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30e anniversary of Institut Méditerranéen de l'Eau

Perspectives on sustainable water resources management in the Mediterranean

REGIONAL SEMINAR

WATER AND ENERGY

7 - 8 February 2013

World Trade Center of Marseille

IME

30 years

Thursday 7 February 2013

8:30 - 9:00 REGISTRATION

9:00 - 10:00 OPENING CEREMONY

Milagros Couchoud
President of Institut Méditerranéen de l'Eau

Anne-Marie Colombier
Regional Director of Electricité de France

Henri Marty-Gauquié
Director of the European Investment Bank

Martine Vassal
Deputy Mayor of Marseille

Rafiq Husseini
Deputy General Secretary for Environment and Water, the Union for the Mediterranean

10:00 - 12:45
ROUNDTABLE 1

IMPACT CLIMATE CHANGE ON WATER AND ENERGY

President Dominique Roux - *Electricité de France*

Experts referent
Hugues Ravenel *Plan Bleu*
Irina Valarié *Conseil Général de l'Hérault*

Moderator Marie-Isabelle Fernandez
Electricité de France

INTRODUCTION

Energy Prospective and climate change in the Mediterranean
Houda Ben Jannet Allal
Observatoire Méditerranéen de l'Energie

CASE STUDIES

Impact of climate change in water field on the Rhone-Méditerranée-Corse basins: Assessment of knowledge
Martin Guespereau
Agence de l'Eau Rhône-Méditerranée-Corse, France

R2D2 Project (Risk, Water Resource and Sustainable Management of Durance in 2050) and Governance of water and energy
Laure Santoni *Electricité de France*

Carbon-Credits: a potential source of energy and operational cost recovery in wastewater treatment plants in Egypt
Rifaat Abdel Wahaab
Holding Company for Water and Wastewater, Egypte

DEBATE

11:00 - 11:15 COFFEE BREAK
11:15 - 12:15 WORKING GROUPS
12:15 - 12:45 ROUNDTABLE 1 SYNTHESIS

12:45 - 14:00 LUNCH

14:30 - 17:30
ROUNDTABLE 2

NON CONVENTIONAL WATER RESOURCES AND ENERGY

President Joaquín Griñán Garcia
Region of Murcia, Spain

Experts referent Koussai Quteishat *Ime*
Pedro Aguilo - *Emssa*

Moderator Hachmi Kennou *Ime*

INTRODUCTION

Towards a better non conventional water resources management in the Mediterranean
Angel Cajigas Delgado
Asociacion Tecnologica para el Tratamiento del Agua

FRIDAY 8 FEBRUARY 2013

9:00 - 12:30
ROUNDTABLE 3

EFFICIENT MANAGEMENT OF WATER AND ENERGY

PRESIDENT **ARCADIO GUTIÉRREZ ZAPICO**
SPANISH ENERGY CLUB

EXPERTS REFERENT
CHRISTIAN MAGNIN *SOCIÉTÉ DU CANAL DE PROVENCE*
GERT SOER *IME*

MODERATOR **JACQUES PLANTEY** *IME*

INTRODUCTION
WATER AND ENERGY NEXUS: EFFICIENT USE AND TECHNOLOGIES
ARCADIO GUTIÉRREZ ZAPICO *SPANISH ENERGY CLUB*

CASE STUDIES
AQUAVIVA, A «CARBONEUTRAL» WATER-TREATMENT PLANT FOR THE CANNES' BASIN
LUC ARIBAUD *LYONNAISE DES EAUX, FRANCE*
CONTROL OF THE ENERGY IN THE SONEDE: CURRENT SITUATION AND PERSPECTIVES OF ACTIONS
KHALED ZAABAR *SONEDE, TUNISIA*
EXPANSION PROJECT OF THE HYDROELECTRIC PUMPING AGUAYO
GONZALO OLASO BESCOS *EON, SPAIN*
OPTIMIZATION OF THE INTAKES IN DURANCE AND CONSEQUENCES ON ENERGY
JEAN MICHEL REYNES *SOCIÉTÉ DES EAUX DE MARSEILLE, FRANCE AND* DOMINIQUE ROUX *ELECTRICITÉ DE FRANCE*

