Water demand management in the Mediterranean, progress and policies

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Monitoring progress and promotion of water demand management policies

National report of Syria

Syrian Arab Republic
Ministry of Local Administration and Environment
General Commission for Environmental Affairs

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Water and Sustainable Development in the Mediterranean

Water Demand Management, Progress and Policies

Report on

Water Demand Management in Syria

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1- Introduction:

1-1 Aim of the Report

As a response to the Syrian commitments towards regional and international obligations concerning incorporation of sustainable development concept within national strategies, as well as the Integrated Water Resources Management (IWRM) principle, Syria had prepared the National Strategy for Sustainable Development (NSSD) taking into consideration the above mentioned principles.

In this regard, this report is aiming at addressing the current water situation in Syria in terms of her national water situation, policies, demands, objectives, and orientations **in conformity with the contents of (NSSD), as well as the current evolution and its consequences**. This is a necessary step that will eventually enable us to analyze the applicable tools to support Water Demand Management (WDM) in Syria. The analysis will based on, data collected from the Syrian concern ministries, interviews with officials and, studies carried out by governmental authorities and specialist.

1-2 Motivation – International & Regional commitments

At the 12th Conference of the Contracting Parties to the Barcelona Convention (2001), the CPs decided to prepare a "*Mediterranean Strategy for Sustainable Development" (MSSD)*, which was announced at Johannesburg Summit on Sustainable Development 2002, while it was adopted by the Contracting Parties to the Barcelona Convention in 2005, it was also endorsed by the Barcelona Euro-Mediterranean Summit.

Syria was amongst countries that made initiative to prepare her National Strategy for Sustainable Development.

Whereas the first priority field of the MSSD was improving **integrated water resources and demand management,** Also, **Sustainable Water Resources Management (**SWRM) has been identified as one of the priority area within the Syrian national strategy, since the process of water resources development has the superiority of interest in Syria, not only in terms of the water significance for life, but due to its valuable role in the national economy, which is based mainly on irrigated agriculture sector the largest consumer of water that will stay the essential subject of development as a source of food.

It was crucial that the work on national strategy started at the first step from the assessment of the existing objectives in the 10^{th} five-year plan, by making sustainability appraisal of the national objectives vis-à-vis with the four basic targets of the NSSD, then getting out the improved objectives to identify crossroads with the objectives of MSSD at regional level, then with the objectives of the Millennium at international level.

Second step was setting orientations, actions to accomplish the objectives, taking into consideration that **the increase in the offer that was the traditional dominant response in Syria to demand increase has reached its limits and is confronted with growing social, economic and ecologic obstacles and trend should be converted into demand management, especially, for the management of water resources**

The Main objectives & orientations of SWRM within NSSD in Syria were reflecting the commitment towards the Millennium Development Goals & Johannesburg objectives, as following:

1- To implement WDM to improve the water sector contribution in the GDP

- *Made reorientation of national water policy to integrate water demand management in agriculture and other sectoral policies, and stabilize water demand through the reduction of water losses and the wasteful use of water, and increase water use efficiency of agriculture and the added value per cubic meter of water used, implement modern irrigation techniques.*
- *To set legal, fiscal & pricing systems, and encourage investment in demand-side management*

2- To promote integrated management of water resources in each catchment's basins

- *To reduce water demand in irrigation sector by modernization of irrigation technique, and reformulation of agricultural policy.*
- *Using non- conventional water resources and clean technology in industrial sector.*
- *Reduce the over-exploitation of groundwater, and promoting the artificial recharge in aquifers & water harvesting technique.*

3- To achieve the Millennium Development Goals concerning access to safe drinking water and sanitation

- *Securing water supplying and sanitation, to halve by 2015 the share of population without access to safe drinking water and sanitation compared to 1990*

4- To promote good governance in water management

- *Promote participatory approach in the sustainable water resources management, including partnership with local authorities and private sector, and promoting the culture of transparency*

1-3 Overview of National Situation

Water supply in Syria has faced severe problems over the years. The reduction in rainfall of the last decades and the overdraft withdrawal of groundwater has resulted in consistent and significant lowering of water tables.

Furthermore, Syria is classified amongst the semi arid countries, with average rainfall decreasing from more than 500 mm/year in the coastal area to less than 200 mm/y in the southern east. This gradient in rainfall results in a heterogeneous distribution of water availability in Syrian water basins, and unbalanced distribution of localities, it means irrelevant distribution with the population. For instance, the percentage of water resources in Damascus Basin is less than 5% of the total water resources in the country, when its population is 29.7% of the total population in Syria. Meanwhile, the population does not exceed 31.6 % in Euphrates Basin with a percentage of 60.5% of the total water resources in the country (figure.1 shows clearly the imbalance between the percentage of population and the percentage of water resources in basins). This situation has led to intensive qualitative and quantitative pressures on water resources, as well as to the increasing demand of water which is much higher than the available resources in some places. Also, it led to a shortage in water supply. The increasing rate of population, and the rapid

economic and social development in Syria during the latest decades, with the accompanied human activities, has led to several changes in land use; and increasing demand of water.

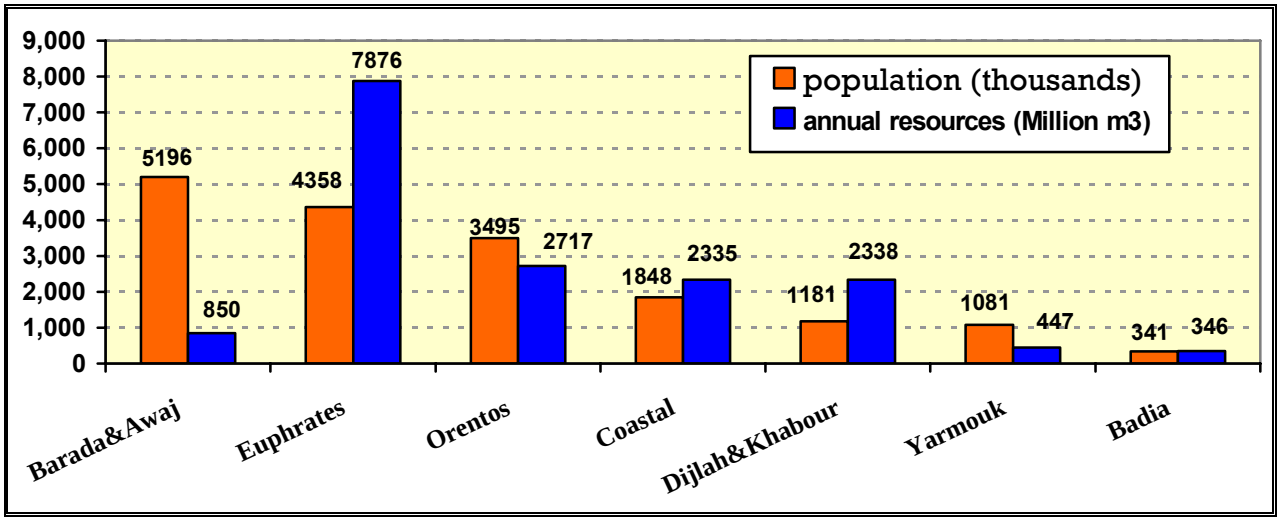


Figure 1: the distribution of population and available water resources in water basins in Syria

