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Better Buildings

Enhanced water-, energy-, and waste-management in Arab urban ecosystems - globally applicable

Henning Schwarze, Marc Breulmann, Mark Sutcliffe, Benno Böer, Nesreen Al-Hashimi, Kamal Batanouny, Joachim Böcker, Peter Bridgewater, Gary Brown, Abdallah Bubtana, Shaukat Chaudhary, Dawud Al Eisawi, Gottfried Faulstich, Ron Loughland, Najat Moh'd Es'haqi, Peter Neuschäfer, Maximiliane Richtzenhain, Katrin Scholz-Barth, Florian Techel

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UNESCO Office in Doha
66, Lusail Street - West Bay
P.O. Box: 3945 - Doha (Qatar)
Tel.: + 974 411 32 90
Fax: + 974 411 30 15

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Foreword

The Arab States are located in a hyper-arid zone which is rapidly developing and face mounting environmental issues. An increasing human population, large per capita water demand, and a natural lack of freshwater has caused a water crisis. The countries in the region now depend on seawater desalinisation, as well as on the exploitation of fossil groundwater resources. Only a few rivers exist in the region, and only a few areas receive sufficient precipitation.

Several Arab countries are dependant on oil and gas production. Fossil fuel is a finite and costly resource, and it is now that awareness and technological concepts on renewable energy have to be developed, in order to get prepared for times of limited or overly expensive fossil fuel. The increased utilization of renewable energy will also contribute to lesser carbon dioxide emissions, and less air pollution.

Waste management systems are a major problem for communities worldwide. Current waste management systems often cause the pollution of air, soils, water, and biota, and contribute to resource consumption. It is very important to improve waste management systems, in order to improve the communities' cleanliness, and environmental health, but also to use resources more wisely.

The above mentioned elements are all applicable for buildings, cities, villages and vehicles, or in general, for urban ecosystems, the human habitats. It is via a regional training and demonstration workshop that UNESCO, together with the Friends of the Environment Centre, have brought together international and Arab experts, in November 2007 in Doha, Qatar, in order to exchange innovative technology information, and experiences. The activity was also supported by UNEP and UNIC. We have decided to follow-up by producing a proposal on *Better Buildings* as a contribution that aims to encourage the member states, and their people, to improve buildings in view of energy, freshwater, and waste management. The proposal provides a number of aspects on how this can be achieved, for example, via awareness, education, and the development and application of good science & technology-based concepts. Developers and inhabitants of buildings and residents of buildings can do much to improve human habitats by applying environmentally friendly concepts and behaviour in water-, energy-, and waste-management. We sincerely thank the authors of this proposal for their highly professional presentations and for putting together this valuable document. It is our intention to use this proposal to try and trigger the next necessary step, the establishment of model-buildings, that demonstrate the existing technologies and to inspire land-developers and stakeholders in the construction industry, as well as the policy-makers, to understand the necessity of enhancing our environment and to make significant contributions towards better human habitats by constructing *Better Buildings*.

Hamed Al-Hammami
UNESCO Regional Representative in the Arab States of the Gulf, and Director of the Doha Office

Saif Al-Hajari
Vice Chairman of Qatar Foundation, and Chairman of the Friends of the Environment Centre

Habib El-Habr
Director and Regional Representative of the UNEP Regional Office for West Asia

Preface

The UNESCO Arab Region stretches over a distance of almost 8,000 km from the west to the east, has a human resident population of more than 300 million people, consists of member states with a broad range of per capita income, sharing totally different statistical profiles and constraints in view of water and energy supply and consumption, as well as waste production.

Most of the countries in the region are geographically situated in the northern desert belt which is a hyper-arid region with evaporation rates well in excess of the very low amounts of precipitation due to the natural climatic regime. In addition, most of the countries have a few seasonal or no meaningful surface waters, rivers, or lakes. This situation makes the cities vulnerable in view of water supply, and most of them are now dependant on groundwater exploitation, as well as seawater desalinization. The Arab States in the Gulf are especially vulnerable, with most groundwater aquifers being over-utilised and many cities are now completely dependent on desalinated seawater, even those which are located far away from the coast. According to a Gulf Times article from 30th of August 2009, Yemen faces severe water shortages with less than 100 m3 of water being available per capita per year. Good water management practices in buildings can undoubtedly play a significant role to enhance the existing situation, such as water education to avoid water-wastage, and apply technology for recycling water and rainwater-harvest in cities.

In view of energy supply, the situation is also highly diverse: some of the countries are among the most important global fossil fuel exporters, whereas others depend on fuel import. The Arab States of the Gulf have also developed very high per capita energy consumption rates, yet most of the countries do not yet participate in the production of renewable energy, even though they have a huge potential for solar and wind energy. Abu Dhabi, with the establishment of Masdar is trend-setting, and has obviously realised the importance of changing the mental model from oil & gas exporter to energy exporter. A highly ambitious renewable-energy project “Desertec” is currently being discussed for the establishment in the Maghreb (http://en.wikipedia.org/wiki/Desertec).

The situation regarding waste product management is again highly different from country to country, based on consumer behaviour and per capita waste production. However, none of the communities has good overall waste-management practices in place: land-fills are continuously growing, with all the associated groundwater and air-pollution, and waste intrusion into natural habitats. Avoiding waste, waste recycling, and participation in the Arab Recycling Initiative, Eco-Schools, and other activities can make a difference.

During the UNESCO Science Retreat in June 2009 in Paris, the general importance of urban ecosystem management and the increasingly important role UNESCO has to play in this field of its mandate, with a special view to water, energy, and waste-management was highlighted. It was clear that scientific research into urban ecosystems and the development of good management practices with a view to water, energy and waste was indeed a global issue.

Our human habitats, man-made urban ecosystems, the places where we live, need more attention from all levels of society, and they can be drastically improved. Considering the available traditional and innovative science-and engineering-based knowledge, and the time we live in, we should very much focus on and apply existing knowledge and good practices, and start systematically improving human urban ecosystems in the best interest of all of us, and our Member States.

Interesting enough, these issues were discussed with UNESCO Programme Specialists serving all UNESCO regions. We can say this issue, which is clearly in UNESCO's mandate, is of global concern. Some regions often have no electricity available, no tap-water being supplied, while water and fuel-wood has to be carried over long distances. Waste is often simply dumped into the neighbourhood, or into the nearest river, causing pollution and serious health problems.

Based on the women in the Arab States of the Gulf who requested UNESCO during an event in 2006 "Women and Water: the women's contribution to water management in the Arab States of the Gulf" to work towards more environmentally friendly buildings, UNESCO Doha Office started seriously focusing on these important urban ecosystem issues, and this was supported by UNESCO's divisions on Basic and Engineering Sciences, as well as Ecological and Earth Sciences. Based on the women's request UNESCO initiated a workshop and produced a proposal on "Better Buildings: towards enhanced water, energy, and waste-management practices in Arab urban ecosystems". This is currently leading to the development of practical applications towards model buildings, and with a special consideration of schools.

Contrast of human living: Modern tower in Bahrain (top), residential house in Croatia (middle) and traditional housing in Ethiopia (bottom). (by B. Böer)

Although the existing ASP school network will be a part of it, we encourage all schools to voluntarily apply better practices on their premises. It is here, where students, parents, teachers, and the board of directors come together and work jointly on this highly important issue. A Doha Green Conference addressing these issues was held in December 2009 in Doha, Qatar, and being jointly organised by UNESCO and the Friends of the Environment Centre, which is one of our important partners on this issue.

Interesting enough, while the first draft of this statement is being written, in September 2009, the world energy crisis, the world water crisis, and the world waste-disposal crises are in their full existence. The cost of a barrel of crude oil exceeded $140 per barrel not so long ago. It is also well established that the existing and economically exploitable fossil fuel reserves have exceeded half of their capacity, and the second half is expected to be depleted much faster than the first. Meanwhile, several major cities in the world were recently unable to properly dispose of their waste. Potable water on the other hand, a life-essential factor, is spread around the world unevenly, with some parts having more than they can handle while others too little. This is a huge problem for people, and generally

the lower the income, the greater the impact on their daily livelihood. The availability of low-cost environmentally friendly housing needs to be promoted globally, in the best interest of the people, as well as to keep the environment healthy, and to avoid wasting precious natural resources.

In the ancient past human beings in their natural environments adapted well to their environmental conditions. In modern times, with a much larger global population this no longer seems to be the case. You can look wherever you want: inadequate waste management, high fuel prices, shortage of water and electricity seem to be omnipresent.

At the same time, there are a lot of ideas, knowledge, and economically feasible innovations available, and once applied, they can generate noticeable benefits for contemporary water, energy, and waste-management related issues.

What we are trying to do here is to deliver a wake-up call: we have got to identify science and engineering based knowledge, generate awareness, and persuade people to apply what is best for them in the long run.

With solar cells on the roof, we will not suffer electricity shortages. With storage tanks, and rain-water collection and filtration from the roof, we will have more water available. With good sewage and waste-disposal practices, many communal problems and human health issues will be minimised. With this statement and this expert-based proposal we hope to promote a new era of focus for the UNESCO Science-Sector, causing short and long-term impact, based on science and education, and with measurable and visible impact and results. We do hope particularly to contribute with this document, and related activities to trigger the development of low-cost environmentally friendly human habitats supported by the ecological and basic sciences, and education.

Benno Böer
Ecological Sciences Advisor
UNESCO Arab Region

Mark Sutcliffe
Natural Science Project Officer
UNESCO Doha Office

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1. Background and introduction

By Benno Böer, Maximiliane Richtzenhain, Henning Schwarze & Marc Breulmann

At the beginning of the 21st century almost 3 billion people or approximately half of the world's human population lived in urban areas. It is predicted that this figure will rise to 5 billion within the next 25 years under current population trends. The Arab States of the Gulf are currently undergoing a period of previously unknown growth and rapid development. Cities are expanding at high speed, and many coastal and marine areas are being developed for human habitation. In the Arab States the per capita consumption of freshwater and energy, as well as the production of waste are high in comparison to other countries in the world.

Taking this enormous growth together with the inadequacy of water-, energy-, and waste-management in urban ecosystems into consideration, it can be assumed that the situation will deteriorate rather than improve. These enormous changes will occur not only in developed countries, it will affect all urban populations.

UNESCO Doha Office, in partnership with the Friends of the Environment Centre (Qatar) organised a regional workshop "*Better Buildings: Enhanced water-, energy-, and waste-management in Arab urban ecosystems*", in order to bring together existing expertise and raise awareness on technological innovations. The workshop took place from 28-29th of November 2007, in Doha, Qatar, and was intellectually and technically supported by the Regional Office in Western Asia of the United Nations Environment Programme (UNEP/ROWA, Bahrain), and the United Nations Information Centre (UNIC, Bahrain). International and regional experts participated, and presented innovative, traditional, and alternative techniques centred on the subject of environmentally friendly buildings. Several constructive presentations were given based on renewable energy, enhanced water- and waste-water

Picture: Wind power converter (by H. Schwarze)

management, environmentally friendly building construction, and sustainable human living. The reason for this workshop was the alarming inadequacy of the current water-, energy-, and waste-management practices in the Arab States. In addition, existing technologies to improve the situation were presented and demonstrated. One of the highlights was a hydrogen-powered glass car, which was connected to a solar-cell, and demonstrated by Ulrich Narup.

High consumption rates of water and energy are based on the climatic situation in the Arabian Peninsula and the lack of interest and awareness of environmental issues. Large amounts of water are being used in particular by the construction industry, but also in agriculture and the irrigation of green areas. Moreover, large quantities of freshwater are being lost because of leakages in the water-supply pipes. Most freshwater-supply comes from desalinization plants, which are in turn high energy consumers, and polluters.

High energy consuming air conditioners, as well as a lack of thermal insulation in buildings together with low energy prices have lead to high per capita energy consumption rates.

The per capita waste production is also high, and waste disposal sites are spreading causing the chemical pollution of water, soil, air, and biota.

The workshop discussed possibilities on how to reduce the above mentioned inadequacies. Methods on environmentally improved design of buildings, and better human behaviour and education were discussed. The workshop offered four main themes:

1. **water**
2. **energy**
3. **waste**
4. **architecture**

This proposal now considers the presentations form of the workshop, and aims to convince the stakeholders that already a lot of feasible technologies exist, and much of them are not being utilised. However, in the year 2009, the Gulf can look back at some tremendous achievements in the overall field of environmental development. The environmental awareness level has risen dramatically, thanks to Governmental initiatives, as well as thanks to significant efforts of individuals, NGOs, and legal and voluntary contributions of the private sector. The awareness level is high, and people want the current environmental situation in the Gulf to be improved.

As an example, the UNESCO Doha Office receives phone calls and e-mail messages frequently, because people, such as individuals, school teachers and university professors inquire about how they can contribute to better resources recycling.

