BIOMASS BASED WATER ACTION PLANS FOR THE EASTERN MEDITERRANEAN COUNTRIES

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ABSTRACT: In the countries of the Eastern Mediterranean Basin agriculture consumes 87 % of the total water resources. Concurrently the water demand of tourism sites develops rapidly. The increasing water competition between these two vital sectors endangers the economic prosperity of the entire region. While agriculture provides the living basis for most of the rural population, tourism carries hopes for increasing wealth and employment in the region. Sustainable water management schemes are urgently needed, since the water conflicts lead to severe overuse of the natural water resources. Such a sustainable water management requires the exploitation of the large marginal water sources of the region. Large-scale implementations of water purification and desalination technologies require huge energy amounts. Biomass is a very suitable basis for providing the water related energy needs. The region has abundant agricultural residues from cereals, corn or palm tree plantations. Moreover, the climatic conditions are favourable for energy crops, which can be irrigated with brackish water. The implementation of biomass based waters supply schemes needs a comprehensive approach of all stakeholders in the private and public sector tackling simultaneously energy and water related issues. This approach best can be achieved by formulating intersectorial water management plans. An integrated model for sustainable water action plans is a valuable tool for supporting the preparation of biomass based water action plans easier on local and regional level.

1 INTRODUCTION

The countries of the Middle East and Northern Africa (MENA) provide a suitable case study for the worldwide water crises. In this region extreme arid climatic conditions meet a quickly growing population and expanding economic development. Moreover, the political instability of the region hinders multinational co-operation on water issues.

Two central sectors for analysing the water situation are agriculture and tourism. Agriculture being the major economic and social basis for the rural population consumes 87 % of the region scarce water resources for irrigation purposes. Parallel to that additional water contingents are required for the quickly developing tourism, which is seen as an important tool for generating additional wealth and employment in the region. The water competition between these two sectors damages the social and economic basis of the region. It forces farmers to abandon agricultural land and raises the investment costs for new tourist projects.

„MedWater Policy‰a network of water institutes from MENA and Europe has taken the task to analyse the concrete water conflicts between the vital economic sectors of agriculture and tourism and to formulate a water policy initiative for intersectorial water management in the region. Major objective is to elaborate working tools that will support decision makers in creating water management plans themselves.

2. METHODOLOGY

The network „MedWater‰analysed the water situation in five target regions, which have important agricultural activities and a quickly expanding tourism sector. The selected target regions were:

- Cap Bon Region in Tunisia
- Dead Sea Region in Jordan
- Fethiye Region in Turkey
- Jericho District in the West Bank
- Naxos Island in Greece

The research monitored the most important water supply sources and water infrastructure as well as the water related energy demand in the target regions. In a second step the water demand of the individual tourism and agricultural consumers was defined by quantity and quality at different times of the year. The results were summarised and systemised in GIS layers:

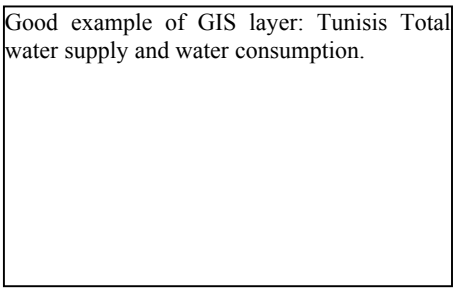

Figure 1: GIS Layer of Cap Bon region, Tunisia.

The research was particularly focused on the socio-economic framework conditions. The water supply expenses and water prices were documented. Relevant actors in the private and public sector were identified.

In a third step technologies for enhancing the efficiency of water use, for allowing larger share of water reuse and for exploiting marginal water sources were surveyed. Basis for assessing the suitability of certain technologies were the results of a field research.

In a fourth phase the research results were rounded up by the political option. Here the partners of the network will bring in their individual experience in the formulation of political strategies.

The analysis results will be summarised and systematised in an integrated model for water management which will enable local decision makers to elaborate and implement tailor made water action plans.

3. RESULTS

3.1 Water demand in the agriculture and in the tourist sector in the target regions

The water demand in the agricultural shows a very unbalanced distribution between the different periods of the year. There are two major peaks in the irrigation demand. A first one in July is followed by a second peak in September.