Demographic & Economic Indicators

In 2004, the population of Syria as shown in figure.2, was 17.921 million, while the estimate of population in 2006 was 18.941 million, over 67% of them are living in major cities, this is attributed to the high population growth rate of about 2.45%, and majority trends from rural areas towards urban centers.

As a result of the high population growth rate, the need of inhabitants for food supplies increased, this resulted in the over-exploitation of local natural resources, especially water resources, which caused an imbalance in the overall environmental equilibrium. Consequently, the demographic aspect of the problem evolved into an environmental issue with developmental and cultural dimensions that manifested itself in the ever-increasing gaps between the needs of the inhabitants in terms of food supplies and infrastructural services, such as education and health , vis-à-vis the outputs of the social and economic development programs. The increasing rates of population, and the rapid economic and social development in Syria during the latest decades, with the accompanied human activities, have lead to several changes in land use, this lead also to the increasing demand of water.

Economic trends in the past 10 years have had a positive effect on the structure of the Syrian economy resulting in the growth of the Gross Domestic Product (GDP) between 1995 and 2004 from 659 billion to 997 billion Syrian Pounds. But, due to a number of external factors, Syrian economy experienced a noticeable slowdown, resulting in the decline of the GDP growth rate from 9.7% to -2% between 1999 and 2000. However, in 2001 this rate rebounded back to +3.4%. The composition of the GDP in Syria varies depending on the contribution of each sector of the economy. The statistical abstract of 2005 illustrated that the contribution of the industrial sector in the overall structure of the Syrian economy was approximately close to that of the agricultural sector. (22% for agriculture , 28% for Mining & manufacturing).

In its tenth five-year development plan [2006-2010], the Syrian government stressed the importance of achieving sustainable use of resources with the objective of reaching a state of equilibrium between the environment and the population.

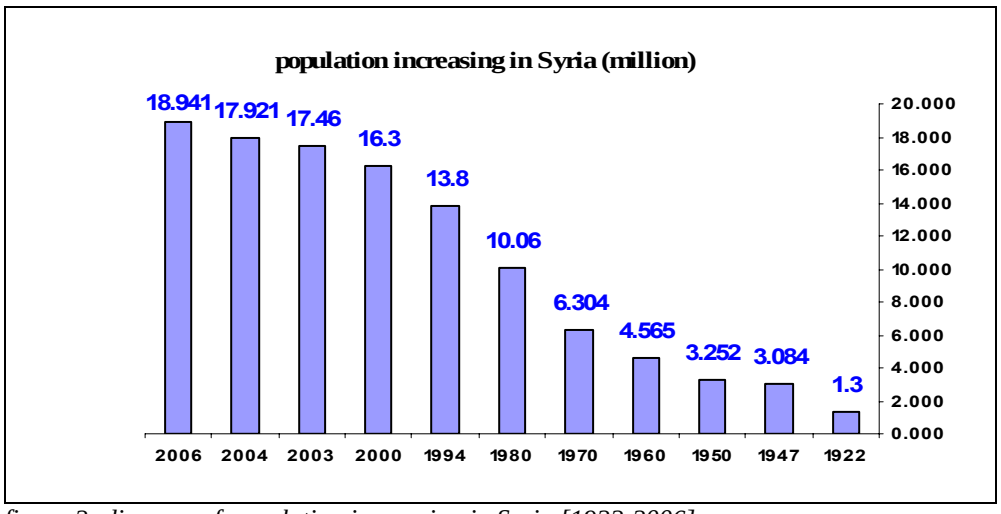


figure.2: diagram of population increasing in Syria [1922-2006]

The plan tries to reflect and materialize the new government orientation in adopting a social market economy. Water was prioritized as one of the main critical sectors for the national development. The planned investments for the entire Syrian water sector amount to 2.796 billion Euro for the period of the 10th Five Year Plan. Approximately 50% of this budget shall be spent in the irrigation sector where the other 50% shall be spent for drinking and sewage projects.

Institutional Structure for Water Management

The responsibility of dealing with water resources management lies within a number of ministries; these ministries are all represented in the Council of General Commission for Water Resource Management.

The Ministry of Irrigation : is the central institution for managing, developing and protecting the water resources, supervising the investments and the establishments in all water basins, Setting strategic plans for executing the water policies to achieve the sustainable development for water resources. The ministry is responsible for making available suitable water resources for all water using sectors, it also responsible for controlling drilled wells, and for licensing future wells.

The Ministry of Agriculture and Agrarian Reform is the main consumer of water resources; it is responsible for the rational use of water for agricultural purposes, minimizing water consumption, encouraging the usage of modern irrigation techniques. The Council of Ministers had agreed (in SEP 2005) to establish national monetary fund for the modern irrigation projects.

The Ministry of Housing and Construction is responsible for Supplying drinking water from surface and underground water resources by building, operating and investing the water networks, and water purification station, and building sewage-water networks and its treatment plants, enhancing the efficiency of water and sewage networks.

The Ministry of Local Administration and Environment : is responsible for monitoring and controlling water quality through its laboratories and observatory networks , and for issuing national standards for the protection of water resources , and tracking the source of pollution in order to implement Environmental Law.

Each Ministry has a local bodies (Local Directorates or Local Institutions) distributed on 14 Governorates related to the central body of each Ministry.

In case of Ministry of Irrigation and Ministry of Local Administration & Environment, there is General Commission for Water Resources and, General Commission for Environmental Affairs as central bodies within the above mentioned ministries respectively.