„It is now time to establish a series of environmentally friendly model houses in the Gulf", functioning as demonstration sites for existing environmentally friendly technologies. People visiting these buildings will be surprised and positively impressed on how good architecture can reduce energy wastage, how effective water management systems can reduce the water consumption rates, how intelligent garden designs can reduce the amount of irrigation water, how recycling systems can contribute reducing the production of waste, and how education can support this by improving the prestige of environmentally friendly behaviour of adults and children. These models aim to function as mini-museums, and they will be updated frequently with the latest innovations. The visitors are school classes and university students, the general public, and especially home owners, owners of buildings, and members of the construction industry. Our objective is that via the workshop, and the production of the proposal, we will be able to raise sufficient funds so as to allow us to build model buildings in the Gulf, showing the way to the future. This will be an important contribution towards inspiring people to make essential contributions towards sustainable human living by building Better Buildings.

In the past twenty years, local and non-local residents in the Gulf have become significantly more environmentally aware. This is evident by the increasing numbers of non-governmental environmental clubs in the region, the large numbers of people getting involved in clean-up campaigns, recycling initiatives, the media time dedicating itself to the environment, the rapid development of relevant environmental private and public posts in monitoring, representation, and public education, as well as the upsurge of interest within the construction community about environmentally friendly buildings. These 'Green' buildings, we believe, will offer plenty of room for future employment and entrepreneurships for locals and non-locals alike, while establishing sustainable practices early. The experiences of other countries restructuring their economies towards sustainability show that it is a much more painful process to accomplish retroactively, rather than during the initial planning and construction phases. Qatar has the potential to become a shining example of sustainable practices into the future, while combating issues relevant to Qatar today.

2. The vision of the Friends of the Environment Centre (FEC) on how to improve Qatar in view of urban ecosystem management

By Nessreen Al-Hashimi

Qatar, like other countries in the region, is experiencing rapid development due to the economic boom which started at the beginning of the millennium. This has led to enormous development projects focused on the country's infrastructure, which, in turn, requires the construction of residential housing in order to accommodate a growing population. Qatar, like many developing countries, lacks the regulations that can guarantee the well-being of people and safeguarding the environment. Hence there is an urgent need in Qatar to adopt a standardized international code for construction which can help control the effects of bad practices.

> "All male and female citizens have the right to decent, safe and healthy housing"[1]

Therefore it is our top priority to bring the issue of environmentally friendly constructions to the forefront and top of the agenda of the decision makers. There is an urgent need to produce the necessary rules & regulations that will control the architecture of the buildings and the practices applied in the enormous construction activities.

FEC realizes that the 1) materials used & the structural design of the buildings together with 2) the typical activities (habits) of the residents within the buildings could have the largest influence on the environment (negative or positive) depending on the applied practices. As a result the FEC has concentrated on these two fronts by raising the level of awareness amongst the public (owners & users) and businesses (Architects, contractors, engineers & legislators) through organizing a series of conferences and workshops:

1. **First Environmental Architectural Forum (15. -19. May 2005)**
2. **Better Buildings (28. -29. November 2007)**
3. **Second Environmental Architectural Forum (1. - 3. March 2008)**

The main goal was to bring key people in the region & international experts from the field together to express their problems and concerns, as well as exchange experiences in order to formulate a better understanding of the current situation while exploring future possibilities. For this purpose the topics at these events were selected in order to reach all stakeholders by showing the best available practices in the field. These meetings were, however, only an introduction to a bigger event.

FEC have taken the initiative to address this important issue in a bigger context through a proposal to the government of Qatar for organizing Qatar Global Conference on Healthy Housing.

Qatar Global Conference on Healthy Housing

FEC believes that healthy housing is a prerequisite for optimal well-being. For every person to function and fulfil their possibilities, access to healthy housing is a must. „Healthy housing is a prerequisite for sustainable development", and is an inherent quality of developments aiming to safeguard the environment

There is considerable evidence that housing conditions do affect health status. Research shows that millions of people are affected negatively by poor and inadequate housing, which is

affecting their performance and hindering their possibilities to live a full life.

Nevertheless, as the United Nations World Health Organisation states: "We are still left with the question, "what is healthy housing?" What is evident is that healthy housing is an integral part of quality of life and will allow humanity to realise its full potential.

The Qatar Declaration on Healthy Housing

The "Qatar Global Conference on Healthy Housing" planned to take place in 2010 will be jointly organised by FEC as well as NHA (National Health Agency).

The government of Qatar may help develop global standards on healthy housing and healthy housing

Picture: Construction site in Doha, Qatar (by H. Schwarze)

policies by organising a global conference on this theme in 2010. This should eventually yield an international code.

The primary outcome of the "Qatar Global Conference on Healthy Housing" should be a basic document called "The Qatar Declaration on Healthy Housing and Healthy Housing Policies". This Declaration should be used as a basis for developing a global standard for healthy housing, and the participants at the conference should request the appropriate unit within the United Nations to further develop such a declaration into a Global Standard of Healthy Housing and Healthy Housing Policies. This could possibly be done with the support of UNESCO, WHO, UN-Habitat, as well as UNEP and UNIC.

With high-level participation, the Qatar Conference may build global political momentum and further develop those elements relevant to healthy housing that were discussed in the Fourth Ministerial Conference on Environment and Health in Europe, organised by the UN World Health Organisation, European Chapter, held in Budapest, Hungary, 23–25 June 2004.

The initiatives taken so far to develop global standards for healthy housing by local and national politicians and researchers as well as the UN have not yet reached their final state of fruition. Another conference is needed to take the existing initiatives from their present state of being into a system of global standards. The Qatar Global Conference on "Healthy Housing and Healthy Housing Policies" in 2010 aims at that role.

The world leaders who met at the United Nations Headquarters in New York from 14th to 16th of September 2005 during the World Summit on the Millennium Development Goals agreed to take actions on a wide range of global challenges. Among these were strong and unambiguous commitments by all governments, in donor and developing nations alike, to achieve the Millennium Development Goals by 2015.

Safeguarding the environment, securing sustainable development and providing for the well being of all are goals that are entrenched in these commitments. Developing a global standard for healthy housing and healthy housing policies will be one important and lasting contribution to fulfilling these goals found within the Millennium Development Goals. The "Qatar Global Conference on Healthy Housing" will be a tool for operationalising this contribution to the Millennium Development Goals.

[1]Article 14, § 1 from "Charter of Human Rights in the Cities".

3. Improve freshwater management in gardens and green areas in the Arabian Peninsula

By Benno Böer, Dawud Al-Eisawi, Kamal Batanouny, Gary Brown & Shaukat Chaudhary

Statement of the authors

We are trying to provide the reader with some simple guidance on how gardens and green areas in the Arabian Peninsula can be improved by applying a few suggestions based on our combined botanic field experience which exceeds 200 years. While we believe that gardens and green spaces are highly important for people for a number of obvious reasons, we are concerned that the available amount of water can be used more wisely. We also know that the capacity offered by the biodiversity of the Arabian flora is totally under-utilised. With our suggestions everybody who has or owns a garden, who manages landscaping or gardening services, can make a reasonable contribution to save precious freshwater, and contribute to real biodiversity conservation. This is not a scientific paper – „this is our expert-based call to apply a few logical thoughts:"

1. **Prefer Arab plants**
2. **Decrease irrigation space**
3. **Use waste-water, and rain-water.**

Past

The Arabian Peninsula is one of the most hostile places on Earth for natural plant life, because of the extremely poor soils, high evaporation rates, limited precipitation, as well as very high surface and air temperatures in summer. This is the reason why, traditionally, there was only a limited number of gardens, and most of them rather small. Gardens were exclusively found in areas where there was a relative abundance of irrigation water, such as in desert oasis with shallow groundwater, or in the mountains, supplied with water by man-made falaj systems. However, gardens always played an important role in the Arabian Peninsula cultures, especially because they provided a beautiful and soothing green ambience, shade, they improved the micro-climatic conditions, they contributed to clean air by filtering dust particles, and, of course, they provided a variety of economically useful plants. Flagship species, to name a few, were certainly the date palm, fig trees, grape vine, pomegranates, a variety of citrus, and mango.

Present

Water

Since the discovery of oil and availability of modern technology, fossil water from deep aquifers was pumped, and large amounts of freshwater were produced in desalinization plants, and brought into the cities, villages and remote areas by water tankers, and pipelines. Subsequently, the Gulf is now the densest desal-plant area in the world, and with all the negative

Picture: Traditional garden in Qatar (by H. Schwarze)

side-effects, such as air-pollution, as well the pollution of the marine environment (salinity, thermal, and chemical). Many extremely beautiful gardens were developed with highly pleasant results in terms of garden design, and urban beautification. At the same time vast amounts

of treated waste water, sometimes treated at the tertiary level have become available some times in the form of virtual small streams or even as vast and sometimes deep lakes in quarry areas. Often this water is used for irrigation of crops and even vegetables.

In the eastern part of the Arabian Peninsula, traditionally the agriculture has been carried out using fairly saline water gushing out of artesian wells while water is also being stored in or under the sand masses which is available to the adapted plants under the vapour pump mechanism as condensate at night.

Gardens

The possibilities, difficulties, and challenges of Gardening in the Middle East has been documented by Eric Moore (1986), and Gardening in the Gulf was presented by Elizabeth Maley & Shirley Kay (1990). These books, and other volumes, describe beautifully how gardens can be designed, and what type of gardens have been designed, and they also provide information on soil amelioration, the selection of species, irrigation methods and requirements, and they also pointed out at the enormous difficulty of salt accumulation in gardening, and garden maintenance.

Natives and exotics

Local plants are adapted to the local conditions and most of them will require less irrigation, less expensive top-soiling, less fertilizer, and less pesticides when compared with exotics. They are therefore more environmentally friendly. However, where ever we travel, we find gardens, and most of them are full of exotic plant species, and devoid of native plants. Why is that ? We believe that one major reason for this phenomenon is the lack of knowledge.

In the time when the first gardens were established on a larger scale, when the cities of the Arab States in the Gulf began to grow, the landscape architects and garden designers had almost no information available on the wide diversity of beautiful and suitable indigenous plants. Furthermore, it is still very hard to find them in garden centres. The lack of knowledge, however, has changed in the 1980s and 90s thanks to a number of scientific and amateur publications dealing with the plant life of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, and Yemen. Specialists that have produced scientific botanic documents came together when the Arabian Plant Specialist Group was formed in 1996 in Riyadh, supported by the National Commission for Wildlife Conservation and Development, and IUCN.

One of the most important message from this meeting was that indigenous species need to be more conserved and researched. Good gardening can play a significant role in this important aspect.

However, by no means does this mean that we intend to exclude exotics: some highly useful species have been introduced into landscaping, and we would like to mention in particular the ground-cover varieties of *Sesuvium portulacastrum* and *Batis maritima*, as well as the back mangrove *Conocarpus*. *Sesuvium* has in many areas replaced freshwater demanding Bermuda grass (*Cynodon dactylon*) as green groundcover, and certainly needs much less freshwater. Provided it is being planted in closed systems, with a permanent irrigation and drainage systems, avoiding leakage into the soils, it can even be irrigated with full strength seawater. This, of course requires carefully and professionally designed plastic or polyethylene container systems, avoiding salt accumulation.

It is now time for garden centres to stock up on indigenous plant species, and make them available for sale to be applied in Arab gardens and green areas. It is also time for the universities and environment agencies with a mandate in research to study and document the advantage of using indigenous biodiversity in gardening.

The local plants that can be used in gardens in the Arabian Peninsula can be put in the following categories:

Annual herbs with showy characteristics like *Rumex vesicaria* a very promising and beautiful plant with several shades of pink to deep red of the fruit.
Perennial herbs like *Horwoodia dicksoniae* (the Khuzzama).
Bulbous herbs like *Pancratium maximum*, *Pancratium tortuosum*, *Pancratium sickenbergii*
Succulent herbs like *Sesuvium sesuvioides*, *Suaeda vermiculata*, *Halopeplis perfoliata*
Succulent shrubs like *Suaeda monoica*, *Euphorbia* spp. *Aloe* spp. *Sansevieria* spp.,
Halophyte grasses like *Aeluropus lagopoides*
Aquatics like *Cyperus* spp., *Juncvus* spp., *Typha* spp., *Potamogeton* spp., *Ruppia maritima*, *Najas maritima*
Deep sand plants like *Cyperus eremicus*, *Cyperus macrorrhizus*, *Calligonum arabicum*, *Calligonum comosum*, *Tribulus arabicus*, *Scrophularia hypericifolia*, *Convolvulus bushiricus*, *Haloxylon persicum.*

Future

In the future gardening should consider the amount of irrigation water needed. The amount of irrigation water use can be reduced by carefully selecting those species with low evapo-transpiration rates. It can furthermore be reduced by reducing the space that is being planted, without loosing the green effect. One possibility is to apply climbers at the garden walls – this will also provide shade on the house-walls, and contribute to lesser energy requirements of air-conditioning. A second possibility is to design fringing gardens: only a narrow line of soil close to the perimeter wall of gardens is being used for the actual planting. Also the application of pots can generate beautiful green spots, and reduces the gardening space. A substantial amount of water that percolates into the soil can be saved this way. This increases the space of the garden that can be used for other purposes, such as sitting areas, BBQ, and children play areas etc..