10:00 - 10:30 COFFEE BREAK

10:30 - 11:00 DEBATE
11:00 - 12:00 WORKING GROUPS
12:00 - 12:30 ROUNDTABLE 3 SYNTHESIS

12:30 - 13:00 RECOMMENDATIONS AND PERSPECTIVES
13:00 - 13:30 CLOSING CEREMONY
PATRICK SAMABARINO *ELECTRICITÉ DE FRANCE*
MILAGROS COUCHOUD *INSTITUT MÉDITERRANÉEN DE L'EAU*

13:30 LUNCH

CASE STUDIES
NON CONVENTIONAL WATER TREATMENT IN MOROCCO: EXPERIENCE TO BE SHARED
SALMA JARIRI
OFFICE NATIONAL DE L'ELECTRICITÉ ET DE L'EAU POTABLE, MOROCCO
WATER AND ENERGY: GENERAL SEWERAGE AND PURIFICATION PLAN OF MURCIA
JOAQUÍN GRIÑÁN GARCIA *REGION OF MURCIA, SPAIN*
EXPERIENCE OF ALGÉRIENNE DES EAUX IN NON CONVENTIONAL WATER RESOURCES MANAGEMENT
ALI AMROUN *ALGÉRIENNE DES EAUX, ALGERIA*
GREENLYSIS: RENEWABLE ENERGY SOURCES FOR RECLAIMED WATER FROM WASTE WATER TREATMENT. A JOURNEY TOWARDS HYDROGEN "FUEL OF TOMORROW", APPLICATION CASE: EUROPEAN PROJECT IN BARCELONA
ELENA MARZO ADAM *AGBAR, SPAIN*

DEBATE

16:00 - 16:30 COFFEE BREAK
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17:30 - 18:00 ROUNDTABLE 2 SYNTHESIS

20:30
CULTURAL EVENING
MARSEILLE-PROVENCE 2013
EUROPEAN CAPITAL OF CULTURE (PAVILLON J.1)

MARSEILLE-PROVENCE 2013 CAPITALE EUROPÉENNE DE LA CULTURE

VISIT OF THE EXHIBITION
« MEDITERRANEAN: FROM YESTERDAY'S CITIES TO TODAY'S MEN »

COCKTAIL

REGIONAL CONFERENCE ON WATER GOVERNANCE

February 6th, 2013

Introductory note

Towards the emergence of a new culture of water governance in the Mediterranean

During the 6th World Water Forum (March 2012, Marseille – France), the Mediterranean water community came together in order to place water governance in a predominant role in the commitment to be made by any political agenda that hopes to contribute to reinforcing the path towards economic, social and environmental progress.

Similarly to other regions of the world, the strategic challenges around water take on a critical dimension, as a result of the deep geopolitical and geo-climatic transformations underway in Mediterranean countries and, particularly those on the southern and eastern banks, where extreme phenomena (drought and floods) are the most acute.

Given the extent and the speed of these transformations, it is urgent to anticipate their consequences, to assimilate the evolutions that they imply, to objectively define the most relevant adaptation solutions, to mobilise the necessary resources to implement them, and to involve all appropriate stakeholders and those in charge of their practical application.

It is also imperative that to ensure wellbeing, peace and stability, the resources that can be mobilised are protected and if possible developed, their wise sharing between different users are organised (urban and rural, socio-economic and environmental), and that they are managed as efficiently as possible, with great solidarity, at every level (from the local level to the large transboundary basins).

These water challenges are complex, interdependent with all the main subjects of general interest: land-use planning and urban-rural relationships, food security, public health, energy, etc. They are of intimate concern, in different and often diverging capacities, for every citizen, each economic stakeholder and every level of administrative or political decision making.

Governance processes should thus in turn adapt to this complexity, and for that purpose reconcile the global vision with local action, while ensuring the best possible articulation between the central and local authorities, according to the principle of subsidiarity, and the responsible participation of all stakeholders in decision-making processes, as well as in their implementation.

Indeed, the process of water governance does not come to an end with the setting up by the central authority of collective rules, which may well prove unrealistic, inappropriate and inefficient if they have not appropriately taken into account the reality in the field and the expectations of those affected; and if the latter do not fully buy into it.

A truly integrated and participatory management of water resources, which aims to ensure access to drinking water and sanitation, the optimal development of water for all uses, and the requirement for sustainable development, cannot be conceived without a commitment towards close partnership with local authorities, and private or associational operators and actors.