2- Major Changes in the Water Situation in Syria:

2.1. Resources, their mobilization and unconventional water production

Natural Resources

The average Renewable Water Resources RWR in Syria reaches in its maximum level to 18.209 Billion m^3/year, distributed as shown in table.1 & fig.3.

Table.1: Renewable water resources in Syria (billion m^3/year)

Nature of water resources	Quantity of water resources
Ground water resources	6.044
Surface water resources	4.288
Minimum portion of Syria's share of Euphrates water as per the protocol signed with Turkey in 1987 and the agreement signed with Iraq in 1990	6.627
Tigris river water apportioned to Syria as agreed upon with Iraq in the year 2003 and this needs a similar agreement with Turkey	1.250
Total	18.209

Source: Ministry of Irrigation

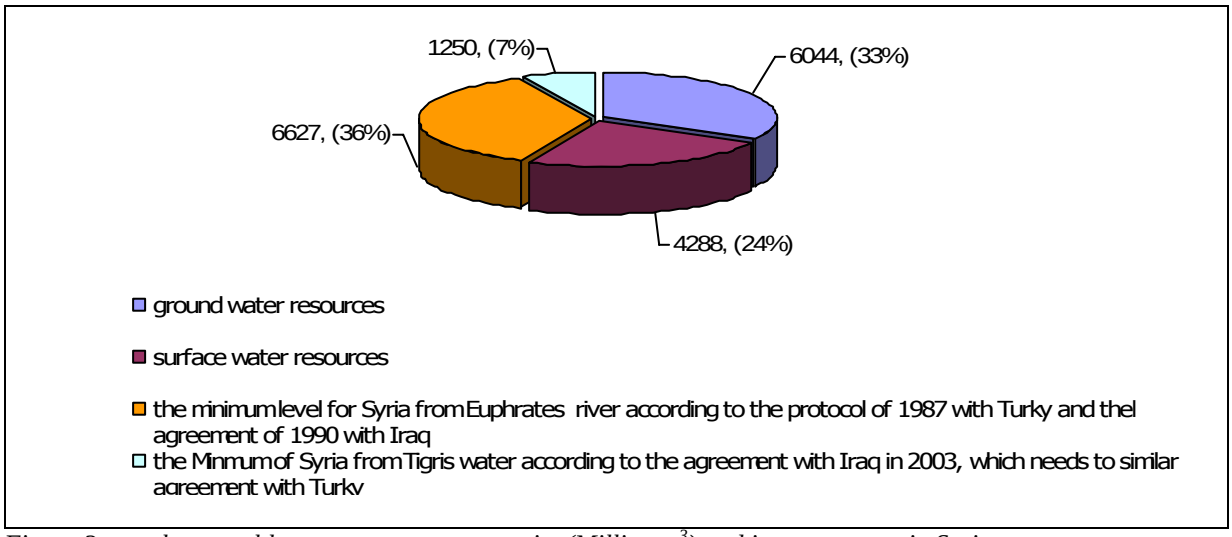


Figure.3 : total renewable water resources quantity (Million m^3) and its percentage in Syria

Taking into account that the average of actual Available Renewable Water Resources (ARWR) is 15.965 Billion.m^3/year. Therewithal, Syria has a population of around 18 million, in other words, the per capita ARWR is now less than the water scarcity index or the threshold of water stress (1000 m3/person/year), average per capita water availability is estimated at 800 m3/hab/yr, including Syria's water share-agreed separately with Turkey and Iraq- from Euphrates river. Although, this would rank Syria amongst countries with moderate water stress, it will be soon classified as a country with severe water stress if its population continues to grow at its current rate (about 2.45%).

- Surface water: The volume of available surface water resources is estimated at (10.915) billion.m³ (with the exception of its share of the Tigris), which comprise 60% of the overall resources. The present status refers to a quantitative deterioration of several rivers to the extent that some of them dry seasonally. Also, the beds of some rivers are converted into drainage of wastewater as the case in Tartous where 350 waste drainages are running in valleys and rivers.

- Ground water: Ground waters are subject to great exhaustion manifested in great drop of water levels in most water basins. Renewable ground water resources of up to 6 billion.m^3/year are subject to illegal utilization in irrigation. Data analysis of ground water in most basins has shown a dangerous and continuous deterioration of water table in a way that **exceeds the possibility of compensating them from the annual renewable flow.**

- Non-traditional water resources: NTWR are considered to be a portion of the agricultural drainage and wastewater discharge. This been estimated by the Ministry of Irrigation for the years 2003-2004 to be 3.615 billion m³. Since the agricultural water charges resulting from irrigation form a quantitatively important source although it is not good quality water.

Mobilization of Natural Resources:

In Syria and until fairly recently, emphasis has been put on the supply side of water management. Demand management and improvement of patterns of water use has received less attention. Water managers and planners have given high priority to locating, developing and managing new water resources. The aim was to augment the national water budget with new water. The most popular way of achieving this aim was to control surface flows by building new dams (there are now around 165 dams in Syria with total capacity of 19.6 BCM), (table.2).

Table.2: Main Dams in Syria - Source (Rasoul Agha 2005 & Ministry of Irrigation 2004)

basin	No of dams	Total storage capacity(m.m³)
Yarmouk	42	245
Barada & Awaj	-	-
Coastal	21	602
Orontes	49	1492
Al Badia	37	69
Euphrates & Allepo	4	16146
Tigres & Khabour	12	1045
Syria	165	19599

According to available data from Ministry of Irrigation (Water Status in Syria 1992-2003), we could measure the regulation index as : **100 x Qr / Qt = 100 x 11893 / 13267 = 89**

Qr: sum of the irregular flows(surface &groundwater) regularized by reserves (annual average)
Qt: annual average irregular flow (intern and external).

While, we have to take into consideration that the available capacity for surface storage is limited, not stable, and we have to increase the exploitation in the Euphrates and Tigris River.

