



**MEDITERRANEAN STRATEGY FOR SUSTAINABLE  
DEVELOPMENT**  
**Water use efficiency**  
**Experts Meeting**  
**Report**

Blue Plan, Sophia Antipolis,  
5 November 2008

**Plan Bleu**

Centre d'Activité Régionale

Sophia Antipolis  
Mars 2009

***Participants:***

*National Experts:* Ms. Selmin Burak (Turkey); Ms. Erna Coric (Bosnia-Herzegovina); Mr. Housney El-Azmeh (Syria) ; Mr. Mhamed Belghiti (Morocco); Mr. Fadi Comair (Lebanon); Mr. Iacovos Iacovides (Cyprus); Mr. Mohamed Hédi Louati (Tunisia) ; Mr. Manuel Sapiano (Malta) ;

*Blue Plan:* Mr. Henri-Luc Thibault, Mr. Pierre Icard, Mr. Mohammed Blinda, Ms. Gaëlle Thivet, Mrs. Julie Viglione.

## **Opening of the meeting**

In his opening speech, Mr. Henri-Luc Thibault director of the Blue Plan has recalled that the ministerial meeting of the Union for the Mediterranean in Marseilles on November 3 and 4 confirmed the proposed Union for the Mediterranean, whose headquarters is in Barcelona. The development of joint projects of sustainable development is a key objective of this union. Water should be taken into account as one of priority issues for the Mediterranean.

This resource scarcity has always been considered by the Blue Plan as part of major problems. In its recent activities, the Blue Plan has placed particular emphasis on issues relating to the water demand management (WDM). During his regional workshop on WDM in Zaragoza in March 2007, the need to improve efficiencies of water use was emphasized. The efficiency indicators are of interest and should be developed to assess progress in convincing policymakers of the benefits of better use of water.

## **Water use and feasible potential savings in the Mediterranean countries (Mr. Blinda, Blue Plan)**

Although they concentrate 7% of the world population, the Mediterranean countries have only just 3% of global water resources. In 2005, there were 180 million in water stress situation in the Mediterranean, ie having access to less than 1000 m<sup>3</sup>/inhab/y, of which 60 million are in shortage situation (less than 500 m<sup>3</sup>/inhab/y). At the global level, the Mediterranean countries gather 60% of the water poor world population.

A doubling of water demand in the Mediterranean was recorded during the last 50 years, and currently amounts to 280 km<sup>3</sup>/year. Irrigation accounts for 64% of the total water demand (45% in the North and 82% in South and East), 180 km<sup>3</sup>/year to irrigate 24 million hectares, or 7500 m<sup>3</sup>/ha/year. The demand for drinking water, it presents significant seasonal peaks. Overall, water use efficiency can be regarded as unsatisfactory. Indeed, losses in transport networks of water, leakage and user's wastage and at the plot are estimated about 100 km<sup>3</sup>/ year, almost 38% of total demand. However, significant progress in this field has been achieved, the margins of progress remain yet considerable.

In this context of increased demand, the tensions exerted on resources are increasing. Some countries presented exploitation of natural renewable water index around (or even exceeding) 100%. The figures are even more alarming when one considers that real water resources, are about half or one third of total resources. Resources considered to be non-renewable are indeed also used, up to 16 km<sup>3</sup>/year.

For the future, the projections foreseen an increase of the population of 7 million (the North) and 140 million (the South). Water demand to increase to 330 km<sup>3</sup>/year by 2025. In this horizon, 250 million of Mediterranean will be in water stress situation, including 80 million in shortage situation, these numbers increase again to reach 300 million and 260 million by 2050. The countries of South and East will be

almost all in water scarcity situation. It should be added 34 million people in shortage situation if one takes into account the increasingly predictable impacts of climate change.

The Blue Plan has currently assessed the potential for water savings to more than 72 km<sup>3</sup>/year. By 2025, a quarter of the demand could be saved, dropping it then to 246 km<sup>3</sup>/year. These estimates are based on experiences conducted in some countries willing to implement policies and measures to promote water savings. In Morocco for example, a methodology approach conducted between 2001 and 2005 in the irrigation sector revealed that the cost of m<sup>3</sup> of water saved by the establishment of saving water irrigation system (localized) was much lower than the cost of m<sup>3</sup> of water newly mobilized. This study also showed that the amount saved would provide a significant additional value compared to the cost of investment and was thus profitable for the farmer (income enhancement). The interest of this work is to emphasize since they evaluate the impact of benefits on both the economic and the social and environmental.

## Discussion

Mr. Comair (Lebanon) mentions the importance of currently choices for future generations. According to him, the major axes of reflection must be:

- Water demand management in terms of both "macromediterranean" and "micromediterranean";
- The reuse of wastewater using secondary and tertiary treatment;
- The concept of "new water" cumulated freshwater treated wastewater and desalination, subject to precise regulations and criteria (a limit of 7000 m<sup>3</sup>/ha/year for irrigation, 200 L / day / person for drinking water and 30% of the volume assigned for the industry). The exploitation of this concept could help to find equitable solutions to water for the Jordan for example.