Treated waste water

The treated waste water often treated to tertiary level, should not be allowed to go to waste. In countries like Australia for example, the treated waste water is supplied to new housing areas just like drinking water supply but in a separate piping system, separate from the normal water supply and is used for watering lawns and gardens, car wash, toilet flushing etc., of course with stringent measures to ensure that the pipes do not get mixed! Such a system would make immense quantities of water available for gardening and even truck crops.

Grey water

Every household produces daily a large amount of grey-water, which is the drain-water from the kitchen, and bathroom, that is not polluted with faeces.

Grey-water can be processed in the house, and made available for gardening as described in other parts of this proposal on Better Buildings.

Rain water

The cities in the Arabian Peninsula receive average annual precipitation between less than 50 mm/m^2, and, in the mountains, more than 150 mm/m^2. That is equivalent to 50-150 litres per square metre annually. Still, most modern houses do not make use of this. We have not seen any houses collecting rain water from the roof top (as it is done in many Mediterranean houses), and collect the water in tanks placed somewhere around the houses, or in the basement. A roof, 10 x 10 m in size can provide in an average year an amount of 5,000 to 15,000 litres of water. That is a lot of water, which could be stored in tanks and used for the irrigation of gardens.

Air condition water

Who lives in the Gulf knows: there is water dripping from the box air-conditioners – some shop owners collect this water indeed for irrigation of pot-plants. The UNESCO Office in Doha applies this. This should be encouraged and become common practise. Think about the millions of cars dripping condensed water in the process of air conditioning onto the roads. Why do we not collect this in inbuilt overflow-tanks, and use it at the end of the day ? Maybe because nobody thought about it…

4. Empowerment of water education for nurturing community participation on water conservation plan

By Najat Mohammad Es'haqi

Abstract

Water shortages and water scarcity have become a common problem around the world despite the increase in socio-economic development of every nation and its technical advancement. Many scenarios for different strategies have been recommended and many actions have been in use with various degrees of success in reducing the deterioration of water conditions, yet every day organizations and experts battle with the ongoing acute water situation. This study looks at Integrated Water management (IWM) from a different angle. The proposed IWM is a kind of integration which stems from within; it is the integration between community members themselves, and their behavior with a view to a culture of change. The management should always rise this question publicly „what if...?" to ring an alarm bell, to be able to set a vision and to plan the road map for having an effective water conservation strategy. Community water knowledge advancement must focus on developing students/youth to be a driving force and informed future decision makers. Only then can all the counter productive attitudes towards water be corrected, so that one can maintain a behavior and style of living which serves not only the needs of the community, but water conservation strategies as well.

Introduction

What if..? This an alarming question to assess the readiness of any nation to face any unexpected situation and to be able to fight back. The actual scary question is; „What if we had a severe shortage of water," or, "What if it ran out completely?"

Conferences, articles, media programs and researchers have been very actively discussing water-concerned topics. Scientists and researchers alike are looking at water problems from a top down prospective. Its as if we are looking at a pyramid from the top, with only the four corners and one middle mark, seen with no links nor integration between them. By looking at the pyramid from another angle, complete, rigid and connected corners are seen with a wide supportive base. Looking at water related issues and the people who are involved should be like the base of that pyramid, far from each other, yet integrated and linked together forming a solid bond as depicted in (Fig.1).

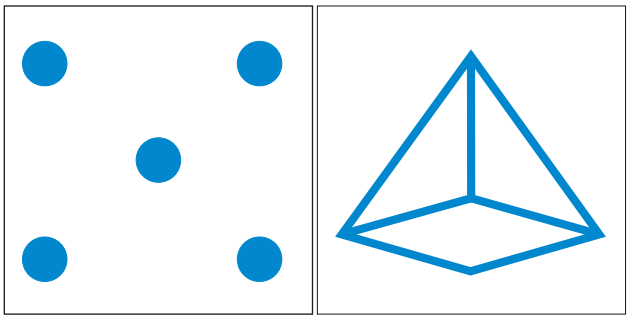


Fig. 1: pyramid's base corners representing solidarity and integration

There is not a perfect, generic and consistent water conservation plan to be followed as a model. Every nation has its values, cultures, believes and limitations that must be considered before suggesting any strategy...but all agree on;

„... Carving values in childhood are like carving on a rigid solid stone; they can't be wiped out ..."

Approaching the young generation during the early days of their education is the only hope of building a sustainable community by enforcing and developing in them all the necessary values

concerning water in order to achieve water sustainability. Building a culture is a very difficult task. A Persian wisdom states that;

„You must be very patient if you have decided to plant a walnut tree".

Having a clear vision to clarify the purpose of the recommended water conservation strategy through empowering water education paves the road to reach the set goals. Tools and the techniques used to achieve the mission and to suggest the indicators for evaluating the success of the plan must be selected carefully.

The first phase before recommending any strategy for water education empowerment is generating ideas to; 1) list and define the water concerned topics and issues, 2) collect the required data for assessing community water knowledge and awareness, 3) emphasis on the cultural, ethical and religious barriers against the success of any plan. This phase answers the questions:

1. What is the needed plan?
2. Why the plan is needed?
3. Who needs the plan?
4. Where the plan is needed?

The second phase commences after analyzing the outcomes collected from the first phase. In this phase; 1) recommend a suitable plan, 2) elaborate on the obstacles and opportunities on implementing the plan, 3) allocate a team, 4) assign responsibilities, 5) and setup a system for continuous evaluation with appropriate indicators. This phase answers the questions:

1. When the plan is needed?
2. How:
    - To implement the plan?
    - Flexible is the plan?
    - To evaluate the success of the plan?

Water Education needs

The need for non-conventional water resources such as building expensive desalination plants has increased due to population growth, fast economic development in the region and rising living standards, all have been putting great pressures on the available water resources. About 90% of the available water used for agriculture and livestock comes from groundwater with the rest coming from treated wastewater. Groundwater over extraction resulted in the deterioration of both its quality due to the intrusion of the saline sea water into the coastal aquifers and its quantity. Construction of Mega projects like the artificial islands needed huge areas granted from sea reclamation which affected negatively marine life, coral reef and mangroves. The questions to be raised here;

1. How much the decision makers understand the threat of having an unsustainable community with so much socio-economical development?
2. How much the community is aware of the actual acute water situation?
3. What are the levels of the available water education programs?
4. What are the available actions and programs to enhance the community's awareness?

An essential step in planning programmes is to diagnose the requirements, assess the capacity of the community, as well as identify the most suitable change strategy, considering the enabling environment (UNDP, 1997).

In recommending a suitable water education empowerment program, a simple assessment of community awareness regarding water related topics and evaluation of the strength of the current water education within the formal educational curriculums, to measure available water knowledge would be a good start.

Water knowledge management (WKM) requires a long process strategy rather than a simple one-off action. Knowledge generally nowadays is said to be the basic economical resource for development (Drucker, 1998). Members of the community must have enough knowledge (factual, physical, chemical, economical ....etc) about their water and its real situation; otherwise, any suggested strategy for reducing water demand cannot be expected to succeed (Mirvis & Clarks, 1998).

Water education should cover the hydrological cycle, resources assessment, monitoring, and management. The empowerment strategy for the water sector involves wide range of education levels, including pre-school, primary and secondary educational levels, vocational training, university and professional education at undergraduate and postgraduate levels, lifelong continuing education and training, as well as the informal and innovative ways of knowledge and information transfer (IHP, 1999).

Capacity building in the water sector has been matter of interest during last two decades (Alaerts *et al.* 1999; Alaerts *et al.* 1991; 2002; IHP, 1999; Biswas *et al.* 1996; Cunge and van der Beken, 2003; Galvis, 2001; Kolsky and Cotton, 1996).

There is a great deficiency in the educational systems in the region. The formal educational institutes are partially isolated from the community (GCC* educational report, 2002). The lack of integration between educational institutes and the community harmed greatly the improvement and the progression of the community, culturally.

Integrated Water management (IWM) coming from... within

Applying regulations, formulating strategies and providing incentives are all considered good approaches to control water wastage and reducing water demand. However, these plans also have proven their limitations in controlling abuses and in reducing water demand.

The IWM proposed here is a kind of integration which is coming from within; it is the integration between the community members themselves as individual within a group and changing their behavior and culture to create a responsible citizenry that can participate in a long term water demand reduction program.

The youth, as members of the coming generation, require recognition as a driving force in this process, since it is this youth who is going to take decisions and will be involved in forming a future sustainable community. They need to be properly prepared so that they may draw strength from their knowledge. The youth should feel that they are needed to be able to play an active role in making changes and to be ready to face the challenges of the future.

Schools need to introduce to students, from their early days in the formal educational system, all the relevant topics and issues of water, locally, regionally and worldwide. Educators should take note of the power of word-of-mouth to spread the knowledge among the close circle of relatives and friends, and its potential for gradually spreading within the society. Visual and practical activities such as on-site visits, stories, movies, games and conducting experiments can be used as learning tools to spread water knowledge, imbuing an ideology of cultural renewal and eventually achieving behavioral change.

Water should be dealt with exclusively on individual campaigns, organized and designed specially for dealing with all water topics for educating the community.

Water concepts need to be integrated into curriculums and into national educational institutes where children and youth are accessible and can be approached directly, to raise their awareness concerning water issues as well as focusing on their responsibilities for achieving water sustainability.

The author believes that water education empowerment in the national curriculums is critically required for creating the needed education for achieving sustainable development and that it must begin early, using all kinds of activities by involving governmental and nongovernmental organizations. Water education should not be viewed as something trivial. Water education is a very strong, unique, direct and effective tool to engage youth and future decision makers in transforming the society to a sustainable society. It also remains a safe tool for democratic cultural transformation.

5. Man-made wetlands and waste water potentialities in the Gulf

By Peter Bridgewater & Peter Neuschaefer

All Gulf Countries are characterized by fast growing economies fuelled by large and significant development projects, which leads to a fast growing population. In turn, these trends will cause a high demand on resources and energy. Actual and potential pollution of natural resources, additional of CO_2-Emissions, and an ever rising demand for fresh potable water will increase in the future.

Promoting sustainable buildings, by linking them to the environment, will be one way of managing this problem. In particular, the issue of water – its production, protection, purification and use, is important. Seawater desalination is not, in the longer term, sustainable without considerable improvement in recycling potential. Nor is dealing with water in large scale operations sustainable – in the 21st century the village (or quarter) scale will become the important management unit for most resources and energy.

How do we achieve such a vision?

As mentioned before, new developments increased the demand for freshwater and, concomitantly, lead to a considerable increase in production of waste water. The amount of waste water exceeds the demands of irrigation water. To avoid simply "wasting" water by returning it to the sea after initial bio-treatments, there is a need for effective utilization or storage. There are many engineering solutions to these issues, but all depend on high energy inputs. On the other hand, soft- or eco- engineering approaches hold many answers to these questions.

For example, wetlands are ecosystems with high biomass production. They also serve to ameliorate the climate, both locally and even globally. They are also indices for biodiversity, both in the ecosystem itself and as a transit for

Picture: Wastage of usable grey water (by H. Schwarze)

breeding or feeding points for other forms of biodiversity. Critically for the better buildings initiative, wetlands are able to store and treat water. Of course the Gulf environment, especially in the coastal plain, is not conducive to freshwater wetlands. Highly saline, or very ephemeral wetlands are the only natural features you can find. However, in the wadis inland, reed (*Phragmites*) and reed mace (*Typha*) are two wetland genera that have properties to play an important role in wetland creation. They are both able to absorb and accumulate excess nutrients in water (nitrogen, phosphate) and especially *Typha* can accumulate heavy metals and other elemental contaminants rapidly.

Given that in any urban system there is an excess of waste water over potable water, treating waste water so that it can be used for irrigation, or allowed to recharge groundwater aquifers, is a technique that can mix ecology with construction, and produce not only sustainable but also green cities. If wetlands are created to perform this service, there is the opportunity to provide complexity and resilience into the urban ecosystem. For example, wetlands "fed" by grey water could be created even in a residential house or apartment block. The water from the wetland treatment could then be used as irrigation for

other gardens – including the possibility of roof gardens. Since roof gardens perform an environmental cooling effect, as well as helping generally control pollution effects, this offers another better feature for buildings.

So, wetlands are significant for achieving the vision for better buildings because they:

- Promote CO_2 capture and storage;
- Enhance the surrounding climatic regimes;
- Maintain biodiversity;
- Help to recharge or create new opportunities for groundwater aquifers;
- Increase environmental complexity; and
- Increase general ecological and landscape resilience

It is the last two points which are significantly important – wetlands can introduce and maintain complexity to an area, and also provide resilience against dramatic swings and changes to systems. Setting buildings in a landscape where small scale wetlands can help in the water cycle, is the key point of this approach: not the creation of large treatment facilities, but rather neighborhood facilities which can respond immediately to local conditions and needs.

Promoting sustainable buildings through better water use and re-use, and by integrating wetlands with buildings will also help national governments achieve some of the Internationally agreed targets, especially the:

- UN Millennium Development Goals – especially Goal 7 on environmental sustainability on time and on target;
- Manage biodiversity effectively (helping achieve the World Summit on Sustainable development's target 2010 target of reducing rate of biodiversity loss).