Such challenges bestow upon governance a key role in the establishment of coordination mechanisms, reinforcing stakeholders' capacities and thus allowing ambitious water policies to be carried out, adapted and shared at the territorial scale.

Through the appropriation of this new culture of water governance, the different stakeholders in the Mediterranean water community are merely renewing a secular tradition at the heart of its evolution as a very rich civilisation in terms of its water heritage and historical knowhow that it has been possible to give value to.

Roundtable 2: Non conventional water resources and energy

Pilot: Foundation-Euro-mediterranean Water Institute (F-IEA)

Fundación Instituto Euromediterráneo del Agua

Introduction

Unlike the traditional approach, by which water supply and power supply analysis followed separate paths, and water planning considered energy just as a needed external input for certain activities in the water cycle, in recent years the need to provide an integrated treatment of both issues has become better understood. Current water resources planning must incorporate energy optimization within the water resources systems as one of its objectives to be reached. The solutions proposed for the future must not only meet the water needs of the territories in an environmentally sound way, but they must do so with the lowest possible energy consumption and maximum recovery.

In the Mediterranean basin, this consideration acquires great relevance for several reasons. Firstly, the scarcity and irregularity of the flow regimes often require the mobilization and transport of resources, leading to significant energy costs. In addition, the intensive use of groundwater requires energy for pumping in significant quantities. Moreover, the use of non-conventional resources, such as seawater desalination, requires significant amounts of energy not only for the water intake and the desalination process, but also for the transport from the coast to the areas of consumption.

Moreover, hydroelectric systems are increasingly flourishing due to their clean and renewable energy characteristics. Further, the development of non-conventional sources of energy such as wind has increased the need for reversible pump and turbine hydrosystems that are capable of absorbing the irregular nature of wind production.

These considerations about the relationship between water and energy operate at the planning level, but are also of main concern at the level of local facilities, in which the links between water and energy are also very important.

In treatment plants and water reuse installations, the cost of energy is a significant fraction of the total cost, so energy optimization has become a key element of those facilities, which can provide significant cost savings. On the one hand, these savings can come from both the design of the plants and its operation and maintenance. And on the other hand, there are increasing efforts to extract energy from wastewater. Research in these fields is burgeoning and of growing importance for economic and environmental reasons.

Similarly, in seawater desalination facilities the fraction of the energy cost is even greater than in treatment and reuse plants, and can be a decisive factor for the economic feasibility of these resources depending on the uses for which they are intended. In desalination plants energy efficiency has experienced substantial improvements in recent years, but the consumption of energy and their costs are still relatively high.

The Region of Murcia, in the Segura river basin, has the highest level of water scarcity in Spain, with a highly intensive use of surface and groundwater, a transfer between basins, and a broad experience in both reusing treated wastewater and seawater desalination. Many existing facilities are now in operation and accumulated experience is becoming very important, making Spain one of the technical-leading countries in the world. The ratios of use of non-conventional water resources in the Region are the highest in Europe and, apart from the facilities; a specific institutional framework has been developed, with an Agency both technical and financially responsible for reuse.

The Regional Seminar in line with the IME's 30th Anniversary offers an excellent opportunity to highlight the importance of joint consideration of non-conventional water resources and energy, to delve into these issues, to share perspectives and experiences in the Mediterranean region, with its specific hydroclimatic characteristics, and to develop options and alternatives for the near future.

Background and rationale

In vast areas of the Mediterranean basin, water scarcity and environmental degradation associated with the pressure on the meager water resources, mainly due to the imbalance between supply and demand, represent an environmental threat and a first-order bottleneck for the economic activities and sustainable development of the involved countries.

In addition, arid and semi-arid areas affected by the lack and irregularity (both in time and space) of water resources pose specific challenges that have received little attention, at least not proportional to the magnitude and severity of their problems. It is necessary to underscore the hydroclimatic singularities of these territories, which can be grouped, in general terms, under the paradigm of arid and semi-arid areas affected by severe water shortages and global water scarcity.