2.2. Water demand and pressures on resources

Withdrawals and Demands

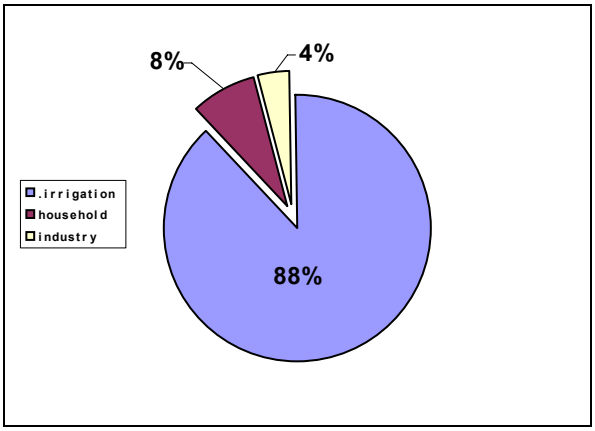
Available water resources in Syria are utilized in domestic, industrial and agricultural sectors at rates, which vary according to the sector. An available information shows that the volume of water resource utilization equaled 16.690 billion. m^3 in 2003, as illustrated in table.3, & figure.4.

Table.3: changes in water utilization by different sectors in Syria - Source : (Ministry of Irrigation 2006)

indicator			years										
			92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-20	00-01	01-02	02-03
Used water	In irrigation	From ground water	6203	7042	6918	6885	6941	7144	6923	6788	7297	7848	8250
		From other sources	5228	5007	5125	5555	5899	6112	7079	6400	6386	6562	6419
		total	11431	12050	12043	12440	12839	13256	13001	13188	13683	14410	**14669**
	In Drinking water		1023	1057	1094	1132	1169	1208	1249	1291	1333	1380	1426
	In Industry		315	342	358	392	418	449	479	510	541	569	595
	total		12769	13449	13495	13964	14426	14913	14729	14989	15557	16359	**16690**

Some scenarios concerning the prediction about water demand in 2025 refers to 23.5milliard. m^3, while others refers to more than 27. 5 milliard .m^3, and to be 39.5 milliard. m^3 in the year 2048

Figure.4: percentage of water uses by different sectors in 2003 (million m^3/year) - Source: (Ministry of Irrigation 2006)



The agricultural sector has monopolized 14669 m.m^3/y (88%) of total exploited water, to irrigate 1439 thousand .ha (2004), using groundwater, and governmental irrigation projects from surface water, rivers & springs. Traditional surface irrigation prevails over more than 80% of irrigated area in Syria, while, the wells used for irrigation are not provided with meters.

Drying of some springs, decreasing of its flow or declining of water table have been noticed, the matter which led to increase pumping & agriculture yield cost.

It is to be mentioned here that the recycled irrigation drainage water has been estimated in the year 2004 at 2246 million.m^3.

The sector of drinking water and household utility: drinking water consumes 1426 m.m³/y (8%) of exploited water; the general drinking water system in Syria covers about 95% of populated urban areas and about 75% of rural areas, while public wastewater network covers about 73.8% nationwide. In any case, these figures do not necessarily reflect the quality of supply. In some areas reliability of supply is rather limited, and in other cases the water supplied through public networks cannot be used for drinking or cooking purposes. In the fast growing areas of Damascus and Aleppo, which are characterized by uncontrolled rural-urban migration and mushrooming illegal settlements, the pressure on drinking water is increasing.

The industrial sector: The volume of water resources utilized for industrial purposes increased from 237.8 m.m³/y in 1992 into 480.9 m.m³/y in 2000, and it became 595 m.m³/y (4%) of the total exploited water in Syria in 2005, it is expected to increase up to 4120 m.m³/y in 2025.

Pressures exerted on the resources

Depending on available data provided by Ministry of Irrigation, it was clear that the exploitation index of renewable resources could be measured as: (A/R) x 100 = (16690/15965) x 100 = 104.5

A: amount of annual traditional renewable natural water consumed for all purposes

R: Annual traditional renewable natural water flow volume

While, due to the data collected from the Ministry of Irrigation, it was clear that the exploited water was exceed the available water during the period [1992- 2003] according to table.4.

date	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	average
(consumed water/available water)%	101%	93%	107%	119%	111%	112%	116%	121%	124%	132%	115%	114%

Table.4 : percentage of used water to available water- Ministry of Irrigation 2006

It means that the water balance has a negative deficit about 14% exceeded the available water, the matter which put the non RWR in an increasing risk due to the current situation.

Pressure on water resources is expected to increase further due to the high population growth, agricultural policy, increasing tourism & industrial development, most important pressures are:

1. water shortage:

A report on agriculture and irrigation prepared for the tenth five year plan has mentioned that the total average use has become 18 Billion.m³ in 2005, accordingly there was a deficit in the water balance by about 3125 million.$m^{3,}$ while the average deficit is about 1727 million.m^3 annually, due to the pumping of non renewable water, increasing population, and inadequate water resources management. These conditions are accompanied with low distributed rainfalls. The only solution for such situation is **Water Demand Management**.

The second pressure is the imbalanced distribution of available water among water basins, some basins enjoy a relative surplus of surface water but the others have already consumed their water resources. Overall, the water balance is negative at present and water deficit will increase rapidly due to high population growth. This will result in more pressure on ground water because Syria has exploited most areas suitable for erecting dams on rivers in an economically feasible manner.

The third pressure is the spatial imbalance between population and water resources; it means irrelevant distribution of water resources with the population. The four major governorates (Aleppo, Damascus city, Damascus countryside, and Homs) have attracted more than half of the population. The handling of this situation requires fast introduction of WDM policy.

2. water resources over depletion:

Water resources in general and particularly ground water, have been exposed to over exploitation and impermissible pumping for irrigating purposes, that explains the serious and continuous degradation of ground water. This degradation is caused because the exploited water is actually exceeds the ability of renewable annual supply.

On the other hand, the irrigated areas from the groundwater wells constituted in 2005 about 60% of the total irrigated areas (Figure.5). This is a great pressure on the limited groundwater sources.