Mr. Thibault (Blue Plan) approves the necessity to articulate a global approach and a local approach, hence the interests of consultation in common on the national studies. The fixed objectives must be formulated at the regional and sub-regional levels. Mr. Icard (Blue Plan) emphasizes the importance of sharing the different countries' work. The issue of water scarcity, processed at the level of watersheds, affects the countries of North and the South, and there is reason to believe in the existence of "water in abundance in the North / drought in the South" roughly cutoff type

Mr. Belghiti (Morocco) says that the agricultural sector, the biggest consumer of water, is to be particularly studied because it is often the most affected by the problems of scarcity. He stresses the necessity to integrate into the reflection, the time required to implement concrete policies and measures WDM involving behavioral changes.

Ms. Burak (Turkey) emphasizes the importance of regional studies, the work on the efficiency and the watershed management in particular, that have much influence on decision makers in different countries.

Finally, Mr. Thibault (Blue Plan) emphasizes the need to adopt a comprehensible language, adapted to the general public, in order not to be limited to an audience already aware and convinced (speaking of "poor water" for a population below 1000 m<sup>3</sup>/inhab/y - indicator based on the natural renewable water resources of one country - is, for example, not easily understandable).

## National report: Bosnia-Herzegovina (Mrs. Coric)

The case of Bosnia-Herzegovina is a special case. Local experts have encountered many constraints for the calculation of indices of efficiency; ultimately, they couldn't be calculated using the methodology that Blue Plan recommended. Among these constraints, there are : the absence of a system of indicators at national level, the lack of organization in the water sector , the lack of funding, and the destruction of many infrastructures (systems of irrigation) during the war.

The new Water Law (2006) refers to the gradual alignment with the WFD. It must lead to the development of two management strategies (one for each of the two constituent entities of the country); following which both of the river basin plan management will be introduced (before 2012 and 2015).

Water public companies manage drinking water supply, as well as that of the industries connected to public network. These companies do not always have meters running. The values used for calculations are estimates. Irrigation systems are managed by farmers, agricultural enterprises or associations. There is currently almost no transmission of data on irrigation, but the new laws should remedy to it.

The data used for calculations are from the national statistics agency and the two regional offices (one for each entity), as well as water agencies in preparation. Self-supply (irrigation and community or individual systems for drinking water) could not be taken into account. The volume of water distributed by each method of irrigation is not known. Finally, no data are available on the quantities consumed and recycled by industry. Based on the limited data available, the total efficiency has been estimated at 53% in 2006.

Sector	Efficiency	Remarque
Domestic water	Losses rate = 46,5% (2005)  Economic efficiency = 66,4% (2005)	Formula used : Unaccounted for water rate (%) = total water volume invoiced / total water volume produced  Revenue collection from households (%) = total water volume paid by households / total water volume invoiced to households
Irrigation	V4 unknown ; E2=55% (1990)	
Industrial water	No data	
Total	E <sub>tot</sub> =53% (2006)	Formula used : E <sub>tot</sub> = total water delivered (invoiced) / total water abstracted (produced)

### National report: Cyprus (Mr. Iacovides)

The government agency (Government Water Works (GWW)) provides:

- 80% of the Drinking water (controlled by the Water Development Department (WDD))
- the Irrigation up to 40%
- the Industry up to 80%

The WIS or Invoicing Water System, maintained by the WDD is a major tool of water management in the country, it is a central database, connected to 35 terminals, covering the sectors of drinking water and irrigation. It allows monitoring the structure and maintenance of networks, but also provides information on consumption (users, methods, volumes) and information on losses. This is a comprehensive system to ensure control of the quantities supplied and paid.

The total efficiency index is about 82%.

The drinking water efficiency, close to 92% today, has been rising since 1999. The current data take into account the sources that were not previously considered. The percentage of water invoiced ("Non Revenue Water" NRW) is 32% in large cities (municipalities), 29% in small cities (Communities) and 23.5% for the Water Boards (in decline since 1983 except a peak in 1998). On average, these figures vary between 18 and 38% depending on the public service responsibility. The losses are mostly due to ageing

infrastructure and meters. The efficiency of industrial water (supplied by the public network) is 90%. The industrial water demand is relatively low and stable (41 major industries throughout the country).

The irrigation network's efficiency shows losses of about 20%, this figure is the result of erroneous measures part of 40 meters. The efficiency plot is 84% in 2000, an increase with the development of localized irrigation systems. Financial and techniques grants have been developed for the conversion to modern irrigation systems and today nearly 95% of irrigated lands have been equipped, about 22 000 ha. The savings were estimated to 75 million m<sup>3</sup>/year, yields of 15 to 76%, a cost / benefit ratio of 10,3: 1.