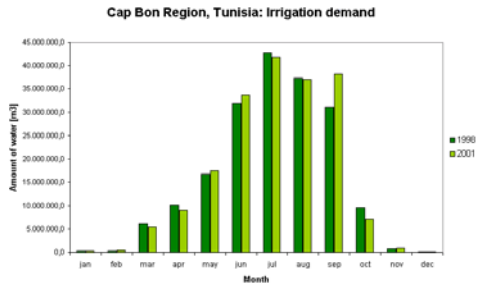

Figure 2: Irrigation demand in Cap Bon region, Tunisia

In the tourist sector the water demand is showing strong peaks in the summer months due to the fact that most tourist accommodation takes place around that time.

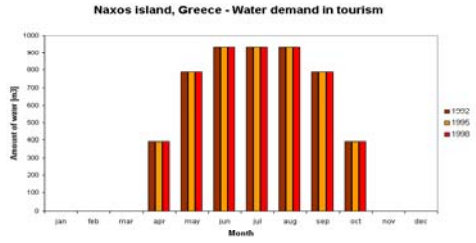

Figure 3: Tourism water demand in Naxos Island, Greece

3.2 Water supply in the target regions

The water conflicts cause a strong overuse of the limited natural resources particularly in the summer months. This leads to a dramatic decline of the natural water resources, in water quantity but especially in water quality. The non-renewable water reservoirs are diminishing rapidly; the remaining resources are threatened by seawater intrusion and by pollution from contaminated effluents. The dramatic water supply situation in the target regions are high-lighted by the fact that in the target regions of Greece, Tunisia and Palestine less than 20 % of the remaining water resources have drinking water quality.

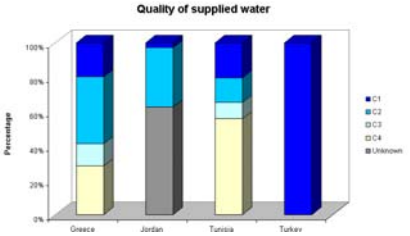

Figure 4: Water supply in the target regions

3.3 Water supply expenses

In all target regions water scarcity has driven up the expenses for fresh water supply. The exploitation of the remaining natural resources require expensive infrastructure of storage dams and long distance conveyors. In certain cases the exploitation of non-conventional water sources in decentralised units turns out to be more cost effective than additional exploitation of natural resources.

Water source	Supply expenses in Fethiye (Euro/m3), TR	Supply expenses in Cap Bon (Euro/m3), TN
Surface Water	0,092	0,54
Ground water	0,097	0,097
Treated waste water	0,46	0,1
Desalinated water		0,61

Table 1: Water supply expenses in the target regions

3.4 Fresh Water Prices

Fresh water in the target regions is considered as a public commodity rather than an economic product. Its use is connected with the payment of certain fees which are defined by political considerations rather than by the real production expenses. Subsidised water is given to user groups with special political support particularly I the agricultural sector. Consequently water supply has been a strict public monopoly for decades. The growing political view that higher prices can help to prevent the waste of water together with the raising expenses of water supply lead to a dramatic increase in water prices. All target regions raised their water prices in some cases up to 400 %. Further increase is expected in the near future. Furthermore, progressive taxation schemes have been implemented: Consumers of larger water contingents have to pay a higher price per m^3.

	Water prices for small scale irrigation in Euro	Water prices for large scale irrigation in Euro	Water prices for tourists in Euro
Island of Naxos	0,88	2,93	2,93
Dead Sea Area	0,18	1,92	1,6
Jericho district	0,16	0,48	2,24
Cap Bon region	0,01	0,092	0,58
Fethiye region	0,0034	0,0034	0,27

Table 2: Water prices in the target regions

The increase of water prices together with the on-going liberalisation has allowed the establishment of niche markets where private water supply companies exploit marginal water sources and sell the purified water. In the Gaza strip for example private entrepreneurs desalinate brackish ground water sources in decentralised desalination units. This private engagement which improves the individual supply situation needs legal framework conditions to prevent additional environmental and social damage caused by the private involvement.