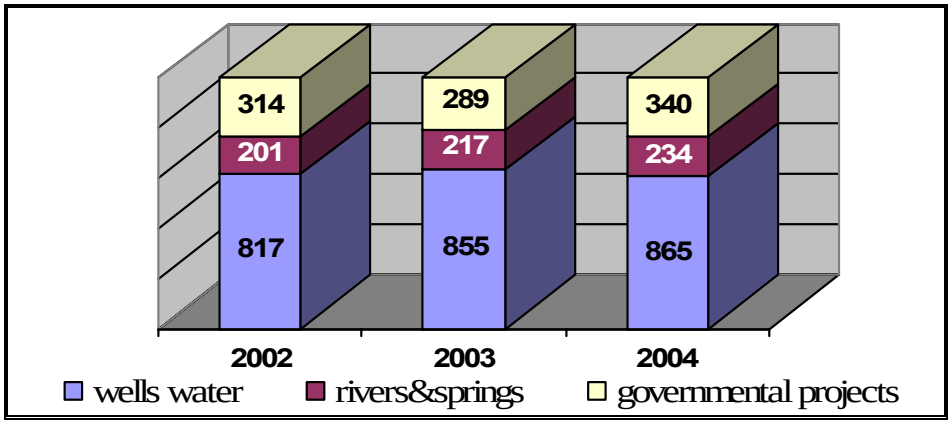


Figure.5: the development of irrigated areas (thousands hectares) using different water resources

It should be noted that the continuation of the irrational withdrawal of ground water for irrigation purposes, will negatively affect the supply of drinking water and Industrial uses, **which will sooner or later lead Syria to re-allocate of water.**

3.Pollution of surface water and groundwater:

The discharge of untreated sewage and industrial wastewater to lands and water bodies lead to the deterioration of aquatic ecosystems of rivers, lakes, and groundwater, and thus exit from the useful investment, in addition to health damages and the loss of its economic and hedonic value.

Due to the fact that sewerage networks have been constructed in most urban areas in Syria and a number of treatment plants have also been commissioned, reduction of bacteriological and chemical contamination of surface and groundwater has been achieved in these areas

4. The disparity between water bodies and low discharges:

There is a considerable difference in the size of annual flows between rivers from billions cubic meters (Euphrates River) to the tens of millions (Kabir Shamali River). Also the main amount of surface water is concentrated in shared rivers in Syria, it is more than 70% of surface water volume, which leads to significant pressures on Syrian water resources in quantity and quality, due to the increased exploitation in the highest areas of rivers, in the absence of clear conventions to regulate and manage the investment of these resources.

2.3. Degradations and threats affecting water resources, facilities, ecosystems and population

Alteration of the quality of the water

The monitoring activities show that near all major settlements groundwater and surface water are polluted with domestic & industrial waste, where, the concentrations of BOD, SS and ammonia exceeds Syrian standards, besides that, groundwater in the basin shows extremely high concentrations of pathogens, nitrates and agrochemicals. This situation occurs in many areas, as:

- water pollution in Barada river from sewage water as illustrated in figure.6

Figure.6: Photographs of water pollution from sewage and industrial waste water in the Ghouta of Damascus

- It has been noted that there is an increase in the amount of Nitrates and Ammonia Ions in some drinking wells in Damascus countryside (Ghouta) over the permitted level,as illustrated in table.5, Thus, this led to stop in 2005 the investment of more than 200 wells for drinking .

indicator	Concentration of pollutants(mg/l)	Maximum permitted limit(mg/l)
Nnitrates	100-200	40
Ammonia	3.2	0.3

Table.5 : concentration of some pollutants in drinking water wells in rural Damascus 2005

- *Industrial pollution*. The uncontrolled discharge of industrial wastewater occurs on a large scale. The fertilizer and food processing industries contribute to the pollution load, but smaller & medium-sized industries as tanneries also contribute and their impacts even larger.
- *Agricultural drainage water.* Drainage water from irrigated agriculture reaches the rivers and groundwater containing excess nutrients, pesticides and sometimes (in the case of irrigation with untreated wastewater) pathogens.
- *Saltwater intrusion.* In areas with heavy groundwater extraction, saltwater intrusion into the aquifer from the sea side or other saline ground waters is happened.

There is sufficient evidence to indicate that significant health impacts have been caused as a result of water pollution. The following cases have been reported:

- Almost, 900000 cases of waterborne disease were reported in 1996, even though, a significant number went unreported. Table. 6 Lists the types of diseases transported by water.
- High rates of infantile diarrhea, with fatality rates up to 10% within some illegal housing areas not served with a drinking water network.

Table.6: Diseases transported by water and food in Syria

Year	Typhoid	Summer type diarrhoea	Acute diarrhoea in children under 5 years
2000	5101	Non-existent	45,290
2001	5781	Non-existent	34,629

Source: Strategy and National Environmental Action Plan (2003)

Degradation cost

The cost of environmental degradation in Syria is estimated in 2004 by METAP /World Bank to be 2.6-4.1% of GDP annually, based on 2001 figures, with a mean estimate of around 31 billion SP per year, or 3.3 percent of GDP. Estimated costs of damage are organized by environmental category. The cost of diarrhea illness and mortality follows at an estimated 0.6-0.7 percent of GDP, caused by a lack of access to safe potable water and sanitation, and inadequate domestic, personal and food hygiene, while the total cost of water resource degradation, and inadequate potable water, sanitation and hygiene is estimated at **0.7-1.0** percent of GDP.

2.4. Access to drinking water and sanitation and collection and treatment of waste water

o Water supply

The general drinking water system in Syria covers about 95% of populated urban areas and about 75% in rural areas. According to 2004 statistics, the rate of houses supplied with drinking water by a public network in Syria reached 88%. So, the indicator of Share of population with access to an improved water sources (total , urban , rural) will be:

Total (E/P)*100 = 88 Urban (E/P)*100= 95 Rural (E/P)*100 = 75

Water shortage causes serious breaks on delivery in many cities. Leakage problems are still serious in most cities, despite of constant rehabilitation works. While, spring water and boreholes which used as water source are requiring rather little treatment, disinfecting.

The extensive use of water for irrigation had led to dramatic decrease of groundwater levels in many areas. Therefore the government has recently banned the construction of new wells.

o Wastewater collection and treatment

More than 80% of the population is served by sanitary drainage, while only 30% of municipal wastewaters in Syria are treated process. It means that the indicator of population with access to an improved sanitation system is:

(A/P)*100 = 80%(total for sanitation network), (A/P)*100 = 30%(total for sanitation treatment)

The reminder wastewater is discharged to the nature without any treatment. Often effluents are used for irrigation purposes, even when untreated, leading to a high risk of contamination of the crops.. Currently, work is underway to expand and rehabilitate sewerage networks in small towns and rural areas. Low cost-effective treatment units are being developed for population centers between 1000 and 10,000.

3- Improve efficiency in the sectors of activity using the water demand management policies:

3.1 Data and Indicators

1) Water for agriculture:

In 2004, the cultivated land area in Syria was estimated at 5525 thousand ha, which accounted about 30% of the total country area. 26% of the cultivated area (1439 thousand ha) was irrigated. In fact, irrigated areas has been widely developed during [1985-2004], increased from 652 thousand .ha to 1439 thousand .ha, in an increase of about 787 thousand .ha, the matter that gave rise to water demand, which reflected as an increasing of water demand from 8.3 B. m³/year in 1990 into 14.545 B.m³/year in 2004, as illustrated in table. 7 & figure.7.