Sector	Efficiency	Remarque
Domestic water	$E_{pot}=92\%$	Losses in the distribution network.
Irrigation	$E_{irr}=80\%$	Many counters wrong. Modern systems developed.
Industrial water	$E_{ind}=90\%$	Low demand (few industries). Index estimated from $E_{pot}$ .
Total	$E_{tot}=82\%$	

### National report: Lebanon (Mr. Comair)

The country has identified three priority topics of work: environmental protection, exploitation of groundwater and regulation. A decennial strategy was established for the exploitation of the surface resource through dams and ponds, although criticized, these storage methods are needed in Lebanon. This strategy also includes the artificial recharge of groundwater and new legislation and regulation. Four basin agencies were created, and a new water code (2000) which will be applied and a public-private partnership for the city of Tripoli. The country has benefited from the support of the AFD, the Conseil Régional Rhône-Alpes, USAID and the European Investment Bank.

Mr. Comair evokes the effects of climate change on his country and its future impact on water resources: large variations in temperatures, melting glaciers...

The equitable sharing of international rivers is a major issue for Lebanon. The territory includes three rivers which crossing also Syria, Turkey, the Palestinian territories and Israel, which involves a complex, work on transboundary basins. However, the most important river is the Litani River, which alone represents 28% of surface runoff and is located entirely on Lebanese territory. The supply of water during the low water period (July to October) is another problem.

Lebanon has 4.8 million with a growth of 2.5% / year. Water demand is 500 million m<sup>3</sup> for drinking water, 900 million m<sup>3</sup> for irrigation and 150 million m<sup>3</sup> for industry (30% of the total allocated to drinking water). Consumptions assign to the agricultural sector have been planned for years to come: 10 000 m<sup>3</sup>/ha/year in 2000, 8000 m<sup>3</sup>/ha/year in 2015 and 6000 m<sup>3</sup>/ha/year in 2020. The irrigated areas are currently 100 000 ha (70% under surface irrigation, sprinkler 20% and 10% in localized irrigation) and should reach 280 000 ha by 2040. The inevitable increase in demands should be accompanied by greater mobilization of resources, 1.5 km<sup>3</sup>/ year in 2000 to 2.7 km<sup>3</sup>/year by 2040.

The different efficiency indices calculated are shown below:

Sector	Efficiency	Remarque
Domestic water	$E_{pot}=70\%$	30% of losses at transport network
Irrigation	$E_{irr}=35,4\%$	40% of losses at transport network.
Industrial water	$E_{ind}=5\%$	Objective: 40% by 2040.
Total	$E_{tot}=39,4\%$	Growing steadily since 2000, should reach 47% in 2040.

## Discussion

Ms. Burak (Turkey) and Coric (Bosnia) report a lack of clarity in the definition of "volume of water invoiced and paid by the user" V1 and distinction should be made between the volume invoiced and actually paid. Ms. Burak has made this distinction in her report.

Mr. Comair (Lebanon) deplores the lack of frequent updating of database systems, efforts should be focused on these tools, especially for emerging countries. In Lebanon, according to him, the volumes invoiced are difficult to assess.

Mr. Al-Azmeh (Syria) says that V1 should refer only to volumes invoiced and paid, the volume not paid being considered as losses; this last point was supported by Mr. Iacovides (Cyprus).

Mr. Louati (Tunisia) says that in his country the water is subject to internannual regulation, a certain volume being raised for 15 to 17 months to support the following year's needs. He therefore wondered about the place in the efficiency calculations of the volume produced but not used. He also discusses the problem of calculating the efficiency of industrial water, complicated by the fact that industries are often fed from network public and from Self-supply. Finally, he considers that it is generally difficult to calculate the efficiency of such badly known a resource as water is.

Mr. Belghiti (Morocco) says that the concept of efficiency should be taken as defined by the Blue Plan. Clear information must be provided to decision makers, particularly on water savings: the increased efficiencies do not effectively gain water but helps facing the shortage.

Mr. Blinda (Blue Plan) states that V1 concerns the volumes actually invoiced and paid, since there is an interest in use efficiency. He is concerned with the easy data access in the different countries.

Mr. Comair (Lebanon) says that his data come from the Directorate General of Hydraulic and Electrical Resources (DGRHE) and the four offices of the water working with systems of gauges, the rates for domestic uses is based on surface and methods of abstractions (on average a maximum of 150 € / capita / year). Illegal abstractions remain however. The introduction of management by telemetry, which should be effective within three years, should allow proper collection of data on distribution networks. Regarding irrigation, he deplores the lack of a clear knowledge of pricing; the country has, however, clear and recent figures for the volumes issued, both overall and by method of irrigation.

Mr. Iacovides (Cyprus) says that his country has a good control of the volumes delivered and invoiced, except for the irrigation sector which is powered for approximately 30% by the government. An effort was made \_ and continues to be done \_ to acquire reliable data, eg for domestic use, the development of people networks putting together the different stakeholders.

Mr. Icard (Blue Plan) emphasizes the importance of governance in the water sector. This is a work trail that appears on a recurring basis.