In the Mediterranean and similar regions of the world, water resources are limited and subject to severe and growing pressures. Urban and industrial, agricultural, point-source and diffuse pollution, industrial and domestic waste and groundwater overexploitation pose a threat to these scarce resources. Floods are frequent and extremely violent and the fragile ecosystems can be threatened by groundwater withdrawals coupled with an inadequate management of surface waters. Moreover, the threat of climate change has to be taken into account, due to the fact that the Mediterranean is a very complex transition area which is highly vulnerable to its effects. Depending on the various future scenarios and simulations, it is expected that in the MENA countries, during the next century, rainfall will decrease 10-25%, runoff will decline 10-40%, and evaporation will increase 5-20%.

Despite the uncertainties of these figures, it is essential to advance in the knowledge and optimization of all available resources, and new tools and specific policy analysis of rational use of water resources systems are required.

Aridity and scarcity of renewable resources, both surface and groundwater, give the non-conventional water resources greater importance than those raised in temperate or humid regions. In some cases, these new water resources could contribute as an important part of the overall solutions to be implemented.

Water use outputs are -in spite of some encouraging results- far from being satisfactory; conveyance losses, leakages and wastage are estimated as about 40% of the total water demand, as a global average. When the expected effects of water-saving measures appear insufficient, and to limit their dependence on unsustainable withdrawals, the use of non-conventional resources (reuse of treated wastewater, seawater or brackish water desalination) can be implemented. The mobilization of unconventional resources has many benefits: quantitative (reduction of water deficit, in particular for agricultural use), qualitative (collection and effluent treatment prior to reuse and improvement of the quality of the receiving natural water bodies) and economic (guaranteed supply that leads to stable activities). It can also facilitate access to sanitation and make an important contribution to adaptation strategies of agricultural policies. Finally, the reduction of imbalances between supply and demands can reduce conflicts between users, between sectors (domestic, agricultural and industrial) and even between countries with shared waters.

Non-conventional water resources represent a substantial and complementary supply in regions affected by extreme scarcity of renewable resources. Such sources, usually counted separately from natural renewable water resources, are mainly related to: a) the production of freshwater by desalination of brackish or saltwater, mostly for urban supply purposes; and b) the reuse of urban or industrial wastewaters (with or without treatment), which increases the overall efficiency of water use (extracted from primary sources), mostly in agriculture, but increasingly in industrial and urban sectors.

The reuse of wastewater for irrigation could be considered an ancient practice, which facilitated an additional high-nutrient resource to grow the crops. Nonetheless, modern quality standards require wastewater to have some treatment so as to make it feasible for each possible use. So the reuse of wastewater, either completely or partially treated, has already been practiced with varying degrees of success in the majority of the Mediterranean Region over the last decades. It must be considered as a hydrological asset and a good part of the solution provided some considerations are taken into account.

Reuse does not always mean the contribution of a new and therefore additional resource. It only generates really new resources in areas near the coast, where the effluent would pour into the sea without another use. In upstream inland areas the used water returns to the system (river or aquifer) and can be used on site or downstream.

So generally speaking, reuse doesn’t mean additional quantity of water, but does always mean an improvement of its quality.

On the other hand, desalination consists in taking out dissolved salts (saline ions) from water. All desalination technologies have a limiting factor in common: they all must apply energy to saline solutions to obtain desalinated water. Furthermore, the higher the desired degree of purity, the greater the energy consumption. So, the relationship between water and energy governs all the applications of desalinated water. It is necessary to consider environmental, energetic and economic concerns that the world-wide experience in water desalination provides. Nevertheless, seawater desalination nowadays has been accredited as a valuable option to approach the problem of water shortage in coastal areas and for some kind of uses. In inland areas, brackish water desalination is more likely to be a feasible solution.

Both solutions, reuse and desalination, are increasingly acquiring relevance in areas of water scarcity, where they are set to become an important asset. In fact, many technologies and related processes, under development for a number of years, are nowadays sufficiently well-known, are fully operative in many places, and have reached their maturity, making the term “non-conventional” becoming obsolete.

Moreover, as a consequence, numerous national and international conferences have been held on both subjects and a plethora of studies and documents have been published by many organizations. In the last few years it is easy to find many reports dealing with both topics that, besides, are focused on specific issues of the Mediterranean region.