The Syrian government is planning to increase the irrigated area about 1135 thousand .ha more than the existing now, the matter which will increase water demand for irrigation up to 25 m.m³ if the plants will be given the same average ration 10000 m³/h.

Note: we could notice a considerable deference in figures offered by Ministry of Irrigation, concerning water demand for irrigation comparing with figures of the same indicator offered by Ministry of Agriculture (ex. Ministry of irrigation announced that water demand for agriculture in 2003 is 16690 mm3, while the same figure refers to 14545 mm3 in 2004 by ministry of agriculture.

year	Surface irrigated (1000 ha)			Groundwater irrigated (1000 ha)	Modern methods (1000 ha)		Total irrigated area (1000 ha)
	Government projects	River, spring & other	total		Dropping	Sprinkling	
1985	-	-	334 (51%)	318(49%)	-		652
1990	-	-	351 (51%)	342(49%)	-		693
1995	-	-	388(36%)	694(64%)	-		1082
2000	-	512.4	512 (42%)	698(58%)	-		1210
2002	314	201.4	515.4 (39%)	817.3(61%)	214.8		1333
					76.4	138.4	
2004	340.2	234.2	574.4(4o%)	864.7(60 %)	187.7		1439.1
					57.5	130.2	

Table.7 : irrigated area by source of irrigation (Somi, 2002-Ministry of Agriculture & statistical abstract 2005)

Taking into consideration that this kind of water demand increasing was not stable and harmonized, since, the percentage of irrigated area on surface resources was reduced in 1995 into 36% while irrigated area on groundwater resources was increased into 64% resulting in intensive consumption of groundwater, the matter which led to declining of water table and reducing of water flow, and it affects negatively on springs which provide irrigation projects with water. Traditional surface irrigation prevails more than 80% of irrigated area in Syria, regular water rations are not taken into consideration, whereas plants are given between [8000-16000] m³/ha.

Also, using of an open government irrigation canals lead up to losses of about [10-60] % of conducted water through seepage and evaporation, as Conveyance efficiencies of surface irrigation canals do not exceed 50-60% due to over irrigation by farmers, the use of traditional irrigation techniques, and the inadequacy of land leveling.
Although the government had lunched with national program for transferring to modern irrigation in order to decrease water losses of about 50%, but the achievements of the national program had not exceed 18.54% of total land which is able to shift into modern irrigation. In addition to that, transferring to modern technique had not touch land with water excessive crops as cotton, since only 4% of cotton land is irrigated by drop, 14% by canals, while 82% by flooding. In the other hand, irrigated area which depend on groundwater is estimated of (60% of total irrigated areas), the matter which causes high pressure on the limited groundwater sources.

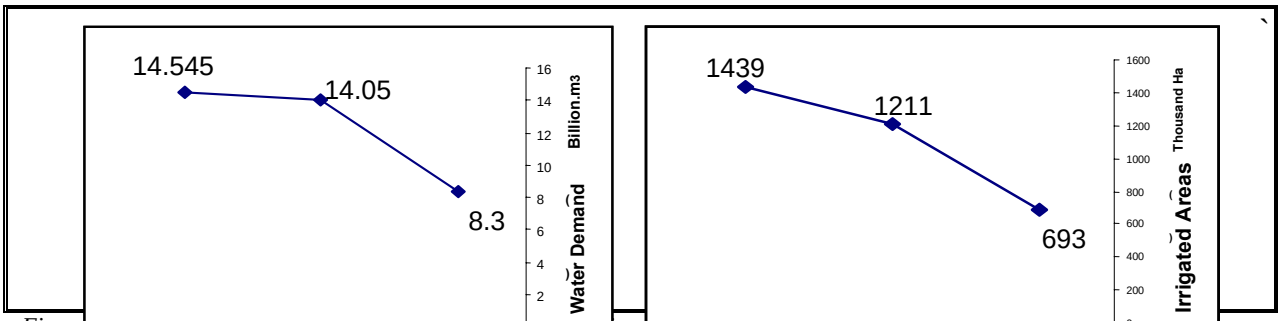


Figure ng

A su ndv for wheat, cotton, citrus, and sugar beet. Area increases have been substantial in the last decade in sugar beet (32%), cotton (75%), irrigated wheat (40%), and citrus(40%). Much of the expansion in wheat has been driven by rapid expansions of its price while water cost has remained low. Farmers are obtaining water at an extremely subsidized rate, and groundwater costs do not reflect their real value because the energy required for pumping is also subsidized.
Legally, licenses are required to drill and use wells. However, poor enforcement has resulted in a large increase in the number of illegal wells almost 50% of the total number of wells.

At the end of 2005, water legislation has been issued, as a response to growing need to water demand management at national level, as well as to achieve the desired development in water resources management, through supporting modern irrigation methods, controlling licenses to drill and use wells, in addition to establish the fund for supporting the transferring into modern irrigation. The turn point in water policy which is supported by new Water Legislation was the establishment of **"Water User Associations"** which consider as specific initiative towards implementing participatory approach in water resources management.

In spite that agriculture contributes about 22% of the country GDP, and the water demand for agriculture compared to the agriculture GDP equals (14545/320227) m.m³/US$, it means that each 1 m³ of irrigation water contribute of about 22 Sp = 0.44 US$ of the GDP, but the water tariff collected from farmers covers only a part of the cost for the irrigation water distribution network, in addition to the costs of network operation and maintenance. The tariff is fixed at 3500 SP/hectare. Apparently, this scheme does not provide any incentive for water conservation. So it's very important to shift to a volume based tariff.

2) Domestic water:

The general drinking water system in Syria covers about 95% of populated urban areas and about 75% in rural areas. According to 2004 statistics, the rate of houses supplied with drinking water by a public network in Syria increased from 84% in 2000 to 92% in 2004. In general, Ministry of Housing estimates that the quantity of fresh drinking water produced increased from 920 m.m3 in 2000 to 1161 m.m^3 in 2004. Also the rate of beneficiaries of clean drinkable water has reached 96%. Table.8 illustrates the production and consumption of drinking water in 2003.