Mr. Thibault (Blue Plan) refers to the case of Bosnia, which demonstrates the primacy of data collection, necessary for Water bodies in the development of strategies and for setting targets. Good governance of the sector greatly facilitates access to information (eg Cyprus). He added that the Conventions were adopted on a collective level, data and definitions should be the same for everyone for working effectively. This is a difficulty well known by the Blue Plan. Finally, he alluded to the interest of a prospective work(eg Lebanon), the figures should not be static data but instruments to guide future actions.

### **National report: Malta (Mr. Sapiano)**

Since 2000, the Water Framework Directive (WFD) has led the country to focus on the quantitative and quality status of surface resources. Reduced demand by 20% (or 7 Mm<sup>3</sup>) would ensure compliance with the WFD, and measures will be undertaken in this direction.

The public service "Water Service Corporation" ensures the production and distribution of water in urban areas. Nationally, nearly 42% of supplies are made through numerous private abstractions points. The WSC has been conducting for more than 10 years an extensive program of rehabilitation of networks, which has enabled a reduction in losses of 19 m<sup>3</sup>/km/day to 4.56 m<sup>3</sup>/km/day, the objective being to reach 2,11 m<sup>3</sup>/km/day by 2010. This program allows a steady increase in the index of drinking water efficiency. Actions are also planned at the household level, with the adjustment of household equipments to increase their efficiency.

Reflection is also committed to reduce the large proportion of unpaid water and solve the problems of measures by replacing defective meters.

Irrigation, representing the largest share of consumption, is entirely self-supplied in the absence of a national network. Data collection for this sector is difficult. Recently launched, an extensive program of census based on a legal obligation of reporting private sources of supply should be addressed. Indicator E1 (transport efficiency) was estimated at 90%, as losses related to distribution are virtually nonexistent. The irrigated areas account for 2000ha to 85% by drip irrigation. Action at the level of demand management should be considered for optimal use of these modern irrigation methods.

Because of their small size, the Maltese industries are generally reluctant to establish recycling, as the original cost of investment needed appear insurmountable. Few data on this sector are currently available. On the scale of cities, some actions that were undertaken have nonetheless had a visible impact on the share of water of the public network allocated to the industry.

The different efficiency indices calculated for the water supplied by the utility (WSC) are listed below:

<b>Sector</b>	<b>Efficiency</b>	<b>Remarque</b>
Domestic water	$E_{pot}=55\%$ (2004)	Increasing demand. Program effective related to leakage reduction.
Irrigation	$E_{irr}=78\%$ (2001)	No distribution system: Self-supply with abstractions at the place of use ( $E1 = 90\%$ )
Industrial water	$E_{ind}=5\%$	Relatively low demand. Slow introduction of recycling.
Total	$E_{tot}= ?$	

### **National report: Morocco (Mr. Belghiti)**

With the increasing needs and decreasing resources, water demand management is at the heart of the challenges the country. Resources have decreased to -40% in some watersheds, most of the development costs of supply are rising strongly. Mr. Belghiti wondered whether it might be desirable to separate the part of tourism consumption.

He emphasizes the importance of supporting technical progress by institutional reforms giving responsibility to the actors. The water sector in Morocco has four main levels of governance:

- Advisory Bodies
- Coordination Bodies
- Instances of planning and sectoral decision
- Operators and users ORMVA (Office Régional de Mise en Valeur Agricole), user associations, basin agencies, boards, ONEP.

Also worth noting, the existence of a central commission of prices.

Through volumetric measurement or counting, the Office National de l'Eau Potable (ONEP) centralizes information on the production of water for domestic uses and partly for the industry (12%), hence a certain difficulty to see clearly the industrial consumption. The ONEP ensures 80% of the production of drinking water and 28% of distribution in urban areas. The distribution of drinking water in big cities is provided to 70% by Boards or by private companies (3 companies delegated for 4 major cities and 13 autonomous Boards for other major cities).

In the irrigation sector, reliable data about the big hydraulic are available. The invoicing is done in terms of volumes consumed, estimated indirectly. For small and medium hydraulic, the data are based on estimates of crops water requirements. The volumes consumed by individual irrigation units (direct abstractions into the tables) are difficult to assess. Moreover, differences between upstream and the plot amounted to 700 million m<sup>3</sup>, but should not necessarily be considered as losses.

Various constraints on access to information remain, particularly the lack of an updated hydrological directory and statistics on the Internet, the lack of maintenance and updating of databases, weak or non-accessibility data at the national level.

Sector	Efficiency	Remarque
Domestic water	$E_{pot}=74\%$ for ONEP(2006)	Data from other operators not always reliable or accessible.
Irrigation	$E_{irr}=80\%$ (2003) for ORMVA (big hydraulic)	Insufficient data on the PMH and private irrigation. Accelerated pace of systems modernization.
Industrial water	Insufficient Data	Actions taken by some major industries.
Total	Network of water supply : efficiency=93% (2006) for ONEP	Data from other operators not always reliable or accessible.

