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Rainwater Harvesting – A global issue matures

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The English term “Rainwater Harvesting” has been internationally widely accepted. Interestingly enough, the emphasis has not been on the utilisation of rainwater but on its harvesting. Harvesting means “crop” or “yield” and is a synonym for “gift of nature”. Therefore, it goes without saying that the harvested should be also utilised and every yield is preceded by its own activities.

Mankind will have to deal more carefully in the future with the world-wide available and utilisable freshwater reserves. This is primarily a question of awareness and education. In Taiwan, Korea and Australia, programmes to promote rainwater utilisation have been launched in schools in order to familiarise future generations with this topic.

Water distribution world-wide

- 0.025 % of the world-wide available amounts of water is utilisable
- 1.4 Million people live without clean drinking water
- 2.3 Million people lack adequate sanitation
- 7 Million people die every year from water-borne diseases
- The daily per capita water consumption in households
  - 350 Litre in North America
  - 200 Litre in Europe
  - 130 Litre in Germany
  - 20 – 30 Litre in Sub-Saharan Africa
- Over 260 river basins are shared by two or more countries mostly without adequate legal or institutional arrangements

Source: Water in Crisis, World Water Council, Marseille 2002.

In the future, service water and rainwater utilisation can back up the water supply in single countries. Resolution methods can be differentiated into two groups depending on the country or region (7):

Group 1, predominantly developed nations with existing infrastructure

- Drinking water substitution in the building services engineering
- Load relief of the existing combined/gravity sewer systems
- Load relief of the existing wastewater treatment plants
- Water retention as a preventive measure against urban floods
- Water for agriculture
- Water for trade and industry
- Back up of the local drinking water supply

Group 2, predominantly developing or newly industrialising countries (NICs) with little developed water infrastructure

- Back up of the regional water supply/basic sanitation
- Water for agriculture
- Water retention as a preventive measure against urban floods

To Group 1 belong countries from Europe, North America, East Asia and Australia which may use service water and rainwater as a supplement to the already existing systems. In countries which belong to the second group, rainwater utilisation can be used cost effectively for the basic supply mainly in rural areas.

These themes are represented world-wide by the International Rainwater Catchment Systems Association IRCSA which was founded in 1991. The aim of this organisation is the promotion of rainwater utilisation on a technical, scientific, planning and educational basis. The IRCSA is represented by 8 directors and 41 national representatives distributed in all continents.

1.0 Asia

1.1 Pacific Islands: Heaven's water harvested from trees

Asia has a special tradition and culture when it comes to rainwater. On Jeju-Island south of Korea and on Miyake, a volcano island in the Pacific about 200 km south of Tokyo, rainwater is harvested from trees. For this purpose, many strings with interwoven ends hang down from trees. Water trickles over this meshwork into a gutter which is directed into a cistern or a jar.

The indigenous people of Miyake use the tap water of the newly installed centralised drinking water supply system only to conserve their cistern reserves. With the hygienically clean municipal tap water which smells strongly of chlorine, they only flush their WC, irrigate their garden or use it for the washing machine.

1.2 Japan: Disaster provisions

Japan is one of the developed countries in Asia who fostered from the very beginning an intensive international exchange in the field of rainwater utilisation. The activities of the administration of Sumida-City are internationally well known and recognised since the first rainwater utilisation conference in Japan in 1994. At the World Congress "Global Cities 21" in 2000 in Dessau, it received a distinction for its activities.

In the Rainwater Museum of Sumida, national and international projects are presented and products exhibited which come partly from Germany. In the past few years, the number of urban buildings in Tokyo utilising rainwater has increased considerably from 3 plants in 1970 to about 1000 in 2003. The city advises and

supports residents and firms in the planning and installation of rainwater plants. Newly constructed public facilities must collect and use rainwater. Other Japanese cities are following in their steps.

Besides rainwater utilisation in the building services engineering, a focal point in Japan is disaster provisions in earthquake events (6). Topics like “Treatment to drinking water” and “Water storage for fire-fighting” are thus strongly promoted. Some fbr member firms are already represented in Japan with their products.

1.3 South Korea: Floods and drought

South Korea is rated by the UNO as a country with water shortage. Measures which conserve drinking water resources are especially important. Flood protection in this country also enjoys the same priority. Strong precipitations within very short time periods always result in heavy floods. Public institutions and universities are developing suitable measures. In addition, rainwater utilisation in buildings plays an important role as part of the rainwater retention measures.

Currently a government programme is being developed which will accommodate in future construction projects the installation of retention reservoirs. Due to the uneven distribution of rainfall with long dry periods, water recycling measures such as greywater recycling, are becoming a part of a sustainable water management (4). The current low water price and flat rates which do not follow the polluter-pays-principle, are still a hindrance for an effective implementation.