Directorates	Actual production (1000 m^3)	Paid consumption (1000 m^3)	Free Consumption (1000 m^3)	Network waste (1000 m^3)
Damascus	207,894	79,264	79,775	48,855
Rural Damascus	91,800	68,850	510	22,440
Homs	75,466	51,802	1,300	22,364
Hama	90,316	62,590	123	27,603
Tartous	37,950	26,190	210	11,550
Latakia	63,752	44,540	1,716	17,496
Idleb	51,100	34,500	3,090	13,510
*Aleppo	241,000	168,700	40,970	31,330
Raqqa	48,250	35,430	1,050	11,770
Deir Ezzor	54,589	31,730	4,860	17,999
Hassakeh	37,353	29,186	1,720	6,447
Dar'a	53,800	37,850	-	15,950
Sweida	18,150	12,371	50	5,829
Quneitra	8,634	5,640	360	2,634
Total	1,080,054	688,643	135,734	255,777

Table.8: Production and consumption of drinking water by governorate (2003)

We could conclude from the above table that the drinking water efficiency equal:

$$E_{pot} = V1/V2 = 688.643/1080.054 = 64\%$$

V1=drinking water volume invoiced and paid by consumer

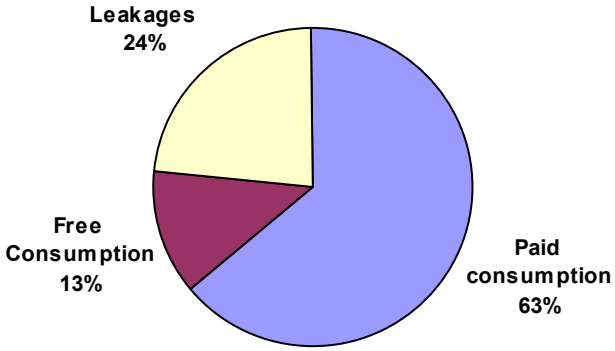
V2= total drinking water volume produced and distributed

In other words, one of the key performance indicators in water supply is the unaccounted for water (UFW), sometimes also referred to as non-revenue water (NRW). It is linked directly to water pricing.UFW includes all technical and non-technical water losses in a water supply system. Currently, a study is carried out in Syria in the context of the Water Sector Programme in Barada Basin, according to findings: an estimated of 40% of the water was unaccounted for. Performance indicators like UFW and water tariff regulations are a major concern in the rehabilitation of existing water supply systems.

Governmental offices and other public institutions pay low or in some cases zero rates for water. This free consumption responds 136 million m^3 (12.6%) of total volume i.e. 13% countrywide. It

reaches its highest rates in Damascus 50.2%, obviously due to its large number of public buildings. Due to leakages in network some 256 mill. m^3 of water was lost, responding 23.7% of total volume. In same cases leakages consists more than 30% of actual production. When these numbers are added (loss rates in the networks and free consumption), it is concluded that 36.5% of water produced by Syria is being wasted in vain, a big loss compared to the costs Syria has to pay for providing potable water for citizens. The following diagram illustrates this situation:

Figure.8 : Overall production and consumption of water in Syria (2003), Source: Ministry of irrigation



One important reason for high leakages is widely used cast iron pipes, which seem to be unreliable in Syria. Plastic pipes are used mainly for customer connections (d < 80 mm) only. On the other hand in certain areas of cities the pipelines are very old and therefore in a need of rehabilitation.

In general, the volume of water resources utilized in drinking utility is estimated 8% of exploited water. Accordingly, the individual's share of drinking water is estimated at 100 to 160 liters/day. Drinking water consumption per capita ranges between 82 l/d in rural and 176 l/d in urban areas

Currently there is a uniform tariff throughout the country for water supply, thus having no relationship with actual production costs in each utility. The tariff level is very low and does not encourage households to save water. For example, consumption up to 20 m^3/month/household is charged by a tariff of 3 SYP/m^3 only. Household water tariffs range from 0.05 to 0.28 Euro/m^3 for domestic use based on an increasing block tariff.

The structure of the water tariff for supplying drinking water to consumers partially covers the costs of water treatment, network maintenance and operation. This tariff structure accounts for the social conditions of the Syrian population. As illustrated in table.9

Table.9: Tariffs for providing drinking water in accordance with quantities consumed

Sector	Consumed water (m^3)	Tariff (Syrian Pounds)
Household	1 to 20	3.0
Household	20 to 30	4.5
Household	30 to 60	13.5
Household	over 60	19.0
Governmental agencies	-	8.5
Industrial, commercial and tourism sectors	-	22.0

Source: Ministry of housing and Construction

This is an important, but only one reason, why utilities cannot operate profitably. As well as in many other services in Syria, water is seen as a necessity and to be subsidized heavily. This leads

to the lack of targeting of the subsidies. In case of revenue, the water authority is required to transfer the profit to the ministry of finance, wherefrom it can be borrowed back by an interest rate of 17%. The practice is not encouraging water authorities to operate profitably.

Water pricing policy determines significantly the performance of water supply. While adequate prices allow high performance standards, inadequate cost recovery very often leads to low performance in Syria.

A more effective pricing system should enable water authorities to recover, at a minimum, operation and maintenance costs of water and sanitation through tariff revenues, in order to make the investments sustainable. In the long-term, the pricing system should move a step further to recover at least a portion of capital costs. An appropriate tariff structure should make it feasible to protect the poor, guarantee sufficient and stable revenues to utilities operating at an efficient level, and to promote allocate efficiency.

3) Water for industry:

The industrial sector consumes only 574 m.m³ which equal 4% of total exploited water, so the potential of water pricing as a tool for water demand management is not considered to be significant. However, the main environmental issue related to the industry is the water pollution caused by industrial effluents disposed with or without treatment directly to the natural waters.

The main part of Syrian industrial activities are characterised by the absence of pollution control measures. The existing industrial wastewater treatment plants are poorly managed and maintained.

Based on the above data, it is obvious that the use of new instruments for water quality management is essential, like the ‘polluter pays’ principle and cost recovery schemes - possibly in combination with incentives for environmentally-friendly activities or a subsidy system that can be funded by such initiatives as charges for polluting industries – is required.