### National report: Syria (Mr. Al-Azmeh)

The different efficiency indices are rising for several years, both overall and sectoral level. For drinking water, efficiency has increased for 10 years up to reach 60% today, with the aim of reaching 90% by 2030. The volumes produced and invoiced (respectively V1 and V2) were calculated from available statistics and evaluated according to the future growth and the rate of coverage provided (100% by 2025). The five-year development plan (2006-2010) aims to reduce financial and administrative losses to 22% in urban areas and 27% in rural areas. The strong increase in pressure on the resources foreseen for after 2015 leads to a major effort in lowering losses.

The efficiency of irrigation water (90% of demand) is close to 45% and could reach 70% by 2030. The total volume of water allocated to this sector (V4) has known a peak in 2005 but is expected to decline in coming years as far as the horizontal increase in irrigated area is limited. Losses upstream of the plots are low due to the lack of distribution networks (E1 close to 90%), the possible savings will then be focused on the conversion to modern systems of irrigation.

The calculations for the industry sector were made from very approximate data. Public authorities wishing to improve the control of small quantities consumed and recycled, while taking measures to reach an efficiency of industrial water to 40% by 2030.

Sector	Efficiency	Remarque
Domestic water	$E_{pot}=60,2\%$ (2005)	Target: 90% by 2030 according to the prospective experts.
Irrigation	$E_{irr}=44,7\%$ (2005)	Objective: 70% by 2030 according to the prospective experts.
Industrial water	$E_{ind}=5\%$ (2005)	Very approximate data based on expert analysis.
Total	$E_{tot}=44,96\%$ (2005)	

## Discussion

Ms. Burak (Turkey) asked about the distinction made in Malta between two types of losses. Mr. Sapiano (Malta) says that the losses so-called "real" are due to distribution networks, which are physical loss, while those so-called "apparent" refer to the volumes consumed but not invoiced due to bad functioning meters.

When asked by Mr Comair on (Lebanon) onto the use of desalination for irrigation in Morocco, Mr. Belghiti (Morocco) answers that this technique is currently used for the production of drinking water, but could be envisaged in agriculture in some cases, especially for high added valued crops in areas in water stress situation following the groundwater overexploitation. He then referred to very complete the cost / benefit study conducted in his country on the savings water by putting in place measures to manage water demand in irrigation. This work has shown that, if fully supported by farmers, the investment costs are not necessarily supportable; as they are for example for gardening, but not for food crops.

Mr. Iacovides (Cyprus) comes back to the question of desalination by specifying that in his country, thought is being given to the effluents desalination.

Mr. Al-Azmeh (Syria) says that the volume allocated to industry in the figures provided by Morocco seems a bit low. Mr. Belghiti (Morocco) confirmed that some of the industrial water is counted in the drinking water since the use of small and medium industries located in the city are difficult to separate from domestic consumption. He goes back then on the suggestion in his speech concerning the impact of tourism consumption, that, if conducted, the study on the subject must be economically justified by its cost-benefit ratio. The industry already had part of the data needed, and surveys could be conducted at intervals of 5 or 10 years. Mr. Belghiti then asks about the possibilities of the wastewater recycling of the tourism sector and how to take it into account in the calculations of efficiency. Mr. Louati (Tunisia) precises that in the case of Tunisia, such a study on tourism would be feasible since there is only one distributor, the part dedicated to the operators would be isolated more than 90%. However, it should put the importance of tourism demand in relation to agriculture, since, comparatively; a significant effort given to the tourism sector would not make big water savings. Mr. Icard (Blue Plan) supports this point and

adds that to remain competitive, a destination cannot pass on the management of its water on tourist fares. The problem must therefore be treated at a very local level. Finally, Mr. Iacovides (Cyprus) says that a study of this type has already been elaborated in Cyprus and has revealed that tourism consumption is about 450L per tourist per day, or 11% of total domestic consumption. The calculations were made based on data from hotels grouped by classification.

### **National report: Tunisia (Mr. Louati)**

In the sector of domestic water, the volumes produced, distributed and consumed are known. Four performance indicators are calculated since 2007 by the Steering Committee SONEDE (in charge of production and distribution at national level): return on distribution network, performance on the water supply network, the overall performance and performance on transfer network. The networks have the characteristic of transporting water over long distances (up to 400 km), which generates most consistent losses. The cost / benefit studies were elaborated and revealed potential savings of more than 900 m<sup>3</sup>, if one weighs the estimated financial gain and investment requirements, works are profitable with a deadline for return on investment of less than 4 years.

With regard to irrigation, 75% of irrigated areas are with water saving means, with a target of 100% for 2009. Each of the three methods of irrigation (surface, sprinkler and localized) is about one third of irrigated land. A system of monitoring and evaluation of water saving irrigation can check the efficiency of each technique. The studies show that the water savings could be between 9 to 14% (depending on the type of culture), which is a significant additional benefit to the recovery of investment (to 278% across the country) with a deadline for return on investment average of 1.7 years. It is from the agricultural sector, which represents 80% of water demand, that will come the majority of water savings in the future, through improving the technical effectiveness and feasibility studies to reason the construction of new irrigated areas (National Plan for Irrigation Water Saving PNEEI adopted in 1995).

