.

The starting point for all of this is that the price of water is set high enough that it is worth saving. The price of water is, of course, a sensitive question which depends on a great deal of transparency in the regulating and dividing of limited resources. In 2005, water privatization – and price increases – caused riots in Bolivia. Progress in this area depends on governments, businesses and civil society working together on water management.

It is important to understand that the lack of water – in contrast, for example, to reduction in greenhouse gasses – is primarily a localized problem. If we save water, it doesn't immediately help those in need of water in other parts of the world. But neither is it without meaning: just imagine if, for example, everybody became vegetarian, this would reduce the demand for meat – and with it the demand for water. Whether this is a realistic scenario is somewhat doubtful however.

A better idea might be to move agricultural production from areas with low water levels to those with more secure supplies. Even though, so far, this method has not been met with much approval, water-poor Jordan has, for example, reduced its demand for water by importing wheat and rice from the USA. The same thinking lies behind the idea that countries with water shortages should not produce "thirsty" crops such as oranges, cotton and rice – and instead concentrate on, for example, dates and olives.

### Combined Thinking on Climate, Energy and Water

It is self evident that households and industry ought to save water. Technically, a city can meet all of its water needs from recycled water, but the question of course is how much energy would this require and how will it affect the climate?

The same question arises in connection with the long held dream of solving the world's water problems by turning salt- and brackish water into drinking water. It is an area that is developing rapidly. According to the International Desalination Association, today there are almost 14,000 desalination plants around the world. A large number of them are in the Middle East where there is a lack of water, but a considerable amount of oil.

Currently, only around half a per cent of the world's water demand is met in this way, and the risk, of course, is that the lack of water will become so dramatic that, in itself, it will increase the consumption of fossil fuels – and so create a vicious circle.

Previously, this technology has been used by the oil-rich Arab states in particular, but this has changed. Similar installations have now been built both in the USA (California) and Australia, and the good news is that advanced technology has reduced both costs and energy use considerably. Perth, in Australia, has, for example, recently built a desalination plant which is driven by wind turbines. At the same time, the Australians claim to have created a system which sends the salt back into the sea in a way that minimizes the impact on the coastal environment.

Danfoss has developed high pressure pumps for salt water which can reduce energy use by 30-40 per cent in comparison with the existing centrifugal pumps. The market for energy efficient desalination plants is likely to grow markedly over the next years. It is already known that climate change affects water circulation. According to the UN's climate panel the higher average temperature will, essentially, make the drier parts of the world even more dry, and the wetter parts even wetter. Moreover, the overall rise in temperature will increase evaporation, particularly in dry and warm areas.

The increased shortage of water will also affect energy production. Water is vital in the production of coal and oil and is used as coolant in power stations. The energy sector simply can't function without water. And, already, existing water shortages in rivers and lakes mean that hydroelectric power station have run short of water for electrical production and that nuclear power stations in the USA, France, Spain and Germany have been put on stand-by because of a lack of cooling water. The coming years' greatest resource issue is hardly oil. The major challenge will concern how expedient we are in the use of our scarce water supplies to increase both food and energy production. The shortage doesn't just place a large question mark beside the current use of, for example, hydroelectric power, because these large scale dams increase evaporation considerably. Even more surprising is, perhaps, that it places an equally large question mark beside the production of bioethanol, which many have seen as a solution to oil dependence and climate problems. Bioethanol is the energy form with the greatest need for water.