Other country-wide benefits that will follow from wetland establishment and management as part of urban developments include:

- Establishing new ways to create energy (bio-energy)
- Establishing new sustainable farming practices
- Creating opportunities for eco- tourism
- Reducing CO_2 emissions
- Using polluted resources to actually improve environmental conditions;

But how can we achieve these outcomes? Given the natural paucity of wetlands in Gulf countries, the step that can be taken are:

1. Managing and extending existing wetlands (Mangroves, sabkhas, salt marshes, reed beds) and linking land based wetlands to coastal wetlands.

2. Creating artificial wetlands with treated (grey) waste water through converting existing sewage lagoons into wetlands and by creating artificial wetlands in small scales from surplus grey water.

3. Implementing wetlands and wetland features into urban and landscape planning (water features, green belt recreation areas) and harvesting wetland plants for forms of bio-fuel and eco-building materials – including creating "green roofs" to aid energy conservation and area amelioration.

Implementation of this suite of strategies will promote better buildings, more sustainable environments, and better human well-being through:

- Producing a better micro- , and meso-climate;
- Supporting development of green belt recreation areas;
- Creating additional leisure time resources;
- Enhancing educational spaces for teaching sustainability;
- Creating new jobs in the wetland-economy
- Saving on water production and storage;
- Creating ecotourism facilities;
- Improving farming potential;
- Increasing value of properties by improving environmental aesthetics;
- Producing bio-energy and eco-building materials from wetland plants.

„All technologies needed *are already available*." What is needed to be done is to connect them with *ecological knowledge at the local level* to ensure the right species are being incorporated in regeneration and planting schemes, and commitment from government and developers to this style of building development. However, it is true that artificial wetlands which have been created have largely been in more temperate climes (London Wetland Centre, Hong Kong Wetland Centre) and that expertise from companies and individuals used to operating in the Gulf country conditions will be needed to achieve success.

These developments have the potential to go beyond better buildings, and to ensure the buildings are set in landscapes which are economically more viable through promotion of eco-tourism and sustainable desert agriculture.

6. Modification of children's behavior towards wise and sustainable use of water

By Abdalla Bubtana

Introduction

Children constitute a critical mass for water waste, mismanagement and misuse. This is mainly attributed to their inability to conceive the danger of water-waste and its catastrophic impact on future generations, the environment, agriculture, human and animal life.

In countries suffering from severe shortage of water, particularly in the Gulf Region, children express careless attitudes towards the issues and challenges faced by many nations around the globe due to drought, depletion of water resources, and dryness of rivers and lacks caused by climate change. They rarely understand that millions of people around the world die from thirst and drinking of contaminated waters. Furthermore, they lack the perception of the increasing areas of deserts and the decreasing areas of agriculture and the catastrophic impacts of this phenomenon.

These attitudes and expressed behavior need urgent modifications and change. This is a shared responsibility between parents, schools, media organs, the NGOs, and the entire society. This issue poses itself as urgent and of extreme priority, particularly for our region. The entire planet and our future generations are at stake.

Picture: Collecting potable water, Ethiopia (by H. Schwarze)

It must be mentioned here that in many countries, especially the industrialized ones, there are rules and regulations concerning the consumption of water. However, there is a growing understanding that regulatory measures alone failed to achieve greater success in water conservation and management in spite of their importance. For these measures to be effective they must be complemented by advocacy, awareness-raising and education initiatives.

Although water conservation ranks high on almost all UN agencies, thousands of NGO's, Governments and all communities around the world, education and the media remain the most

instrumental and effective organs in affecting children's behaviors and attitudes towards water issues in general and water conservation in particular.

We cannot live without water. And yet, most of us take it for granted. As long as water comes from our faucets clean and ready for us to use, we don't even think about it or its importance. We must be aware of this precious resource. It is important that our children grow into responsible adults who can make logical decisions that will result in a sustainable water supply for the future.

Water education is one of the most important lessons we can teach.

The water we have on our planet today is the only water we will ever have. Therefore it is important to teach children to treat water resources with respect and to conserve and reuse water whenever possible.

It must be said here that in some Arab oil producing countries such as Libya, Qatar and Kuwait a liter of water is more expensive than the liter of gasoline. However, in all these countries the amount of water waste is very high and very few education programmes exist for water conservation and preservation.

A brief about world water situation

All reports, including the UN water development report, the water assessment programme hosted by UNESCO, UNDP, UNICEF, HABITAT and others provide a gloomy picture of the global water crisis and their evolution in the future. The link between these crisis and other human issues such as desertification, erosion of the environment, hunger and poverty, death caused by thirst and drinking contaminated water are highlighted by these reports. K. Matsuura of UNESCO has said that "no region in the world will be spared from the impact of this crisis which touches every facet of life, from the health of children to the ability of nations to secure food for their citizens" He further added that "water supplies are falling while the demand is drastically growing at an unsustainable rate. Over the next 20 years, the average share of water world-wide per person is expected to drop by a third".

Here are some facts about the water crisis according to the UN water development report:

- By the middle of this century, at worst seven billion people in 60 countries will be faced with water scarcity.
- Among the 180 countries ranked by the reports in terms of the amount of renewable water resources, the poorest is Kuwait (where $10m^3$ available per person each year, followed by Gaza 52, UAE 58, Bahamas 66, Qatar 94, Maldives 103, Libya 113, Saudi Arabia 118. The richest in the world in terms of water availability are Guiana (812.121 m^3 and Iceland (609,319 $m^{3)}$ per year per person.
- Poor countries will be the worst affected, with 50% of the population exposed to polluted water resources.
- About 2 million tons of waste is dumped every day into rivers, lakes and streams. It is estimated that there is an estimated 12.000 km^3 of polluted water worldwide.
- Every day 6000 people, mostly children under the age of 5, die from diarrhea diseases because of drinking contaminated water.
- About 25.000 people die every day from hunger and about 815 million people suffer from undernourishment.
- The estimated per capita use of water in residential areas is 350 liters in North America, 200 liters in Europe and 10-20 liters in Sub-Saharan Africa
- It is estimated that about 24 % of the mammals and 12% of birds are threatened by water shortages and contaminated water.
- Present irrigation systems are inefficient and almost 60% of water used for irrigation is wasted and the size of arid zones and desertification is growing at fast rate.

In spite of these gloomy facts and statistics about the global water crisis, available scarce water resources remained badly managed in great percentage of countries in the world and particularly in the Arab region and Africa. Most

countries in the gulf region in spite of their low ranking in terms of water availability are among the worst in the world in terms of water waste and mismanagement.

As mentioned before, children are the worst water wasters in this region. They normally do not have a clear perception of National and Global water crisis. This is one of the causes of their careless or negative behavior concerning water saving. On the other hand most countries have failed to develop water awareness and a water saving culture in their societies. The regulatory mechanisms are either not existing of totally not enforced.

In a situation like this a pledge must be placed on education and media as the most effective institutions in shaping and modifying social and individual behavior for a positive attitude towards wise and sustainable use of water.

The role of education

As mentioned before, water education programmes are crucial for water conservation and preservation. In many developed countries such as the United States water education is an important component of school curricula. Teaching materials, conservation kits and teachers guides are made available in all school districts. A system of monitoring the impact of water education on children's attitudes and behaviors are set in place in almost all schools.

Water education is designed not only to change the cognitive aspects of children in terms of assimilation of knowledge on water waste and management but also targets change of behaviors, attitudes and ethics in this domain. For example in the United States and Australia and many developed countries water education is not provided for school children alone but for the whole community i.e. parents, water providers, water employees etc. However, studies proved that children and young adults are the major water wasters in the entire community. This is mainly attributed to the fact that these categories on one hand are not fully aware of water issues and the consequences of water waste and mismanagement and on the other they do not pay the high cost of water consumption.

„The water we have on our planet today is the only water we will ever have." Therefore it is important to teach children to treat water resources with respect and to conserve and reuse water whenever possible.

Water education should aim to make students more aware of the complex network of society, technology, and science that are part of water conservation efforts. Students will learn about water as a renewable resource and how it is recycled. They will also learn how consumption can affect the availability of water by calculating water usage and learning ways to conserve water. However, students must learn also about the gloomy situation of water around the world. They must learn that millions of people in Africa die from thirst or drinking contaminated water. They must know that in Australia urban areas and cities may be evacuated due unavailability of water. These facts do have an emotional impact on students and help shape positive attitudes towards water conservation and sustainable use of water.

All these aspects must be included in any school curriculum, water conservation kits and teacher's guide.

It is mentioned before that almost all developed countries have been able to introduce water education programmes in schools as either a separate subject or incorporated into a wider environmental education programmes. A certain level of success has been achieved through combining of various measures among them public awareness, regulatory measures, water exhibitions etc.

However, in regions hardly stricken by water shortage such as Africa and the Arab Region this aspect has been neglected and did not appear as a priority for the countries concerned.

One recent and highly important initiative which can be cited in this paper is "The value-based water education component" of the water for African cities programme which was launched by UN-HABITAT support African countries in the development of new ethics for water governance in cities.

The main activities of this programme are:

- Development of water –related environmental education strategy for African cities;
- Establishment of water classrooms;
- Schools water audit;
- Water quality education;
- Curriculum development & introducing water education in pilot schools;
- Non-formal education with community initiatives;
- Water health care education;
- Information exchange & North-South twining arrangements.

The broad aim of this programme of water education is to facilitate changes in behaviors and personal attitudes among water consumers and to promote better understanding of the environment in a water context. To achieve this, it is important to develop capacity in schools and communities in order to optimize human potential, thereby empowering individuals to:

- Develop an awareness amongst boys and girls of water related environmental issues;
- Gain knowledge, insight and skills necessary to analyze the issues and understand why men and women, boys and girls view and use water in the environment in particular ways;
- Examine attitudes, values and behavior in gender sensitive manner regarding consumption of water in communities found within each city;
- Identify the underlying causes of current water related problems in the city;
- Support informed decision making by the community that could affect the quality of their lives with respect to water;
- Participate actively in the sustainable management of the environment in a water context; and,
- Evaluate and propose actions that will achieve effective water related solutions in support of water conservation (UN- HABITAT).

In reality all education programmes which are designed to instill positive attitudes and behaviors towards water conservation and sustainable use of water should be based on the above mentioned objectives and guidelines.

However, educating children in the school system on water issues is not sufficient to achieve the desired results. A system of monitoring behavioral changes must be built in the education programmes to assess the impact of the educational programmes on children's practice of water conservation tips. Water audit systems applied in schools and outside the school is an important tool for monitoring behavioral and attitudinal changes. This should be coupled with a certain reward system giving recognitions to students who proved better abilities in water conservation and management.

Picture: Polluting freshwater, Ethiopia (by H. Schwarze)

The question which can be raised is what are we doing in the Arab Region to conserve our limited water? This question must be answered in the light of the severe water problems being encountered in almost all countries in the region and in particular the Gulf Region which mainly lives on the very expensive desalinated water. The answer to this question is that we are doing very little and insignificant in the education system or within the media organs.

Water is a scarce commodity in the region and the renewable sources are drying due to limited rainfalls and aquifer overutilization. Water is more expensive than gasoline in a number of countries and yet the Arab region ranks among the worst in water waste and mis-management. In only a few countries regulatory measures are implemented or enforced. Arab children completely lack knowledge about the threats imposed by water shortages and their impact on the environment and future generations. In the region one can rarely see a TV programme or documentary about water situation in the world including thirst and children dying because of drinking contaminated water in Africa.

Only with knowledge of these facts, can our children develop more cautious attitudes towards water consumption and waste.

Although this is the responsibility of national education and information systems, but organization such as UNESCO, HABITAT and UNICEF must play a role in this domain. It is to be suggested here that UNESCO, through its associated schools can provide school children with water conservation kits and tips, conduct workshops for students and teachers and develop guidebooks and manuals along the line of " Rashid the Recycler" produced by UNESCO DOHA.

It must be said that conserving the scarce water can only be achieved through a comprehensive campaign that involve all stakeholders and supported by all agencies of the United Nations working in this field.

The role of the media

Public media such as TV, news papers, radio etc have profound impact on children's behavior and often exceeds the impact of schools.

In many developed countries governments and the private sector allocate funds for launching media campaigns to promote public awareness about national and global water issues. Special TV reportages, movies and even cartoons are produced and disseminated through public and private media organs. Water magazines and newsletters are also produced and distributed freely during organized water exhibitions and campaigns. All these organs undertake extensive coverage of water events especially in the celebrations of UN activities such as the year 2003 "The International year of fresh water, water days and the launching of the UN water reports.

In Australia a country which is hardly hit by water shortage, for example all media organs are mobilized for water conservation and awareness campaigns. Positive results have been achieved in this country in terms of drastically changing social and individual attitudes towards water conservation and responsible management of water resources.

The role of the media in the hardly hit countries in the developing region remains insignificant and often non existant in spite of instrumental and important effect on individuals and society at large. In our region you hardly see a TV documentary or news paper article dealing with the water crisis and challenges we are facing.