From a geopolitical point of view, it must be remembered that there are nearly 500 million inhabitants and more than 250 million annual visitors (tourists) in the countries facing the Mediterranean. It is foreseen that this population could increase by 90 million inhabitants in the short-medium term. Moreover, almost 200 million inhabitants live in areas with less than 1,000 m^3/capita, a figure that is likely to reach 250 million inhabitants by 2025. The “water scarce” population, i.e. that with less than 500 m^3/inhab./year, is likely to pass, over the same period, from 60 to 80 million inhabitants. In fact, water scarcity in the Mediterranean region is among the highest in the world. For instance, 7 out of the 9 SEMC countries (Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, the Palestinian territory, Syria and Tunisia), in 2010, had less than 500 m^3/capita of sustainable freshwater. It is evident that there is a trend towards the worsening of current problems, as a result of the increasing water resources scarcity and imbalances between supply and demands.

Solutions that were put forward at the 5th World Water Forum, both in the Istanbul Water Guide and in the Ministerial Declaration, indicate that the major challenges to be faced in water management over the coming years will be the population growth and migratory movements, as well as changes in land use, the increase in pollution, and all issues resulting from global changes, which advocate for decisions to be made such as the inclusion of national strategies for improved groundwater management and a greater investment for the reuse and desalination of water.

With this background, and according to the 6th World Water Forum’s overriding theme Time for solutions, it is necessary to explore what are the real possibilities for the use of new resources that minimize, sooner rather than later, the impact that a water crisis might have on the population, the economic activities and the environment, a crisis that without doubt will be brought about due to the intensification of droughts and the resulting lack of resources to face the growing demands.

In conclusion, there is a very significant activity on the use of non-conventional water resources in the Mediterranean, but there are also big regional and inter-country differences, raising very important margins for action and improvements in the next future.

Desalination and Energy

Regarding desalination, most countries are nowadays using this technology, although only a few of them have done it within a planned framework. Moreover, some countries have bet on ambitious (maybe overambitious) desalination planning whereas in other cases it is still only an anecdotal resource.

Seawater desalination is mainly used to meet human supply needs, and in some specific cases industrial uses. This resource will only be applicable for irrigated agriculture if it becomes part of an integrated strategy that gathers every available resource, conventional and non-conventional, and all the existing demands in a mixed, integrated system. Economic analysis and experience shows that exclusive, direct use of desalinated seawater for agriculture is not possible due to its high cost. Also high energy consumption and potentially high environmental impacts should be considered in the planning stage. An alternative option should be to consider desalination as a complementary resource, the main contribution of which will be to guarantee supply during severe water shortages.

Large desalination projects are usually directly related to seawater plants and are called to meet a high share of the overall resources at a local or even regional scale; whereas small-scale projects are often related to brackish water desalination, mostly in inland locations where groundwater resources with relatively high salt contents could be mobilized and used. The latter kind of projects takes on great importance for remote settlements with scarce or irregular water resources.

The total production capacity of desalinated water in the Mediterranean Region represents about 20% of the world's operative installed desalination plants. Among the top countries in terms of the installed capacity are Spain (44%), Algeria (19%), Israel (14%) and Italy (4%), even when real production doesn't necessarily fit and could be lower than the maximum capacity of the plants. As for the origin of the feeding water of the Mediterranean desalination plants, seawater is predominant with a share of 64%; brackish water participates with 25% and river water with 4%.

With regard to uses of desalinated water, municipal supply is the main use in the Region, representing 74% of the total, followed by industrial application with 12% and irrigation with 6% of the total installed capacity.

Energy and water are strongly interlinked. Energy requirements are increasing for pumping, transport, treatment and desalination. Today, power consumption from water accounts for around 5% of power consumption in the Northern Mediterranean Countries (NMCs) and around 9% in the Southern and Eastern Mediterranean Countries (SEMCs) (being around 15% in Israel). In most countries, these rates are set to rise in order to meet the increase in demand: resorting to deeper wells and longer transfers, as well as an increasing call of wastewater treatment and of desalination.

Some analyses conclude that the energy needs for water are set to double within 10 years. They are likely to account, by 2030, for 15% of the overall power demand for the SEMCs, against 5% for the NMCs and 10% for the whole Mediterranean riparian countries.