Three types of measures have been implemented to improve efficiencies:

- Regulatory measures: increasing investment subsidies of 40, 50 or even 60% ,
- Technical measures: changing non-standard sensors, networks equipment systems of regulation, research of leaks (8300 km inspected in 2007),
- Institutional measures: Delegation of the maintenance and management of collective groups of interest, both for domestic water and irrigation.

Sector	Efficiency	Remarque
Domestic water	$E_{pot}=77,3\%$ (2007)	Target : 80% en 2025 regarding PNEEI
Irrigation	$E_{irr}=52\%$ (2007)	Objective : 85% en 2025 regarding PNEEI
Industrial water	Non distinguished from domestic water	
Total	?	

### **National report: Turkey (Ms. Burak)**

Ms. Burak says firstly that for calculating the efficiency of drinking water, the experts took into account the volume V1 invoiced and paid by the user, and V2 the volume produced and distributed. The volumes of water not paid are not included in the calculations of efficiency. Moreover, in Turkish study, we may specify that the terms water "potable", "urban" and "City" means the same volumes.

The surveys elaborated by TURKSTAT are based on cities (urban consumption). Urban and Municipal correspond to the same volume but do not cover the use of drinking water in rural areas which is not identified and that corresponds to an insignificant proportion compared to the so called 'urban' use (distribution by cities networks).

The municipal networks supply three types of uses: domestic (household), commercial and industrial, and public. This sectoral efficiency reflects the physical efficiency (losses) networks and the commercial efficiency of the responsible authority (ability to cover the costs). The latter is a function of water unaccounted NRW "Non Revenue Water ", which includes both the physical losses (" real ") and non-physical (" apparent "or" commercial "), ie water uninvoiced, either voluntarily or not (illegal connections to the network). The water volumes consumed illegally are unknown by statistical institutes. Three recent case studies, confirmed in 2006 by the national results, assess the percentage of water voluntarily uninvoiced (mosques, parks, cemeteries, fire) to 2%. The efficiency of drinking water is currently about 45% at national level; the figure is highly variable at the regional level. Ms. Burak cites the example of the city of Bursa (Anatolia), where efficiency is increased from 50 to 75% in 10 years with new investments controlled. The methodology used in Bursa should serve as an example for cities like Mersin where the rate of NRW reached 67%. The importance to take action in this regard is strengthened by the application of the country to the European Union: Turkey needs to comply with EU directives to integrate the EU set deadline. The rehabilitation of networks has been identified as being the priority investment.

Turkey has 8.5 million ha of irrigable land. The goal of reaching 100% of the land effectively irrigated by 2030 now seems today hardly feasible. 2,5 million ha are equipped with SDI, the main public institution responsible for national water resources management, but only 1.7 million ha were actually irrigated in 2007. Various reasons are cited: lack of water (3% of cases), inadequate irrigation (6%), economic and social reasons (22%)... The government hopes to increase the coverage of irrigation network with closed systems (closed conduits / pumping) from 11 to 40% by 2025. The surface resources used for irrigation are 81%, used mainly by surface systems, and 19% groundwater. Practices "over-irrigation have been identified. The current national policy aims to increase the "crop per drop", rather than increased volumes of water made.

In the industrial sector, a distinction was drawn between "water reuse", which leaves the production system, and " recycled ", which passes from one stage to another system. As part of its application to the European Union, Turkey must agree to the IPPC Directive. Studies are under way, through surveys in key industries.

Sector	Efficiency	Remarque
Domestic water	$E_{pot}=50\%$	NRW often above 50%, poorly measured.
Irrigation	$E_{irr}=45\%$	Objective: 50% to 60% by 2025 with the extension of the network.
Industrial water	Manque de données ; $E_{ind}$ estimé à 25%	Highly polluting industries identified, planned actions.
Total	$E_{tot}=33\%$	Ensuring compliance with EU directives involves important actions in the 3 sectors.

## Discussion

Mr. Belghiti (Morocco) stresses the need to harmonize definitions of theoretical efficiencies, as well as the distinction between industrial water recycled and reused, so that clear comparisons can be made between countries. Mr. Blinda also emphasizes the issue of water volumes uninvoiced, in Turkey, according to Ms.

Burak, it is "commercial losses", both illegal (clandestine) and authorized (eg places of worship). Mr. Al-Azmeh (Syria) redefined the definitions of reused and recycled water:

- Reuse = should be considered as a new resource (eg treated water by industries subsequently used for agriculture)
- Recycled = what remains in the industrial process

These definitions, exacts with those provided by Eurostat, are those that were seen in Turkey.