1.4 China: Environmental education and Olympic Games

Prevailing water scarcity dominate in the high density area of Peking as well as in other parts of North and West China. Groundwater recharge, efficient drinking water supply and economical use of water are very important issues in these regions. During the past 10 years, the groundwater table sank 10 meters and at some areas even 20 meters. Currently, priority is given to decentralised rainwater management systems and multiple use of non-faecal wastewaters from residential areas. Exemplary results have been already presented in the scope of an EU project in Peking (10) (11).

Precisely Peking needs at the present time compensatory measures since in connection with the construction works for the Olympic Games 2008, new sports and residential areas with the corresponding infrastructure are emerging at a very high speed.

1.5 India: Low cost

Traditionally, rainwater has been the basic provision of the population in India before the colonial power England supplied the country with a centralised drinking water supply system. In the meantime, local community initiatives grasp back on the well

established decentralised concepts. The Centre for Science and Environment (CSE), an independent organisation, which supports and promotes rainwater utilisation in India through several measures, offers courses continuously in the different regions of India. The adapted technology for community self-responsibility, means on implementation and operation instructions are documented in the Book “Making Water Everybody’s Business” (12). The CSE received for its engagement the internationally renowned Stockholm Water Prize 2005.

Rainwater distribution varies from 100 mm in the Northwest deserts to 15,000 mm in the mountains of the Northeast. Rainwater harvesting supports agriculture in India since a long time. In addition to that, there is a demand for novel methods for decentralised water supply systems in urban areas. Large investments in residential construction programmes for the coming years in Mumbai (Bombay) are an answer to the continuing migration into the cities. Due to the strong population growth, urbanisation as well as increasing commercial activities, India has been ranked by the Food and Agriculture Organisation of the United Nations (FAO) as one of six countries with a significant future water shortage. Today, comprehensive government programmes are promoting a water-saving building services engineering.

2.0 Australia: Commitment to rainwater utilisation

In Australia, a considerable expansion in the service water and rainwater utilisation is anticipated for the next years. In Sydney, private households consume about 70 % of the total drinking water requirement. The government of New South Wales began action by enacting ordinances and propagating massive water-saving campaigns in order to reduce the water consumption. A part of these measures is the Building Sustainability Index, BASIX, a programme which incorporates rainwater utilisation among other issues. Since October 1, 2005 all new buildings have to be constructed according to the BASIX-Standard. This implies that rainwater utilisation plants are becoming a must.

Rainwater has been used since long as a drinking water resource in Southern Australia. Likewise, it is common to use rainwater in the “hot water systems” (building services systems for hot water processing) for the personal hygiene. Long-term, scientific investigations on the impact of rainwater used as drinking water are available in Australia since 2001. The risk for intestinal diseases has been rated as very low (5).

Water suppliers and public health authorities in Australia promote water-saving measures such as rainwater and greywater utilisation on a wide basis. This will considerably enhance the development of service water and rainwater technology. A special case was the application of rainwater technology in WC of the Olympic Village in Sydney in 2000, in which the athletes lodged (6). A spectacle in itself was the action of the Australian Airlines Quantas who filled bottles with rainwater from Tasmania and distributed them as a delicacy among its passengers.

3.0 America

3.1 Brazil: One million cisterns

Problems are featured on the one hand by the dry Northeast and on the other hand by megacities like Sao Paulo on the coastline, which is repeatedly afflicted with typhoons with high precipitation (15). Due to climate changes, the clouds rain down over the big cities, such that the drinking water reservoirs in the highlands remain empty. Governmental agencies have reacted and imposed the construction of rainwater reservoirs for roof surfaces above 500 m^2. Due to the threatening water shortage also as a result of the high water consumption in the cities, rainwater utilisation is becoming more popular.

In the North of the country, the government launched a one-million cistern programme. With this, a basic water supply should be established for a wide population group.

3.2 The Caribbean: Tax reduction for cistern construction

On Haiti, where only a small part of the population have access to the public drinking water supply, the whole water requirement is traditionally covered by rainwater cisterns. Freshwater reserves are not available on the island. In the capital Port-au-Prince where most of the population live, water from tank lorries can be also bought to fill the cistern. However, the costs for this water exceed the contingency of the family budget. Also in Bermuda, Antigua and Anguilla it is self-evident to use rainwater from cisterns for drinking purposes.

On Barbados, there exists an obligation in new buildings to set up appropriate cisterns dependent on the area of the building. The costs can be set off against tax liability (6).

3.3 North America: Critical roof material

Increasing interest in rainwater utilisation can be also identified in the USA and Canada. Storage technology is so far available, however, other remaining components do not conform with the German standards and are still in the initial stages of development (3). Lacking environmental awareness and across-the-board billing methods during consumption measurement in buildings are the causes for about three to four-fold higher water consumption than in Germany. Other reasons are partly the lower construction standards in the house services and sanitary engineering.