The main challenge of desalination is to get a competitive cost of desalinated water production as compared to other water resources. The energy component of desalination (44% on average) makes the gradual increase in the cost of energy generation a progressive increase in the cost of desalinated water to a greater extent than other conventional water resources. To achieve a competitive cost it is necessary to minimize the influence of the energy component in this cost, both in terms of fixed costs (power term) and variable costs (energy term). If the cost of depreciation of the facilities is considered in the price of water, it is estimated that about 40% of the total cost comes from energy, while the amortization costs are between 30% and 40%. If investment cost recovery is not considered, then the energy costs will represent nearly three-quarters of the total cost of the water, thus imposing an economic barrier to the development of desalination for agriculture, even if all the investment is subsidized.

In order to reduce energy consumption for water uses, some research fields seem to be promising for the future: hybrid power plants, energy recovery from the brine generated by desalination plants, and use of renewable energies for desalination.

The energy consumption of desalination plants 30-40 years ago was 20 kWh/m^3, and it has currently dropped to 3.5 kWh/m^3. That means a great advance, achieved by the incorporation of diverse technologies like devices to recover the residual energy of the brine, the improvement of the efficiency of pumping systems and membranes, and the general optimization of the process.

Nevertheless, it can be considered that this great development and reduction of energy consumption in the last decade is reaching an asymptotic limit and significant improvements are not expected in the future.

Therefore, a key question is the energy dependence and its influence on the evolution of production costs.

Paradoxically, the product of increasing energy cost by decreasing energy consumption shows actually a final increasing result. In that respect, technological innovation towards a higher reduction of energy consumption and the implementation of renewable energy sources must be encouraged.

Possibly a new revolution in the sector will be required to reduce the energy consumption, such as forward osmosis or nanotechnologies. Although those kinds of devices are nowadays far from being ready for industrial size applications, it would be advisable to monitor their evolution.

One of the handicaps for generating desalinated water is the scarce knowledge on the long term impacts caused by the brine disposals over the land and/or aquatic ecosystems. Besides, given the high amount of energy required by these facilities, a notable environmental impact can be produced associated with the emission of greenhouse gases (carbon footprint).

The other relevant aspect regarding both desalination and reuse, is the development and application of non-conventional energies that would contribute to make these activities more energetically and environmentally sustainable.

Using renewable energies for desalination is a recurrent objective for planners and designers of desalination plants. Nowadays solar and wind power technologies are only applied at a small scale and their real contribution to the total energy required by desalination facilities is negligible. Currently, solar devices are only able to supply energy to auxiliary systems having a low consumption (lighting, general services of the plants, etc.), because of the impossibility of supplying energy to the main equipment such as high pressure pumps. As regards wind energy, more desalination applications have been developed although not in a direct manner. Due to the fact that the best location for desalination must not coincide with the best location for renewable energy production, both facilities are usually separated and the energy is supplied from considerable distances, normally indirectly through the electric power transmission networks.

The result is that, except for very small, local installations, medium and large desalination plants always need to be connected to a guaranteed electric power source than only the national mixed-source generation, transmission and distribution networks could provide.

So, on the one hand, the use of renewable energies for large desalination projects must of course be fostered and extended, but contributing as sources to the mix of the global electrical grid, not as a direct solution for desalination plants. On the other hand, there seems to exist an opportunity for these technologies when applied to small-scale desalination plants: considering their use in small and isolated settlements (both from water and energy regular sources) characterized by high annual sunshine levels, systems like solar-powered RO membrane desalination could be a good solution.

In this sense, the most promising technologies (Ghermandi et al., 2009) are photovoltaic-powered reverse osmosis (PV-RO), solar thermal-powered RO, and hybrid solar desalination. Hybrid systems comprise combinations of solar power with power from one or more additional source, such as wind, diesel generators, or grid electricity.

Wastewater Reuse and Energy

As regards for reuse of wastewater the casuistry is very wide. This is a usual practice, widely used mostly in irrigated agriculture, but growing for other uses such as industry, landscape gardening, golf courses... However, like for desalination, the planned use of this valuable resource is not as common as might be expected. Only a few Mediterranean countries have implemented wastewater reuse within their water resources planning, while in other cases users do not even apply any treatment to those waters before using them. In the most of these cases, farmers irrigate with diluted, untreated, or partly treated wastewater.