In the Arab Region, the time has come to invest this influential institution in raising awareness about water crisis and issues and their impact on the environment and future generation. All stakeholders public, private, NGO's, water producing and distributing companies and local governments must cooperate in designing water conservation strategies and disseminate tips and kits about water conservation through all media organs. Attitudes and behaviors of individuals and the entire society must change and change fast if we wish to prevent devastating crisis in our region.

The responsibility of developing a wise-water-culture must be vested with education and the media but supported by all stakeholders in this domain.

Picture: (Water) education is essential (by H. Schwarze)

The role of the parents

Parents and the entire home environment play an important role in shaping children's behavior towards water use and management. Children usually imitate their parents or older brothers and sisters in the ways they use and consume water. This role playing has a great influence on children's behaviors and attitudes. If parents use water wisely it is possible that children do the same.

However, it is not only important for parents to be a behavioral and role models, but their responsibility extends beyond this to reinforce school education tips and kits received by children, install the necessary gadget for reducing water wastage, run water audits at home to verify water consumption and use and inform children about the gloomy situation of water shortages in other regions of the world. They must understand that their countries and populations are at risk of similar consequences if scarce water is not used wisely and responsibly.

Conclusion

From the previous analyses, the following conclusions can be drawn:

1. Children constitute a critical mass for water waste-mismanagement and misuse. This is mainly attributed to their inability to conceive the danger of water-waste and its catastrophic impact on future generations, the environment, agriculture, human life.
2. In countries suffering from severe shortage of water, particularly in the Gulf Region, children express careless attitudes towards the issues and challenges faced by many nations around the globe due to drought, depletion of water resources, dryness of rivers, and climate change.
3. Every day 6000 people, mostly children under the age of 5 die from diarrhea because of drinking contaminated water. About 25.000 people die every day from hunger and about 815 million people suffer from undernourishment.
4. Water education is designed not only to change the cognitive aspects of children in terms of assimilation of knowledge on water waste and mismanagement but also targets change of behaviors, attitudes and ethics in this domain.
5. Water education should aim to make students more aware of the complex network of society, technology, and science that are part of water conservation efforts. Students will learn about water as a renewable resource and how it is recycled. They will also learn how consumption can affect the availability of water by calculating water usage and learning ways to conserve water.
6. In regions hardly stricken by water shortage such as Africa and the Arab Region water education has been neglected and did not appear as a priority for the countries concerned.
7. Educating children in the school system on water issues is not sufficient to achieve the desired results. A system of monitoring behavioral changes must be built in the education programmes to assess the impact of the educational programmes on children's practice of water conservation tips. Water audit systems applied in schools and outside the school is an important tool for monitoring behavioral and attitudinal change.
8. Conserving the scarce water can only be achieved through a comprehensive campaign that involves all stakeholders

and supported by all agencies of the United Nations working in this field.

9. The role of the media in the hardly hit countries in the developing region remains insignificant and often non existant in spite of instrumental and important effect on individuals and society at large. In our region you hardly see a TV documentary or news paper articles that deal with the water crisis and challenges we are facing.
10. The responsibility of developing a wise-water-culture must be vested with education and the media but supported by all stakeholders in this domain.
11. Parents and the entire home environment play an important role in shaping children's behavior towards water use and management. Children usually imitate their parents or older brothers and sisters in the ways they use and consume water. This role playing has a great influence on children's behaviors and attitudes. If parents use water wisely it is possible that children do the same.
12. Implementing a successful water conservation campaign is a shared responsibility among all segments of society but education and media play a significant role in this domain.

Recommendations

Based on the above-analyses and conclusions, the following recommendations can be made:

- Arab countries must intensify their efforts in designing water conservation strategies and programmes to face immanent water crisis.
- Water issues and challenges must rank high in all government programmes.
- Water education programmes must be designed and introduced in school curricula.
- Public media must assume its responsibility in the campaigns against water-waste and mis-use and the development of appropriate water culture in society.
- Parents assume greater responsibility in teaching their children how to use water in a rational and responsible manner. It is therefore important to launch awareness programmes and workshops for parents.
- It is recommended that UNESCO, through its associated schools can provide school children with water conservation kits and tips, conduct workshops for students and teachers and develop guidebooks and manuals along the line of "Rashid the Recycler" produced by UNESCO-DOHA.

7. CARE-ful design / Vers une architecture sensible

By Florian Techel

For the longest time mankind designed sensible dwellings, built structures that were sensitive towards the environment. However in recent history or more precisely, since the discovery of large quantities of energies, primarily in the form of fossil fuels, this sensitivity has become lost, with societies throughout the world having become complacent and lazy, „generations of people have forgotten about the proper design of buildings". Design movements such as International Style and post-modernism have manifest the human arrogance of designing any kind of building anywhere in the world not matter what climate. This attitude has come to haunt the human race through pollution of the environment and global warming. The addiction to cheap energy and resources has already triggered several wars, which next to the loss of lives and damage to property, has had each time a significantly negative effect on the (local) environment. Many philosophers and scientists have stated in the past that the ability of mankind to destroy has far

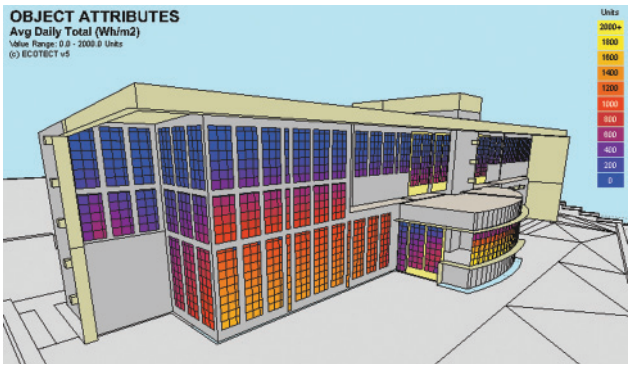
exceeded the ability of mankind to comprehend just that very power.

Conserving energy benefits the environment and national economies at a micro- and macroscopic level, as well as supporting the peaceful coexistence of nations. The question is which plan for the survival of mankind on planet earth is most effective. The automobile industry and airplane manufacturers recently received their fair share of criticism and change is starting to take effect, in no small part due to the currently extremely high cost of energy. It is an old wisdom that people will do the right things if they see and feel an immediate advantage for themselves.

By now most people know that climate change is a serious threat for the collective survival of the human race. It is now common knowledge that a significant contributor to global warming is the rising concentration of carbon dioxide in the atmosphere through the excessive combustion of fossil fuels. And although CO_2 is all around us, the human body has little means of recognizing the concentration of this colorless and odorless gas.

According to wikipedia approximately 20% of the current worldwide energy consumption and CO_2 production can be attributed to personal and commercial transportation.[i] Consequently, most of the remaining 80% happen in the residential, business, industrial and construction sector, or simply spoken: inside buildings or towards their construction. This should help to illustrate the magnitude of the problem and the responsibility of all involved in the process of designing and constructing appropriate buildings or the proper building management throughout its life cycle. Perhaps because CO_2 is invisible and odorless and because the running costs are usually turned over to the tenant and energy until recently was perceived to be cheap, investors in the Gulf region, have until recently shown little or no interest in the design of energy efficient buildings.

Because of the sudden affluence through fossil fuels, most of the collective knowledge of ancestors on how to design buildings properly, has unfortunately been lost. As little as fifty

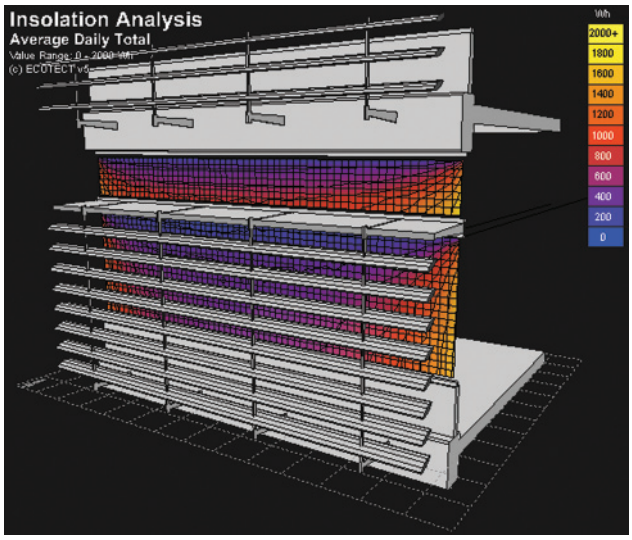


Drawing: Solar radiation gain (by ECOTECT)

years ago people designed and built more sensible buildings for anything else would have been foolish and immediately punished with unbearable living conditions. The introduction of air conditioning however, with the allegedly infinite availability of electricity, clouded the understanding for proper building design. This knowledge has been so completely eradicated that any person who suggests the possibility of designing buildings with dramatically lower energy consumption, is immediately cast as a snake-oil-salesman. His/her claims simply sound too good to be true.

The effects of wasteful building designs are becoming difficult to overlook. Water demand in the Emirate of Abu Dhabi increased by over 10% in only one year from 2003 to 2004.[ii] With the current intensive construction these figures have probably accelerated since. Between the years 2000 and 2004 the demand for water and electricity rose in Abu Dhabi and Dubai alone between 6 and 15% per annum. Other sources see the increase of electrical capacity at up to 24% per annum.[iii] The energy footprint of the UAE is approximately 7.5 global ha/person, ranking among the highest in the world.[iv] Peak electrical demand in Dubai rose by 15% from 2006 to 2007. The same figures show an increase in peak demand of approximately 80% in the summer months over winter.[v]

[i] http://en.wikipedia.org/wiki/Energy_consumption
[ii] Emirates Center for Strategic Studies and Research
[iii] Emirates Center for Strategic Studies and Research
[iv] http://emirateseconomist.blogspot.com/2005/04/energy-consumption-in-uae-ameinfo-uae.html
[v] http://www.dewa.gov.ae/aboutus/



Drawing: Shading simulation (by ECOTECT)

These dramatic growth figures are met by physical limitations. It appears increasingly difficult to solve the issue of sufficient supply of energy on the supply side. Rather the dramatic demand increase needs to be curbed or future economic growth is seriously threatened. The Abu Dhabi Water and Electrical Company (ADWEC) predict electrical shortages starting in 2009 as power demand will exceed installed and planned electrical capacity.[vi]

The Dilemma of the (In-)Visible

Customers in the Gulf Region are among the most affluent in the world. Cars, jewelry and perfumes are only a few examples of items where people are willing to spend significant amounts of money if the quality and added value can be perceived in any way.

The dilemma of the building industry is that neither the architects nor the contractors usually have the capital to put the final product in a showroom. Instead, architects, throughout the ages, have built models and produced renderings in order to help the client visualize the planned building. That makes the business of *selling architecture* an extremely *visual* industry. Issues that cannot be seen are usually ignored during the decision making process.

This lack of visualization becomes increasingly problematic, for especially these invisible dimensions are damaging the environment, and increasingly local economic development.

Customers and investors normally make the proper purchasing decisions in the correct economic, financial, political and social framework. A sensitization towards new values in the design and construction of buildings is required. This appears to be happening all over, as the world is becoming used to high and probably permanently high energy costs. However, in order to make the proper investment decisions within the new paradigm requires new technologies in visualizing that what is otherwise invisible. In the near future, renderings of a building should not only comprise of light and shadow, images of happy strolling pedestrians with perhaps even a fly around the building, but infrared thermal renderings and simulations of the future behavior of the building with all its services.

CARE-ful Design

Knowledge of how to build proper buildings may be considered part of the culture of a people. This culture is being lost and replaced by an ever-increasing world culture of the arbitrary, a second *International Style*. While cars, coats or computers may be exported throughout the world, construction of buildings through the ages was a process deeply connected to the culture and the climate of the genius loci. It is imperative to redevelop these abilities. **C**ulture, **A**rchitecture, the **R**egion and the **E**nvironment cannot be detached from one another when it comes to the design of buildings. CARE-ful design, throughout the ages, has created structures that stood the test of time, helping to identify the genius loci, and giving people buildings that they could identify with and be proud of. CARE-ful architecture is in sync with its environment and carries a certain self-evidence significantly differing from the ever-increasing Las-Vegas-style cacophony of high-rise buildings vying for the attention of the potential customer. „Physically speaking, skyscrapers in the Gulf region are very ornate oversized and badly insulated refrigerators."

[vi] http://www.adwec.ae/maps_graphs/ [item no 4.0]

CARE-*less* design that dominates the current landscape design ignores most of the factors mentioned above, and is consequently, despite its current glitter, doomed to fail miserably.

Towards CARE-ful design, a stepped approach

It is important to design and build prototypes that are accessible to the public. They will serve as a proof of concept. These should be buildings in which the advantages of the new type of design may be immediately experienced in the same way that a customer can experience the qualities of a new car in the showroom. On a hot summer day the visitors will immediately sense the comfort and serene eenvironment of these structures. Compared to a normal building where the Air Conditioning could be heard and felt, instead such a new building would be in contrast surprisingly silent.