Mr. Iacovides (Cyprus) says that the index  $E_{pot}$  ignores the estimated huge losses within households. Mr. Blinda (Blue Plan) adds that the efficiency objective of the pricing system is to change individual behavior through incentive policies. In Tunisia, there are audits made, according to Mr. Louati, to determine the causes of a consumption that is too high in a society or even a household. In Cyprus, water invoices include a graph reflecting the consumption of 12 months, allowing the user to easily identify a possible peak. Mr. Belghiti (Morocco) agrees that it would be interesting to know the losses within the household, but that such control is difficult. In some countries, water-saving systems are installed at homes. Ms. Thivet (Blue Plan) concludes the matter stating that the indicator  $E_{pot}$  efficiency relates (physical and economic) on distribution modes of drinking water, selected as an indicator of priority of the Mediterranean Strategy for Sustainable Development, as it encompasses the elements on which policy-makers can act and set goals. The components used in the household could be included in future work. Currently, it would be more interesting to pay attention to the uses within industries.

Mr. Louati (Tunisia) evokes the difference between the objectives of the domestic and agricultural sectors. In the topic of drinking water, the pricing is often dissuasive enough to prevent waste; in Tunisia for example, if consumption of a user exceeds a certain threshold, it increases fivefold the price of  $m^3$  consumed. Agriculture, however must be regarded as an economic activity, it is a sector where real water savings can be achieved, more than industry where accurate data are rarely reported.

Mr. Iacovides (Cyprus) asks about the future of saved water: is it coherent to use the water saved by modern irrigation methods to increase the irrigated area? The consumptions management is not relegated to second plan. Ms. Thivet adds that the term "technical" water savings "is also subject to controversy since water is not really saved but used for other requirements. Mr. Louati illustrates this by the example of new developed irrigated areas in Tunisia, which have ultimately proved to be more extensive than it had been anticipated. Reflection on the new stores has improved since five years and must continue.

Mr. Belghiti advances that, if the aim is to reduce demand or increase efficiencies, the methodology to be used differs. There is indeed no interest in reducing demand in the developing regions.

## **General discussion: policies and priority actions**

### **Bosnia-Herzegovina**

The country is still in a particular situation. The current master plan just gives the direction and goals for the 15 or 20 years to come, including:

- Improving access to drinking water (60 to 80% of the population connected to the network);
- Reducing losses for any purpose, without any distinction between the sectors (50 to 20% losses);
- Setting up meters for all sectors (no schedule);
- Removing illegal connections.

No guidance is provided regarding efficiencies. This plan should provide the basis for finalizing the water management strategies in preparation for the last two years, which will give more specific targets.

### **Cyprus**

Despite the lack of an explicit national strategy and deadlines, improving the use efficiency is a priority of national plans and policies on water as well as development plans. The conclusions reached in October 2007 by the European Commission on drought and water shortages have been taken into account and the focus was on issues related to water demand management. In general, we can note among the national objectives:

- The creation of a unit (a technician and an engineer) that specializes in the collection and analysis of data needed for efficiencies calculation;
- The Improvement of the collection and access to information (hardware, databases);
- The Precise identification of the volumes delivered and consumed in each sector;
- The development of an inter-sectors network, with the organization of workshops between correspondents;
- The conduction of audits: inventory of equipment in order to detect leaks.

### **Lebanon**

The decennial strategy implemented in 2000 includes various technical aspects: assurance of additional resources, improvement of drinking water networks' efficiency (reduction of losses from 40 to 30% in Beirut and from 50 to 25% in Tripoli these last 15 years) and of the irrigation, extension wise of irrigated area, wastewater reuse, recharged of groundwater, risk management (floods). An institutional reorganization plan is necessary, leading to the creation of water offices.

Progress is also done in the topic of demand management: meeting the needs with a flexible and reliable management. The adoption of new practices and measures must also be considered, as well as increasing the availability via the exploitation of unconventional resources. Mr. Comair again addresses the concept of "new water mass" issued from the combination of conventional and unconventional resources, which might help to unblock the economic, physical and social situations. The environmental dimension (water quality) must not be excluded. The pricing must be seen as an important management and efficient tool. The aim is to encourage and expand the debate on the water to take an interest to its economic value. Often, improving efficiencies goes together with improving the services. The public-private partnership represents a channel to explore.

Reflection, to be effective, requires the implementation of different tools: professional adapted training, databases at catchment level, institutional reorganization, communication between technicians, managers and researchers involving universities and high schools of engineers. The aim is to cover the same issues in the environmental, social and economic dimensions.

### **Malta**

At the national level, the main objective is to implement the principles of the Water Framework Directive. Reducing the exploitation of groundwater is also one of the priorities of the country. Two levels of action are to be considered:

- Government Level : reducing leaks and losses, starting with improved metering systems, and setting up a national strategy for the wastewater reuse
- Local level: increasing the efficiency of household with adapted equipment and public awareness.

In agriculture, the only possible actions are related to demand management. However, data collections must be focused on.

Finally, in the industrial sector, an effort must be made to the promotion of actions for water recycling.

### **Morocco**

The question of improving the efficiencies cannot be processed without any responsibility of all actors involved. Water demand management is a key issue, but cannot be addressed without the proper tools, especially in Institutional level:

- Creation of a good system of regulation: the role of the Water Interministerial Commission;
- Development of public-private partnership;
  
- Public-public contracting;
  
- Reflection on pricing, which will enable both recovering the cost and giving responsibility for all stakeholders.