The high requirements of the currently much demanded LEED-Certificate for buildings may find a remedy on the long term. Special engagement in rainwater management is known from the US States of Maine, California, Oregon and Washington. Rainwater

utilisation for irrigation is popular in Texas. The American Rainwater Catchment Systems association ARCSA is based there as well as a commercial filling station for rainwater for use as drinking water. The bottle labels have been humorously designated with “fresh squeezed cloud juice”. The source of origin is the Dripping Springs.

In Canada, the wood shingle roofs which are being treated with fire resistant materials in compliance with guidelines of the insurance companies, influence the quality of the draining rainwater. The same influence from fungicides can be seen in asphalt shingle roofs (3). Under the aspect of environmental protection and improvement of the water quality for rainwater utilisation, a rethinking is urgently required. In the coastal regions of the Atlantic and the Pacific, rainwater is often utilised as a drinking water substitute although these roof materials are widely spread.

4.0 Africa: Help for self-help

Rainwater utilisation is an option for a decentralised water supply or a supplement to the existing water infrastructure. A product transfer, for example from Germany, is actually only in cities of the north coastal regions with partly available water infrastructure, possible. This is presently being investigated within the scope of the Zer0-M EU-project for Egypt, Tunisia and Morocco (7) with fbr participation.

In the Harambee culture in Kenya, women are responsible for the community infrastructure. They construct cisterns above the ground made from local concrete with the help of church organisations from Germany (6) and with governmental aid from New Zealand (9).

5.0 Europe

Due to the extensive market development and about 80,000 plants produced yearly, Germany is as before the leading country in Europe playing a significant role in the development of service and rainwater utilisation. Developments in the field are also found in Austria, Switzerland, Belgium and Denmark. The popularity of rainwater utilisation depends on the water price. The higher the price, the better is the amortisation of the plant. Denmark (1.84 Euro/m^3) and Germany (1.73 Euro/m^3) have the highest costs and according to the National Consulting Group NUS, are world leading.

Further markets are developing slowly in France, Great Britain (foundation of the Rainwater Harvesting Association UKRHA, 2004), East Europe and North Italy.

5.1 France: Powerful water suppliers

The official attitude in France is determined by the water suppliers, who for reasons of economical self-interest similar to Germany, look with criticism at rainwater utilisation. However, there exist regions in France (south of France, Grenoble area, Elsass,

North of France), which struggle against low precipitation and a sinking groundwater table (7). The government reacts in form of decreed restrictions such as prohibition of car wash during midsummer (Périgord, 2005) and prohibition of irrigation in appurtenant structures (Grenoble, 2005). Interest in rainwater utilisation is present among the local authorities, planners and architects. However, the state of knowledge and recognition for rainwater utilisation is very low at the present time. Exemplary is ARENE, the Energy and Environmental Agency in Paris and the surroundings, which has defined the building standard HQE. It stands for ecological building quality. The proper dealing with water is thereby one of their central themes (14).

5.2 East Europe: Awakening (dawning, arousing) interest

The East European neighbours, the Czech Republic, Slovakia, Poland and Hungary in the first place are forced to raise the technical and environmental standards to the EU level. The interest in rainwater utilisation is constantly increasing. Some commercial and public large projects have been already realised. Because of the low water price and low income of private households, the investments in own homes is still restrained. Wage differentials and governmental subsidies lead to the foundation of production facilities and branch offices of German rainwater firms in these countries.

5.3 South Europe: Little initiative

The development of a rainwater market in South European countries such as Greece, Italy, Spain and Portugal which are partly afflicted with massive dry periods, is still currently at very low level and is influenced by region.

5.4 Germany: World-wide impulse

Through the International Rainwater Conference 2001 in Mannheim, the fbr contacts have considerably widened. Over 400 participants from 68 countries met for the first time in Germany in order to amply discuss the role of rainwater utilisation in settlements and urban developments.

From press releases it can be realised that Germany, like other developed countries, can hardly maintain the widely-spread conventional system of combined/gravity sewer in the long run. In a current state-wide study, the German Association for Water, Wastewater and Solid Wastes (DWA) estimated the costs for the rehabilitation of the sewer system at about 50 to 55 Milliard Euro (2). The Frauenhofer Institute ISI in Karlsruhe prognosed that in a few decades, the drinking water quality cannot be anymore guaranteed with the conventional structures of the water supply systems. Assistance can be brought about by shifting the drinking water “production” to the consumer. Raw water which then flows in public supply networks will consist largely of rainwater similar to the pilot project Knittlingen (13).

It is quite clear that service water and rainwater utilisation have won internationally on significance. Germany is leading in this field and gives impulse for technical standards, public relations, advanced training and system dissemination. fbr firm members are increasingly exporting their products with much success. In order to accommodate this fact, the fbr takes over in 2006 the European office of the International Rainwater Catchment Systems Association, IRCSA.

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