Stage One: Demonstration Objects

Knowledge of how to build appropriate buildings has to be relearned, as most of this understanding has been lost in the last two generations. This process will take time. It requires sample buildings designed in an experimental way and monitored over duration of several years to thoroughly investigate their thermal behavior in that specific region. Residents of the Gulf know too well that different regions within the Arabian Peninsula experience significantly different climatic conditions. The microclimate in Kuwait is distinctly different from Doha and Abu Dhabi, while that of Muscat and Salalah differs once again. These differences need to be addressed with proper building design. An international style is exactly *not* the answer.

Stage Two: Give incentives / Identify early adopters

It is the experience in the industrialized world that government regulations (dos and don'ts) usually motivate people to only do the bare minimum. Incentives, however, properly applied, may motivate investors to extend beyond these minimums.

Once the government(s) has/have defined their own goals they can usually motivate investors, designers, contractors, and others better by giving incentives for proper behavior. These measures include, but are not limited to: architectural design competitions, faster building permits, better/ sooner access to scarce energy, tax incentives, prominent documentation, awards, etc.

In several UAE Emirates many new building permits are currently delayed because of lack of electricity. Governments could decide to hand out building permits with priority based on proper energy conserving design.

If the incentives are formulated such that they do not permit windfall gains but truly necessitate new design they will motivate early adopters to change their behavior in the desired manner. Early adopters are those individuals, groups or commercial or governmental bodies, who will likely jump on to emerging trends early on. Their motivations usually differ but for as long as they can be motivated towards the same goal, this should be viewed rather as an asset than a threat.

Stage four: Implement regulations for everyone

It can appear to the interested outsider that innovations are frequently hampered because of the breakneck speed of development. This appears in strange contrast to the words of the Prophet (PBUH) who defined patience as an Islamic virtue. With all the capital and the most modern technology, research into the best possible design of buildings in the region still consumes time.

Newly erected buildings should be part of a monitoring program in which their performance figures are regularly recorded over several years. This will gather invaluable local data that can be used towards formulating appropriate regional building design codes.

Conclusion

The creation of low-energy, even zero-energy buildings, in the Gulf region is not a question of technology; it is more a question of political will and the establishment of the proper economical, political and administrative structures.

8. Sustainable architecture, landscape architecture and urban planning in arid places - or: the sum is greater than the whole of its parts

By Joachim Böcker & Gottfried Faulstich

Global warming and diminishing resources are a major concern nowadays. On top of these global problems, which demand a serious and responsible approach, we face another issue. Relatively realistic prognoses estimate that by the year 2030 the population in cities will have grown by another 2 billion people. (see "City Alliances"). More than two thirds of the world's population will be dwelling in cities or urban areas. There will be more than 500 cities with a population exceeding one million, half of which will be in Asia. Climate change possibly arguably will make the temperatures in the "warm islands of cities" rise even further. Just with that in mind, the importance of climate friendly and optimized

Picture: Mangroves in Qatar (by B. Böer)

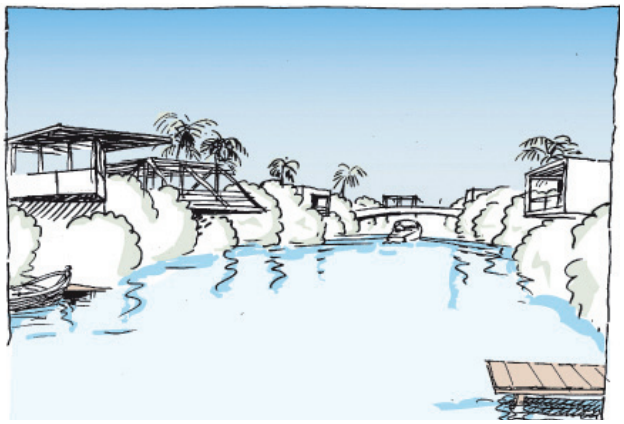
urban planning becomes evident, as well as securing the supply of water and its clarification.

In short, the tasks that lay ahead of us in the domain of urban planning are vast. Especially if we think towards a sustainable and future oriented planning, a planning which comes with awareness and responsibility. We need city development structures which go beyond spectacular island solutions and which result in fragmented megacities. It is not our aim to tear down existing cities and thus rob places and people of their history and origin. But we need to consider ecological, financial, and architectural as well as social aspects when planning for cities. And we need to further work on implementing rational energy supply systems (wind, solar and photovoltaic, biomass, geothermic and hydropower). All of this should be done under close consideration of the cultural background and with broad participation of the communes and residents.

Promotion of sustainable city planning and development of settlements

The following measures form the basis for more sustainable cities:

- Implementation of an integrated environment protecting infrastructure for drinking water supply, sewage systems, canalisation and waste management.
- Introduction of environmentally friendly energy supply and transportation. The reduction and optimized management of traffic lead to improved quality of air.
- Protection under a sustainable zoning plan and management of areas.
- Realization of environmentally friendly and healthy building measures.
- Extensive greening of street spaces and public places. Plants have a soothing effect on the climate and induce shade.
- Adequate housing for everyone.



Drawing: Mangrove channel (by bfk&Partners)

All these measure will be implemented in accordance with the principles of sustainable urban planning and especially conserving the use of energy and resources. This will be done by abstaining from the use of fossil energies. In details these measures are:

- Use of photovoltaic's (panels can also be used for shading).
- Use of the earth's heating and cooling functions.
- Conservation of treated fresh water through the use of grey water and plants well adapted to the location.
- Adequate building materials and surfaces (insulating render and rear ventilated facades).
- Passive houses with good insulation and capability to store cool. These also provide a comfortable room climate.

The resulting reduction in emissions, especially that of CO_2 leads to better air quality and an all over improvement of the global climate.

The city oasis as the leading objective

The over all goal is to come as close as possible to the definition of the ideal urban climate, a climate which offers its inhabitants a great diversity of atmospheric conditions, and is largely free of pollutants. Stress due to extreme temperatures should only occur on few days in accordance with the climatic zone.

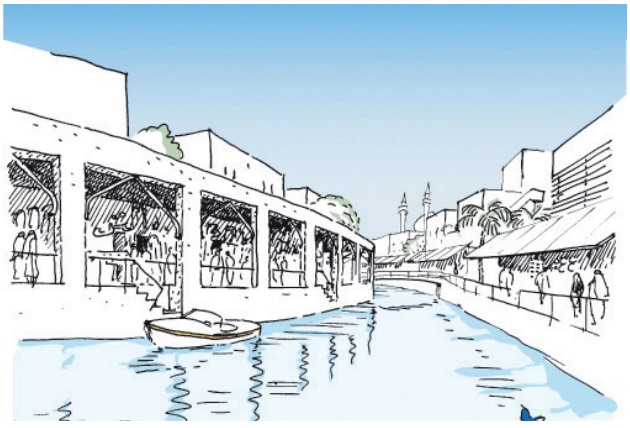
Cities heat up immensely due to the intensive radiation, especially the city centre. It is therefore of utmost importance to provide for an appropriate amount of green spaces. Green areas help equally distribute and reduce the heat. By central greens spaces we mean parks as well as large gardens.

Also netlike green belts along the side of streets, channels, green fingers, coast lines and small fractions such as park pockets and parking spaces are options, one should consider.

A significant improvement of the microclimate is the rewarding result. Shade induced by tall trees complements the cooling effect, as well as filigree construction or "sunpanels". The improvement of the urban climate is especially achieved through lowering of temperatures and ventilation. Sufficient wind also blows respiratory and abrasive dust out of the city.

Further these objectives can be achieved when the following measures intertwine:

- Cooling of the induction of evaporation processes on water surfaces and vegetation on surfaces and facades as well as the building of city fountains and water channels.
- Usage of plants suitable for the location and native to the area, which results in lower consumption of water and little care needed.
- Reduction of cross-sections in urban streets as well as building measures (i.e. shade giving rooftops, building of arcades and usage on little reflecting surfaces) bring cooler temperatures to the city.



Drawing: ‚Oasis City' Doha (by bfk&Partners)

‚Oasis City' - Potential for better cities – the example Doha City, Qatar

Doha once was a small pearl fishing village which has now grown into a major city with over 1.600.000 inhabitants. And it is still growing at a fast pace.

The city centre, with its area of approximately 1,2 square km, consists largely of elements dating back to the 50's and 70's, will serve as an exemplary area. In the following we will illustrate, taking this old city centre as an example, how a grown city can be sustainably developed.

Our vision is to turn Doha into an attractive and liveable oasis, into what we call „Oasis City Doha". Ample green areas and water channels, which are attached to the Gulf, form the basis for an increased attractiveness of the city centre.

The following measures detail our vision:

- Extensive greening of streets leads to the lowering of the meso-climatic temperatures by evapotranspiration.
- Mangroves and other local plants fringe the water channels, which are regulated by sluices. This improves the cityscape and the amenity values.
- Use of plants well adapted to the location and climate, which have a low demand of water and care.
- Reduction and optimisation of traffic routing lead to an improved air quality.
- Reduction in cross sections in inner urban streets as well as building measures (i.e. shade inducing rooftops, building of arcades, as well as the use of less reflecting surfaces) bring more chill to the city.
- Building shells and technology will be optimized for heating (in the moderate winter months) as well as for air conditioning. This is equally important for new buildings as it is for the refurbishment of old buildings.
- Shade inducing trees as well as a large amount of small parks and city gardens improve the urban climate and result in a further reduction in temperatures and increased ventilation. The image of a "Green Roof Doha" guides these ideas.

Various other measures (i.e. shade inducing solar panels, heat reducing surfaces of building shells and on streets) complement these suggestions.

The vision sees Doha grow the strength of a blooming oasis: an autonomous refuge, which meets the need for protection, adequate supply, communication, tradition and development while using its resources (water, soil, air, commodities, finances, information, engagement and imagination) intelligently.

The improvement of the urban and climatic situation will not only be a great benefit to the people of Doha, but also be an impulse to its touristic ambitions. A sustainably planned city could thus not only produce a better quality of living, but also hold large economic potential.

Drawing: Villa in the ‚Oasis City' (by bfk&Partners)

- Conserving use of asphalt and concrete, as these store heat over-proportionally. Instead we suggest the implementation of water bound surfaces as well as natural stone, i.e. on walkways and in parks. This also has the advantage that roots of plants are not been overly damaged by ground sealing.
- Usage of insulation and insulating rendering on facades, with similar to loam rendering do not capture the heat as much. Rear ventilated facades to reduce the long wave radiation and the storing capacity.

A highly concentrated building structure should be avoided since the harshness of the surface reduces the exchange of oxygen. Old grown city quarters give a good example for these principles.

An extension of green spaces has the following effects:

- A reduction of the temperature and an increased cooling off at night
- Dust as well as heavy metals is bound in the air. Rain washes these particles from the leaves and it is then sedimented on the ground.
- Improvement of the air quality though an increased production of oxygen.

Next to the climatic improvements that come with more parks and gardens, they also offer great opportunities for recreation to the people living in the neighbourhood as well as visitors.

Fruits and vegetables from the city oasis - the new urban gardens

Oases are traditionally known as islands rich with plants at the border or in the exterior of deserts. Their richness is due to an easy access to ground water or a well. Often they were enlarged by an intelligent system of irrigation. Also oases are normally densely populated and intensely farmed (field crops, fruit trees, especially date palms).

This traditional arrangement can well be translated into modern urban planning. And in such a way that tradition, usefulness and social interaction are intertwined.

The cultivation in the housing areas can be run as privately owned crop production, whereas parks and greenbelts are subsidised by public funds. Inner urban areas are thus transformed into lush gardens.

These gardens also provide for a valuable supply of fresh fruits and vegetables, an important source for vitamins, minerals and dietary fibres.

Conservation of resources

Building materials and garbage can be partially recycled. Plants adapted to the location and proper irrigation techniques reduce the demand for water. Treated black water allows for the production of top-quality fertilizers for trees and decorative plants. Greening of housing areas and greenbelts have a positive effect on the microclimate and the quality of living. Environmentally friendly desalination techniques use the energy from photovoltaic panels to drive their engines. Energy produced during the process of desalination can be used for the air-conditioning of buildings. Lack of nitrate in desert regions can be accommodated with the help of composting plants.

Implementation of photovoltaics

The implementation of photovoltaics and other measures for a more sustainable city are more easily integrated into newly developing areas.

Picture: Palm trees in Nizwa, Oman (by H. Schwarze)

This has many reasons. Existing buildings could hinder the proper adjustment of the photovoltaic panels on the building shell. Also the surrounding infrastructure such as streets as well as the layout of the property could pose such an obstacle. Also trees on the neighbouring properties could be in the way of the sun.

Newly designated building areas can, on the contrary, fulfil all the requirements for the successful integration of photovoltaics into the architecture. This is especially the case, when matters of solar energy are already fully incorporated into the urban development scheme. The designation of adequate building areas as well as the preliminary fixing of gaps and building orientation can form the basis for successful implementation of photovoltaics.
In countries, with a high solar radiation, the use of energy produced through photovoltaics can be used on a high-tech level. Here the demand for energy corresponds seasonally with the sun's radiation. In summer the need for cooling of buildings is high. Electric powered air conditioning compressors, which are still widely used, nowadays can be replaced by solar powered ones. Especially in summer this would be ideal, as the demand for energy follows the cycle of the sun very closely.