3.5 Technical options for sustainable water supply

The target regions have long traditions in advanced water supply technologies. Emphasis was on storage and irrigation techniques. Today the technologies need a new focus. The current pressure on the natural water resources can be reduced significantly by large-scale implementation of technologies for exploiting the huge marginal water sources of the region like brackish water, sea water and effluents.

The water treatment for all non-conventional water sources need a lot of energy. This can be seen on the example of the target region of the Dead Sea Area:

New water related energy demand for the Dead Sea Area				
Place	**Water user**	**Water infrastructure**	**Water capacity**	**Energy demand per year**
Sweimeh	Tourism and public	Desalination site for tourism and public supply	45 MCM	**10 MVA**
Sweimeh	Tourism and public	Transport of water	45 MCM	**25 MVA**
Sweimeh	Running new hotels			**9 MVA**
Baptism Site	Tourism	Waste water treatment and brackish water desalination	0,2 MCM	**3 MVA**
Kafrein	Agricultural irrigation	Transport of water	18,4 MCM	**3 MVA**

Table 3: New water related energy demand in the Dead Sea Area

3.6 Biomass based water treatment

In many cases it is economically and technically feasible to satisfy the water related energy demand from biomass sources. Non-conventional water sources often are to be exploited in remote areas with no connection to the public grid. Most suitable are decentralised plants combining the water treatment and energy generation unit. Early research and demonstration projects have brought promising results:

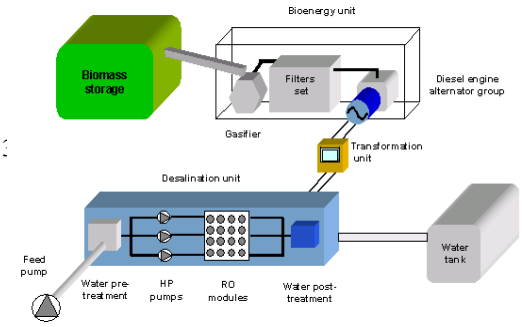

Figure 4: Scheme for a biomass based desalination scheme.

3.7 Potential for biomass feedstock

Several researchers are studying the possibilities to cultivate specific crops requiring low water inputs (i.e. cynara, sorghum, robinia, etc.) and therefore are capable to grow also in arid regions. These plantations are very suitable as energy crops for fuelling biomass energy systems. Moreover, plants are under examination, which can cope with brackish or salt water. Most promising herewith is the palm tree which is able to cope with irrigation water with high salinities.

3.8 Biomass based water management plans

The target region field research has shown the high complexity of sustainable water management. Any kind of water reform therefore has to base on clearly formulated water management plans which monitor all water supply and consume of a particular region and formulates the technical actions.

This is specially the case for biomass based water supply. The formulation on water action must include the analysis of:

- Marginal water sources
- Current and future water demand (quantity and quality)
- Biomass residues in the region
- Potential for energy crops.

4 Conclusions

In the countries of Middle East and Northern Africa the reasons and effects of the worldwide crises in water supply can be analysed in an exemplary way. The dramatic overuse in the vital economic sectors of tourism and agriculture causes the rapid deterioration of the natural water resources both in quantity and particularly in quality.

A major element of a sustainable water management in the region lies in the large-scale exploitation of the huge marginal water sources namely brackish water, seawater and wastewater. These potentials only can be exploited, if the necessary energy amounts are exploited in a decentralised and cost-effective way.

A major source for the additional energy demand can be generated from biomass. Suitable agricultural residues are abundant in the region. All research points towards the strong potential for energy crops.

The ongoing liberalisation and the recent rise in water prices helped establishing first niche markets for private water supply based on the marginal water sources. Private entities install and operate small and decentralised units combining water treatment and energy generation technologies. This privately produced fresh water is expected to augment significantly in the MENA countries and in other arid and semi arid regions in the near future. Biomass based water treatment plants which are suitable and cost effective for decentralised applications will find very interesting conditions in these emerging water supply markets.

Sustainable water management schemes require profound consideration of various aspects like water demand, water resources and various socio economic aspects. Thus, biomass based waters supply in the arid regions of this world has to base on well-designed water action plans. MedWater Policy will provide an „integrated water management tool‰ that will serve as template for water management planning on local and regional level.

ACKNOWLEDGEMENT

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