Management efficiency appears to be mainly an institutional problem.

### **Syria**

An important objective is to remedy to problems of shortages encountered in some watersheds, resulting in the decrease of groundwater level

This is to rethink the allocation of water resources among different sectors (Water Strategy of the Syrian Arab Republic adopted in March 2003), while stopping gradually abstractions on non-renewable resources.

The main way of reflexion is the rationalization of agricultural demand. The importance of the agricultural sector is clearly demonstrated by the efficiency indices calculated, the total efficiency being almost equal to the irrigation efficiency. The National Program for Conversion to Modern Irrigation set up in February 2005 describes an inventory of sector, makes recommendations for actions with their estimated costs and establishes a special fund particularly providing loans to farmers to convert to modern irrigation systems.

### **Tunisia**

Planning at the national level is difficult because of huge differences between the regional situations in the north and south of the country. The work currently undertaken will concern, by 2050, sustainability and availability of the resource. There is no "right to water" but a "right to use water", thus avoiding the problems of speculation.

The future strategies will focus on counting, the hydraulic installations interconnections (20 dams throughout the country), the control systems downstream, the measurement of breakage per meter of network to identify segments with high loss, wastewater reuse and desalination. The latter will be considered as a potential source of supply outside the cities.

### **Turkey**

The country seeks primarily to comply with European Union directives, in particular the IPPC Directive for the industrial sector. In agriculture, improved efficiencies will be through the decrease of water demand, with the development of micro-irrigation and closed irrigation systems. This is a major objective, clearly present in the willingness of government officials.

The present climatic situation is an incentive, but it remains to find ways to involve the elected representatives. The information must be clear to all levels to responsabilize all the actors. The people in financial payment difficulty must be identified in order to find solutions.

In general, regulation is abundant, for all sectors, but the follow-up remains frequently problematic. It is also necessary to establish the clear terms of reference for an harmonization between the different collaborating countries.

Mr. Icard pinpoints the common element to all the day's interventions: improving efficiencies must be backed up by institutional reforms. The Blue Plan can be a player in regional cooperation, playing a role of facilitator between the countries. Acceptance of the indicators should be the same for everyone. One asks oneself about the interest of the value of sectoral indicators in relation to a single global indicator; they have the advantage to push to the data collection improvement. For good economic approach, it is important to quantify feasible efficiency gains. The discussions and exchange of ideas must be pursued; the case studies provide a good perspective at a regional scale.

Mr. Belghiti (Morocco) says that economic aspects cannot be properly dealt with if the social dimension is not integrated. We must always weigh up the two aspects by determining who are the beneficiaries of feasible savings? For example, the agricultural sector should not be neglected because its added value to the m<sup>3</sup> is lower than for other sectors, being however a very important social contributor.

Mr. Comair (Lebanon) stresses the capital character of various indicators and suggests launching investigations by mail.

Ms. Thivet evokes the interest of the Blue Plan for case studies involving analysis of the added value per m<sup>3</sup> of water used and cost / benefits of new measures or investments.

Mr Louati says that it is important that the group continues to work together on efficiency issues. The Blue Plan has the best position to take a multidisciplinary approach.

Mr. Al-Azmeh stresses the need to standardize the languages between the Blue Plan, the different countries and the local managers within countries. He proposes the creation within the country of specialized small units, in conjunction with the Blue Plan. Mr. Belghiti says that if the Blue Plan is a good regional leader, national leaders are also essential to overcome sectoral resistance.

### **Synthesis and conclusion (Mr. Thibault)**

All that the Blue Plan produces and provides is the result of the work of national experts from different countries. It regularly call upon national experts' contribution, more aware of local realities. Having long focused on natural resources, the Blue Plan is taking into account the socio-economic approach to try to convince policy makers, because of the current and futures tensions.

The work on the efficiencies, to be effectively pursued and strengthened, calls for a common language. This involves improving data collection systems, which have not a single academic role but are real tools for decision support. The research on the use of unconventional resources must not be overlooked.

In a country, the cost of improving the efficiency is at the same time social, cultural and economic. For interested policy makers, we must know both the cost of non action, but also and especially that of action.

The work undertaken has economic implications but also political, with an important local dimension, hence the interest of a collective exchange in the Mediterranean. The idea of establishing within countries small units that could work in conjunction with the Blue Plan is interesting. The Mediterranean Strategy for Sustainable Development adopted in 2005 is a "framework strategy "that can inspire the development of national strategies for sustainable development. If it is to establish collective action and to guide policy decisions, it is well for each country to set its own objectives. The Mediterranean Strategy is perhaps insufficiently known outside the initiated circle.

The Blue Plan will develop a work program to include both methods of calculation of indicators and socio-economic aspects, which will submit to the Working Group established by the national experts who participated in this meeting. This working group could be expanded to other national and international experts.

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