Conclusion

This short introduction to the various options of sustainability planning for cities is of course a very general one. To implement these measures careful research concerning climate, building structure, transportation, flows of energy, development policies and implementation strategies will have to be conducted. Based on the results a superior master plan will provide guidance for further planning. As already said, adjustment will have to be made according to the local circumstances. Here a prominent feature is the permeation of the inner old city centre with a system of newly incorporated water channels. The channels will be flowing with salt water and mangroves planted along its sides.

9. Green roofs in Doha, Qatar and the Middle East

By Katrin Scholz-Barth

Abstract

In the temperate climates of Europe and North America green roofs have been used successfully to minimize the impacts of urban growth on water management and climate. By utilizing the natural functions of landscapes, including water storage, evaporative cooling, and carbon sequestration, green roofs have proven to provide cumulative social, economic, and environmental benefits. Worldwide, green roofs have been integrated into various green building guidelines to promote the use of this technology. The US Green Building Council in its Green Building Rating System Leadership in Energy and Environmental Design (LEED) recognizes green roofs specifically for their water retention capacity and their ability to reduce the urban

heat island effect. While stormwater runoff and urban heat islands may not be of greatest concern in the hot and dry arid climate in the Middle East, flood control during single intense rain events and the indirect benefits of green roofs for energy efficiency and indoor environment, on the other hand, might be of greater importance in this region. This discussion about green roofs analyzes the feasibility and applicability of green roofs in Doha, Qatar and its potential benefits.

Introduction

Industrialization and urban development on the Arabian Peninsula, mainly in the countries of the Gulf Cooperation Council (GCC), including Saudi Arabia, Bahrain, Kuwait, Qatar, the United Arab Emirates, and Oman, has been booming over the past 20 years, and the building and construction industry can hardly keep up with the demand. For the past two years, however, an exciting new trend is starting to take hold. Sustainable building practices along with a general growing awareness of environmental protection present new opportunities to reduce the environmental footprint of the dense urban areas in the Middle East, and green roofs can play a significant and very visible role. While there are currently only a few examples of green roofs in the Middle East, the potential to enhance energy and water management with this technology is vast.

Green roofs have a long history and tradition, dating back to as early as „the Hanging Gardens of Babylon" built by King Nebuchadnezzar around 600 BC. In the 1980s, Germany adopted a more contemporary use of green roofs into its sustainable design and building practices for their many social and environmental benefits including rainwater retention and reuse, energy efficiency because of the temperature moderation (inside and outside the building), added green space, wildlife habitat and air filtration.

Rainwater runoff from roofs and sealed urban surfaces can no longer infiltrate the ground and extensive infrastructure is required to transport water away to prevent flooding. Runoff water is often discharged through pipes to far away,

Picture: Green roofs provide benefits (by K. Scholz-Barth)

hydrological disconnected areas depriving local aquifers of groundwater recharge and further depleting scarce groundwater levels.

When rainwater runoff exceeded the existing sewer capacities in Germany, green roofs became mandatory to reduce, delay and slow down roof runoff. Since then, many countries in Europe and North America incorporated green roofs into building design and specifically utilize green roof to mitigate the impacts of imperviousness from urban growth and development.

Living in the subtropical desert of the Arabian Peninsula is challenging not only because of the extremes of the arid climate but also because of limited access to green landscapes, flowers, and forests. The average annual rainfall in Qatar amounts to merely 75 millimetres (mm) and occurs in heavy single rain events, on as few as two to three days during the year, between November and April. Not many plant species can survive throughout the year on only natural precipitation in this region, and fresh water for landscape irrigation is a limited resource. Discussing the application of green roofs in this context may seem counterintuitive, however, in the Middle East, they may proof more beneficial for their indirect cooling effect by protecting the roof against direct sun exposure and thereby reducing the solar heat gain of the building, and the added green space. Because of Qatar's ambitious urban growth and expansion, which will ultimately transform the conventional landscape, infrastructure and real estate, green roofs may have a great potential to aid in creating

sustainable communities despite the hot climate and water shortage.

What are green roofs and how do they work?

Green roofs are vegetated roof surfaces and comprise of watertight roofing systems, soil, and plants. There are two types of green roofs. Living green roofs (extensive green roofs) have a shallow soil profile with a soil depths ranging from 10 to 25 cm and are planted with a predominantly succulent plant community (sedum) to maximize the environmental benefits. Landscapes over structure (intensive green roofs) are more complex and have a deeper soil profile ranging from 30 cm to several meters. Landscapes over structure are intended for active use and recreating and exhibit a more mature landscape, including shrubs and trees.

Careful structural planning is required to ensure load-bearing capacities are met for the added soil, landscape, and infrastructure (walkways and irrigation) needs. If the roof is intended for human access and inhabitation, this live load has to be included into the structural capacity as well for liability reasons. Structurally, green roofs add little cost to new construction. However, retrofitting an existing building may require a structural upgrade, which can be expensive.

In arid climates both green roof types will have to be irrigated for plants to survive. Water conservation benefits can be realized by choosing suitable and low water use vegetation and by irrigating with non-potable water. The green roof designer must give serious consideration to various non-potable water sources for irrigation to provide a true net gain in sustainability. Reliable non-potable sources for continuous green roof irrigation may include condensate from air condition units, onsite generated and treated grey and wastewater, or swimming pool drainage.

The continuous vegetation cover and plant foliage of green roofs transforms conventional, unused roofs into green spaces that shade and thereby protect the roof against direct exposure to the sun and the resulting solar heat gain of the building. Capitalizing on the natural ecosystem services of green roofs (water storage and retentions, shading, cooling, filtering of water and preconditioning of air, evaporating and transpiring), functional and effective landscape design can be incorporated into the building architecture for water conservation and energy efficiency.

Indirect green roof benefits include energy efficiency and a healthier indoor environment. The vegetation layer shades and thereby reduces the solar heat gain through the roof. A lower required cooling load to offset solar heat gain in turn increases the energy performance of a building. This indirect cooling effect can be significant. Evaporation from the leaf's surface and the plant's transpiration processes provide a cooling effect (referred to as evaporative cooling) that keeps the inside cooler and reduces the ambient outside temperature directly above the green roof. The green roof plants filter the air by fixing dust and particular matter to its foliage and preconditions the air before intake into the building and lessen the human health impact.

Green Roof Benefits

The main environmental benefits of green roofs in the Middle East include:

- Cooling and Energy Efficiency
- Carbon sequestration
- Flood Control during single short rain events
- Dust Control
- Mitigation of Urban Heat Islands (reduce surface temperatures

Economic Benefits:

- Reduced energy consumption and lower operating costs
- Extended roof live

Social Benefits:

Quantifiable social benefits include considerable added green space that positively impact the health and wellbeing of building occupants and patrons with view access to the greened

structures and the improve appeal of the city as a green tourist destination with economic benefits.

Suitability of Green Roofs in the Middle East and Potential Applications

Considering the vast number and variety of mostly flat roofed buildings, there is great potential for green roof applications in the Middle East. All building categories, including commercial office buildings, residences, and hospitals, are

Picture: Green roof technology (by K. Barth-Scholz)

suitable for green roofs, depending on their load bearing capacity. The cooling and energy benefits from green roofs are greater for single-story or low-rise buildings than for high-rise buildings, because the large roof to wall ratio maximizes the reduction in solar heat gain through the roof, whereas in high-rise buildings gain most heat through its glazing and building envelope.

Green roofs could also be significant to urban stormwater management to reduce flooding and sediment and nutrient input into the Arabian Sea during the few rain events of the year. However, buildings will require a watertight roofing system and a structural load bearing capacity that will safely absorb the additional weight of a green roof at full saturation to protect the integrity of the structure and the building.

The application of green roofs is especially beneficial to Middle Eastern urban cities and tightly built environments, such as residential compounds. Flat roofs and privacy walls make up a large part of the hard surfaces and can be softened and transformed into living green roofs and green walls and screens that help mitigate environmental impacts of continuous growth and development.

Conclusion

Despite the semi-arid climate, green roof technology emerges as an innovative and very suitable technology in the Middle East. Adapting green roofs to the GCC green building industry can provide significant benefits and offers an effective measure to reduce the environmental footprint of urban growth and development.

The greatest potential benefit of green roofs in arid climates is the protection against direct sun exposure and solar heat gain of the building. The soil and vegetation layer shields the roof and thereby extends the roof life. Energy efficiency and an improved building performance result from a reduced required cooling load to offset heat gain with air conditioning. The same evaporative cooling lowers roof surface temperatures and thereby mitigates the effects of urban heat islands. The soil layer absorbs rainwater and helps attenuate floods during the short and heavy rainfalls.

Integrating green roofs into urban planning may become a realistic solution to adding large-scale green spaces to the urban environment on new and existing flat roofed buildings without taking up additional land. The relative ease of installation and low cost of green roofs combined with their cumulative social, economic, and environmental benefits makes the technology a potential low risk and high return in investment strategy in the Middle East.

10. Recycling at your residence

By Ronald A. Loughland

Introduction

Recycling and waste reduction have become globally increasingly important and are set to become two of the major issues confronting our society in the coming years and beyond.

Traditional use of resources is changing and some Arab countries are now amongst the highest users of packaging and generators of waste in the world. This places great pressure not only on our environment but also on our societies, because „something has to be done with all this rubbish".

In some Arab countries on average every man, woman and child throws away over half a tonne of rubbish each year. City and town residents alone discard millions of tonnes of garbage annually, enough to fill a large Sports Stadium.

It has been estimated that up to 80% of this discarded garbage could be recycled. At present only 3% is recycled. The recycling of the other 77% would mean a saving of millions of dollars on waste disposal each year. To make the situation worse millions of dollars worth of recyclable resources are thrown away in the waste system annually.

There are four main ways of dealing with all this rubbish.

1. **We can bury it.**
2. **We can burn it.**
3. **We can recycle it.**
4. **We can reduce the amount we produce.**

Land disposal and incineration are very expensive and produce large quantities of various pollutants. Recycling reduces the quantity of materials requiring disposal and therefore saves money, time, natural resources and energy. For these very reasons, Governments at all levels are urging and supporting recycling and many individuals across the Arab World are involved in money earning schemes to collect recyclable goods from homes and businesses.

Reducing the amount of rubbish we produce is the best solution to waste minimisation and people who recycle will become aware of how much rubbish they actually produce. Recyclers fast become conscious of what they consume and what they do not need to buy.

The environmental and economic problems of waste disposal now facing North America and Europe will soon occur here in Arabia. We have only a few years to get on top of our waste situation and there is a solution:

Reduce, Reuse and Recycle!

By following these three simple steps we as individuals, and collectively as a society, can save considerable amounts of money and time. In addition, we will be helping to conserve the valuable resources of our planet.

In the past many people have wanted to recycle, but have not been able to, simply because they did not know what could be recycled or what to do with the material once it had been collected.

Picture: Recycling bins in Doha, Qatar (by H. Schwarze)

A new publication by UNESCO titled Rashid and Dana the recyclers is a practical guide that provides many answers. By reading the UNESCO guide you will be encouraged to become an active recycler. The guide will show you not only how to reduce your waste, but will help you save money, time, and help you contribute to saving the planet!

Recycling at a residence

If you learn good recycling habits from the UNESCO guide, then it will be easy and fun to preach these habits and get the whole family recycling. Up to 80% of household garbage has the potential to be recycled. Therefore before you discard anything, consider if it can be used again. When you are out shopping, consider the purchase of products that are not over-packaged and support products that use recycled wrapping or that themselves can be recycled. By purchasing goods in bulk we can save on money, time and excess packaging.

Picture: Collected metal for recycling (by H. Schwarze)

One good example is purchasing goods in larger containers, instead of several smaller ones. Try to avoid disposable goods; instead purchase durable products that last longer. These efforts will reduce the waste you produce and they will also save your families money and time.

One important point to consider: On average each of us collects and carries home 350 plastic supermarket bags every year. One well-known grocery company in Arabia hands out many millions of plastic bags per week. Maybe you have seen a few of these bags blowing around the streets or desert, or hanging in trees. Perhaps taking a reusable string bag to the market would be much more sensible!

Most of us spend at least one half of our waking hours at work each day. Therefore, if we carry our good recycling habits from home to our work and teach our colleagues, we could very quickly make a huge difference and quickly help to protect our precious environment.

Our residential garbage can be divided into four main categories, each having excellent recycling potential:

1. **Organic matter (food and garden wastes)**
2. **Paper and cardboard**
3. **Glass**
4. **Metal**

The remaining garbage is made up mostly of plastic and packaging material. Some plastics also can be recycled.

Over the course of one year the average person will throw out 67 kg of paper, 33 kg of glass, 24 kg of metal, 93 kg of plastic and produce over 262 kg of food and garden wastes.

In comparison with industry, residences tend to produce small amounts of mixed contaminated waste. The extent and variety of this contamination is determined by three main steps.