The inclusion of reuse of wastewater in the water plans of the Mediterranean countries is essential and must be carried out bearing in mind the advantages and limitations of this kind of resource, and the necessity to rely upon a well-defined legal framework and a code of good practices. A successful use of regenerated wastewaters will imply not only a possible increase of net water resources (especially in coastal areas), but to achieve a substantial improvement of the environment at a local level and for the Mediterranean Sea.

All stakeholders commonly agreed that it is time for this situation to be solved. It is necessary to encourage the Mediterranean countries to develop water plans explicitly including feasibility analysis and development programs for non-conventional resources. Those water plans must integrate all the necessary technical, institutional, regulatory and economic aspects, and define specifically the applicable technologies, treatment costs and tariffs, quality standards for each possible use and an appropriate legal framework.

The total volume of reused treated wastewater in Europe (AQUAREC, 2006; EUWI-MED 2007) is 964 Mm^3/year, which accounts for 2.4% of the treated effluent. Spain accounts for the largest proportion of this (347 Mm^3/yr); Italy uses another 233 Mm^3/yr. In both countries, agriculture absorbs most of the treated wastewater. In the Mediterranean region, Israel is another large user of treated wastewater (with 280 Mm^3/yr, around 83% of the total treated wastewater). The treated wastewater reuse rate is high in Cyprus (100%) and Malta (just under 60%), whereas in Greece, Italy and Spain treated wastewater reuse is only between 5 and 12% of their effluents, although with significant regional differences.

The amount of treated wastewater reused is mostly very small (less than 1%) when compared with a country’s total water abstraction. Only Malta and Israel augment their water supply by 10 and 18% respectively, using treated wastewater as an alternative source.

Some forecasts predict that on the Mediterranean coast these percentages will surpass 60-70%, having already reached near 100% in some Spanish coastal, water scarce regions, like Murcia and Valencia.

According to World Bank 2007, on average, across the region of the Middle East and North Africa (MENA), 2% of water use comes from treated wastewater. Jordan is reusing up to 85% of treated wastewater and Tunisia 20-30%. Egypt and Syria reuse treated domestic wastewater to some extent. Moreover, the Gulf countries use about 40% of the wastewater that is treated to irrigate non-edible crops, for fodder, and for landscaping.

As in the case of desalination, energy is an input of vital importance for wastewater facilities. Energy costs means usually between 5 and 30% of total operating costs worldwide (Energy Sector Management Assistance Program - ESMAP, World Bank, 2012), although this share can be higher in developing countries. Therefore, improving energy efficiency is a key point to reduce operational costs. Many efficiency measures have short payback periods (usually less than 5 years), so their impact on the overall costs of the wastewater utilities should be fast and noticeable. Many technologies, to meet more stringent regulations, tend to be more energy intensive than prevailing technologies. Examples of these newer technologies include ultraviolet disinfection, ozone treatment, membrane filtration, and advanced wastewater treatment with nutrient removal. Nonetheless, some technologies may offer additional environmental benefits, for example reduced chemical use (and associated embodied energy). Combined heat and power (CHP) systems using biogas from anaerobic sludge digestion, a well-established means of generating energy, can provide up to 15 percent of the power requirements at wastewater treatment plants using activated sludge process. Biogas may be used for other energy applications. Anaerobic digestion also reduces the solids content of sludge by up to 30 percent, reducing the energy costs involved in its transport.

Energy usage of municipal wastewater treatment varies substantially, depending on treatment technologies, which often are dictated by pollution control requirements and land availability. For example, advanced wastewater treatment with nitrification can use more than twice as much energy as the relatively simple trickling filter treatment. Pond-based treatment is low energy but requires a large land area. The estimated energy intensity for typical large wastewater treatment facilities (about 380,000 m^3/day) in the United States are 0.177 kWh/m^3-treated for trickling filter; 0.272 kWh/m^3 for activated sludge; 0.314 kWh/m^3 for advanced treatment; and 0.412 kWh/m^3 for advanced treatment with nitrification. The ascending energy intensity of the four different processes is due mainly to aeration (for the latter three treatment processes) and additional pumping requirements for additional treatment of the wastewater. In fact, for activated sludge treatment, a commonly used process in newer municipal wastewater treatment plants (WWTPs), aeration alone often accounts for about 50 percent of the overall treatment process energy use.