1. **The first occurs in the manufacturing process,**
2. **the second during the use of the product, and**
3. **the third takes place in the handling of the product after its use.**

This contamination can range from a plastic or waxed coating on paper to all types of food and beverage residues.

The most important key to having a successful residential recycling system is to sort out and separate all recyclable items and to reduce contamination.

Therefore at home separate:

- **Glass**
- **Metal**
- **Paper**
- **Plastics**
- **Food & garden wastes**

Using different bins or boxes for each item, or one big box that can store all the goods with the exception of organic wastes.

Some materials such as bottles will require further sorting into colour types such as green, brown and clear. This increases their value and can be done later at the point of collection. In addition, all steel cans need to be clean and de-labelled. This is easily achieved by washing the cans at the same time as you wash the dishes. Despite making them more attractive to recyclers, it makes them much less attractive to pests such as cockroaches, flies, and ants.

The organic matter that is mostly vegetable peelings and garden clippings can be composted. By keeping a small airtight container in the kitchen, most food scraps can be saved without any effort. Since the average kitchen produces around l kg of food scraps daily, this would need to be emptied regularly.

Now that you have collected and sorted all these recyclable materials, what do you do with them? The answer is simple: Friends of the Environment Centres often operate collection centres for recyclables, and the Municipality may also accept recyclable materials (call the Environment Centres or the Municipality for details).

There are other services available; for example there are some companies usually in the industrial areas that recycle paper, aluminium cans, wood, and plastic. Some industries will also pay cash for recyclable materials, and will collect material in large enough quantities. Examples of these are aluminium and paper manufactures.

Recycling food and garden wastes

Over half the contents of our garbage bin is made up of food and garden waste. Instead of being thrown out this could be composted to produce a rich fertiliser for our soil.

The average home discards up to 1 kg of kitchen scraps per day and depending on the location, between 10 and 20 kg of garden waste per week.

Composting is a method of speeding up the natural process of rotting and involves the natural breakdown by microbes of organic matter to produce a dark earth-like substance. Composting is not new; it has been an important agricultural process for at least 4000 years, and is used today by the Municipality to treat most of the organic materials that enter the waste system.

By composting at home you will reduce half your garbage and save time in bagging and transporting your lawn and garden clippings. This will also save you money, especially if your family pays somebody to take your garden wastes to the tip. There are other benefits such as improving your garden soil and saving on the purchase and use of chemical fertiliser. As well as reducing the use of chemicals, composting eliminates garden cuttings burning, therefore preventing pollution and the production of greenhouse gases.

Compost will improve your soil by restoring the fertility and condition, whereas artificial fertilisers only supply nutrients. Compost will also improve the structure, water holding capacity, friability and aeration of your soil. This is of most benefit to sandy low organic soils such as those in Arabia.

The use of compost material is convenient because it can be produced in weeks or months, depending on your requirements. This material can be used as a fertiliser around trees, in indoor or outdoor pots or as a mulch on your garden. Even by simply leaving your lawn clippings on the lawn after cutting, you will be dramatically increasing the nutrients in your soil as well as saving your valuable time.

To start a composting scheme at home yourself, create a basic enclosure or heap away from the house. Keep a small airtight container in the kitchen for scraps and empty this daily into the pile. Each week place your garden and lawn clippings onto the pile.

Include: Grass clippings, kitchen wastes, fruit and vegetable peelings, left over pet food, shredded pruning's, tea leaves and bags, coffee grinding's, indoor plant cuttings, egg shells, manure, weeds, hair, cooking oils and vacuum cleaner dust.

Avoid: Large branches, meat, fat, whole bones, plastic, waxy plant material, underground stems or any diseased or pesticide-contaminated plant material. Of course, glass, plastic, paper, empty batteries, chemicals, paint, and expired medicine do not belong here. The reason for avoiding diseased and contaminated plant material is to prevent the spreading of these diseases and contaminants through your garden.

It is important that your compost heap should not become a rubbish heap, therefore the pile should be kept tidy and compact. This will also aid in retaining heat and moisture which is vital for decomposition. Another reason for keeping the site tidy is to avoid problems with pests as well as neighbourhood pets. The construction of an enclosure on the ground that still allows the movement of air and earthworms into the pile usually overcomes this problem.

For best results maintain maximum aeration. This can be achieved by placing the coarser substances at the bottom and then building up with finer materials. In addition, mix low nitrogen materials such as straw, sawdust, and plant cuttings with high nitrogen materials such as food scraps, lawn clippings, weeds and leaves. The decomposition will vary with the content of the heap as well as the season, but after a couple of months the material should be ready for use.

It is also possible to construct your own composting unit using a 200 litre (44 gallon) drum with holes cut in the bottom and sides to allow for aeration. By placing a large hole or door at the bottom of the drum you can have a continuous system where material is added at the top and removed at the bottom.

There are commercial composting units available and these range from concrete, plastic or wooden boxes to plastic or metal bins with tight fitting lids. These come in various sizes to suit your particular needs and some units can be rotated for convenient mixing and aeration. Some of these units are available at hardware stores, nurseries and some department stores. The prices for units vary depending on the size and model you desire.

For more details on Recycling at your residence please visit the UNESCO website www.rashid-and-dana.org

11. The Arab Recycling Initiative - A UNESCO Doha project

By Mark Sutcliffe

Background to the project

Waste management, together with recycling, reduction and reuse of waste as raw material, is becoming increasingly important in the world's ever more densely populated countries. In the future, sustainable waste management techniques will become an integral part of the knowledge society with a tremendous input based on education and science and it will cause positive changes in those countries' cultures.

Science and technology based waste management

Picture: Presenting the project in Bonn (by H. Schwarze)

will not only contribute to cleaner landscapes, ground water, cities and environments; it will also help saving costs and generate jobs and income in the waste management industry.

In this context, UNESCO Doha Office actively promotes recycling in schools since 1998. In 2005, the UNESCO Office in Qatar, in collaboration with the Ministries of Education, Energy and Municipal Affairs in Qatar, published a guide on recycling entitled Rashid the Recycler based on the Qatar experience. In 2007, after consultations, a girl, Dana, joined Rashid to invite their friends and cousins from Algeria, Bahrain, Egypt, Kuwait, Iraq, Jordan, Lebanon, Libya, Mauretania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, the United Arab Emirates and Yemen to embark with them on this important project.

Concise description of our project

The overall aim is to assist catalysing the waste-recycling industry in the Arab region. We believe „that recycling is only possible in the long-run if there are jobs, income and profit associated."

The Arab Recycling Initiative includes an expansion of the first guidebook for Qatar, using as its starting point a pan-Arab platform addressing students at the ages of 12 to 18, encouraging everyone to become successful recyclers. It contains an interactive CD and training materials. It is an inter-sectoral product of science, education and culture that provides general views on recycling "Reduce, Reuse and Recycle" at schools and at home.

To enhance the impact and to encourage further involvement, as well as facilitate the development of a knowledge network, an interactive open platform style website based on the book will be created which will not only offer a static representation of the book, it will also aim to provide a useful and dynamic source of information on lesson plans, suppliers, contacts, jobs, facts and figures relating to recycling. This will form a crucial link between stakeholders interested in recycling, allowing for the free flow and exchange of ideas, experiences, 'best practice', and contacts.

Project Location

Country: Qatar, Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, UAE and Yemen.

Region: Arab Region

Outstanding characteristics of the project

The Arab Recycling Initiative, consists of two parts, namely:

1. The pan-Arab version of the guidebook named "Rashid and Dana - The Recyclers" which is to be localised in 19 countries. In other words, it is a regional initiative developed based on a national pilot project "Rashid - The Recycler", with the aim of localising the guidebook with country specific and culturally sensitive role-models with which children can identify. The project touches on regional environmental priorities (waste management) and provides solutions. It combines together education, culture and conservation of natural resources.

2. The website will be a nexus for the pan-Arab dimension of the book where the sharing of knowledge, and the participation and inclusion of all stakeholders, from students and teachers, to practitioners and relevant awareness programmes as well as sponsors will be promoted. In keeping with UNESCO's

philosophy, all other recycling initiatives will be linked to in order to promote knowledge sharing and cooperation in order to take advantage of potential synergies.

It has been approved as an official element of the UN Decade of Education for Sustainable Development 2005-2014, and it has been selected to take part in the World Conference on Education for Sustainable Development from the 31st March to April 2nd 2009, as one of the 25 Education for Sustainable Development (ESD) projects for the conference exhibition.

Moreover, this initiative is strongly supported by 19 UNESCO national commissions, line ministries, local environment institutions as well as private sector companies. This enhances national ownership of the project and therefore ensures its sustainability.

This pan-Arab guidebook will contain an interactive CD and training materials (Train-the-Trainer and Train-the-teacher-material) in 3 languages, in addition to a publication as paper saving e-book.

Besides providing general views on recycling-, reduction- and reuse- possibilities combined with the school / student activities, the guidebook and website will offer statistical data. This will enable the reader to get an overview about waste-generation and waste treatment in the participating countries.

The guide and website will be user-friendly, simply written and logically laid out to help readers start a complete school or home recycling scheme.

www.rashid-and-dana-org

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13. Participating authors and contact details

Nasreen Al-Hashimi
Member of board of directors,
Friends of the Environment Centre (FEC)
P.O. Box 1822, Doha (Qatar)
Phone: +974 4874731
Fax: +974 4877301
Email: nalem@qu.edu.qa
Website: www.fec.org.qa

Joachim Böcker
Managing Director, BFK&partners
Hans Leistikow Str. 15
34134 Kassel (Germany)
Phone: +49 561 5603242
Fax: +49 321 21192336
Email: boecker@bfk-p.de
Webstite: www.oasis-city.com

Benno Böer
Ecological Science Advisor for the Arab Region,
UNESCO Doha Office
66, Lusail Street – West Bay
P.O. Box: 3945 – Doha (Qatar)
Phone: +974 4113290
Fax: +974 4113015
Email: b.boer@unesco.org

Marc Breulmann
Helmholtz Centre for Environmental Research
Department of Soil Ecology - UFZ
Theodor-Lieser-Straße 4
06120 Halle (Saale) (Germany)
Phone: +49 345 5585423
Fax: +49 345 5585449
Email: marc.breulmann@gx.de

Abdalla Bubtana
UNESCO
Education Sector
7 PLACE Fontenoy Paris 75007 (France)
Phone: +331 698766029
Email: abdalla_bubtana@hotmail.com
Website: www.unesco.org

Peter Bridgewater
Director, Global Garden Consulting
2, The Wharfside Station Place
Peel/ Purt ny h'Inshey
IM5 1AT, Isle of Man/Ellan Vannin
British Isles
Phone: +44 7624 221224
Fax +44 1624 840121
Email: peter@global-garden.net

Najat Mohammed Es'haqi
Lecturer (Sustainabel Development), University of Bahrain, Chemical Egnieering Department,
PO.Box 32038,
Isa Town (Kingdom of Bahrain)
Phone: +973 17 876786
Mobil: +973 39601701
Email: najat_mohd@yahoo.com

Gottfried Faulstich
Managing Director, BFK&partners
Hans Leistikow Str. 15
34134 Kassel (Germany)
Phone: +49 561 5603242
Fax: +49 321 21192336
Email: faulstich@bfk-p.de
Webstite: www.oasis-city.com

Peter Neuschäfer
Division Manger, waagner biro gulf
P.O. Box 8542, Dubai (UAE)
Phone: +971 43203870
Fax: +971 43203871
Email: wabidxb@emirates.net.ae
Website: www.waagner-biro-gulf.com

Ronald Loughland
Director: Ecological Resource Management
AES International Consultants,
Abu Dhabi (UAE)
Phone: +973 39982012
Email: ronald.loughland@aesintlconsultants.com
Website: www.aesintlconsultants.com

Maximiliane Richtzenhain
Associate Expert, World Habitat Society (WHS)
Moltkestr. 24
54292 Trier (Germany)
Phone: +49 6519928927
Mobil: +49 1782068367
Email: m.richtzenhain@world-habitat-society.org
Website: www.world-habitat-society.org

Katrin Scholz-Barth
President, SustainableQatar
Principal, Katrin Scholz-Barth Consulting
Doha (Qatar)
Phone: +974 5162764
Email: katrin@scholz-barth.com
Website: www.scholz-barth.com
Website: www.sustainableqatar.com

Henning Schwarze
Managing Director, World Habitat Society (WHS)
Paderborner Str. 11
33189 Schlangen (Germany)
Phone: +49 5252 26928380
Fax: +49 5252 26928389
Email: h.schwarze@world-habitat-society.org
Website: www.world-habitat-society.org

Mark Sutcliffe
Programme Assistant, UNESCO Doha Office
66, Lusail Street – West Bay
P.O. Box: 3945 – Doha (Qatar)
Phone: +974 4113290
Fax: +974 4113015
Email: m.sutcliffe@unesco.org
Website: www.unesco.org

Florian Techel
Chair, School of Architecture + Interior Design
Canadian University of Dubai
308 Road, right behind Shangri-La Hotel
PO Box 117781, Dubai (UAE)
Phone: +971 47096231
Fax: +974 43211991 (Att.: Florian Techel)
Email: florian@cud.ac.ae

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