The industrial sector in Syria formed about 28% of the set-up of the GDP in 2005. The discharge of untreated industrial water to lands and water bodies lead to the deterioration of aquatic ecosystems of rivers, lakes, and groundwater, and thus exit from the useful investment, in addition to health damages and the loss of the economic and hedonic value of the flat water body, because of the high percentage of each phosphate, bacteria, BOD, COD, dissolved solids, heavy metals, and suspended solids in surface and groundwater. Many examples could be put on those problems in water basins

Currently, the costs of industrial wastewater treatment are not recovered. The decreasing ability of industry to pay the wastewater fees and the poor law enforcement play an important role. Fines for exceeding the permitted concentrations are not enforced. Generally speaking, industry is motivated to discharge wastewater through the public sewerage, as this entails lower costs.

From available date provided by Ministry of Irrigation, a report was mentioned that the recycled water volume is estimated about 160 m.m3, it means that the efficiency of industrial water use is:

$$E_{ind} = V1/V2 = 160/574 = 0.28$$

V1=Recycled water volumes *V2= Gross volume consumed for industrial processes*

3.2 Retrospective Analysis

In 2000, the 9th five year plan [2001-2005] oriented to develop agricultural sector to achieve food security, it was the policy of the government irrespective the risk of entrance in water resources deficit. At the end of this temporal period it was clear that Syria was facing a deficit in water balance by about 3 milliard m³, which returned basically to the yearly increase of water uses in the various sectors which is exceeding the renewable water.
The ninth five years plan indicated the necessity to enter the concept of integrated & sustainable water resources management to protect it in quantity & quality.

In 2002, the Syrian government presented its policy priorities for water resources utilization according to the following order:

1. ***Supplying drinking water***
2. ***Developing industry and tourism***
3. ***Promoting modern irrigation practices in agriculture***

Nevertheless, it was noted that for the foreseeable future, the agriculture sector will remain the dominant consumer of water in Syria.
Through general analysis of the previous national plans, we could notice that **the increase in the offer was the traditional dominant response in Syria to demand increase, and then it reached its limits and confronted with growing social, economic and ecologic obstacles.**
We could identify the main weakness points in the previous policy as following:

- *Syria had not gain its total portion from Euphrates, and not gain its portion from Tigris river according to the agreement with Iraq in 2003, since it needs a similar agreement with Turkey.*
- *The volume of exploited water exceeded the available water resources of about 32% as an average in all basins except the Euphrates and Coastal basins, the matter which led to water deficit of about 1727 m.m³ as an average, and to about 3000 m.m³ in 2005.*
- *the percentage of irrigated area on surface resources reduced into 36% while irrigated area on groundwater resources increased into 64% resulting in intensive consumption of groundwater, the matter which led to declining of water table and reducing of water flow, and it affects negatively on springs which provide irrigation projects with water.*
- *the per capita ARWR is less than the water scarcity index (1000 m3/person/year), average per capita water availability is estimated at 800 m3/hab/yr.*
- *Although the government had lunched with national program for transferring to modern irrigation to decrease water losses of about 50%, but the achievements of the program had not exceed 18.54% of total land which is able to shift into modern irrigation.*

In spite of water shortage in Syria, a huge amount of water had been exploited in irrigation, as well as large financial resources had been allocated for developing agricultural sector, while the development in irrigation methods was very slow, the matter which affected negatively on the rate of economic growth , especially that the added value of financial investments in agriculture sector was very low, taking into consideration that the other sectors which already had higher revenue of water had not have the same interest by the government , the matter which led to slowing down of social – economic growth rate, and to water resources deterioration from quantity & quality viewpoints.
Hence, the table.10 illustrates the comparison of economic revenues of water unit in each sector.

indicator		unit	years											average
			92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	
Net domestic product	agriculture	Million Syrian pounds	156769	166401	173109	198391	192859	235923	200163	218594	237568	255098	250088	207723.9
	Irrigated agriculture	=	125415.2	133120.8	138487.2	160696.71	156215.79	193456.86	166135.29	183618.96	201932.8	216833.3	212574.8	171680.7
	Industry	=	162052	168741	192205	235455	274424	284197	274566	251485	252250	243704	246339	235038
	other sectors	=	313898	342994	360012	362021	368837	372414	385517	395314	409502	439304	467077	383353.6
	total	=	632719	678136	725326	795867	836120	892534	860246	865393	899320	938106	963504	826115.5
Economic revenue of water unit	Agriculture	S.P/m³	11	11	11.5	12.9	12.2	14.6	12.8	13.9	14.8	15	14.5	13.1
	Industry	=	643.1	616.7	671.1	750.8	820.6	791.2	716.5	616.4	582.8	535.4	517.5	660.2
	Other sectors	=	4982.5	5014.5	5028.1	4617.6	4411.9	4147.1	4024.2	3875.6	3784.7	3860.3	3925	4333.8
	total	=	53.9	54.7	58.5	62	63.1	65.1	63.8	63.2	63.2	62.6	63.1	61

Table.10 : comparison of economic revenues of water unit in each sector- Ministry of Irrigation 2006

It was clear through cooperation projects with German and Dutch governments, that the most important issue that should be emphasized on was the reforming of water policy, introducing WDM policy by the use of economic tools in the water sector, especially that mobilization of additional surface water resources in Syria is very limited, so the only suitable solution is to invest in improving the efficiency of the existing irrigation and water supply systems. In this regard the low level of cost recovery in Syria is a main issue to be addressed in the water policy reform, since the low water tariff means that there is practically no demand management.

The main political instruments implemented to reach the goal in each sector were:

Water for Agriculture

In the agricultural sector, the structure of the water tariff collected from farmers covers only a part of the cost for the irrigation water distribution network plus the costs of network operation and maintenance. The tariff is fixed at 3500 SP/hectare irrespective the type of crops, or the amount of exploited water. Apparently, this scheme does not provide any incentive for water conservation. So it's very important to **shift to a volume based tariff for irrigation**, in spite that till now there is no strong policy to set prices for irrigation water, and no legal regulation for invoicing the price of irrigation with volume-related pricing system.

The most applicable method for implementing WDM in agricultural sector was the transferring into modern irrigation. In this field, Syria had a success story with field applied research of transferring into modern irrigation on the most strategic crop "cotton", **which considered as a base, good motivation for the government decision on transferring to modern irrigation**.

Case study

Due to the growing strategic importance of cotton over the recent years where cotton grown area ranged 250-270 thousand.ha, And since cotton is consuming larger portion of irrigation water ranging 3-4 billion m³,and the prevailing irrigation method in cotton land is flooding irrigation which has many disadvantages as law application efficiency (50%), so, losses 50% at least, and high water table, soil salinity as in Down Euphrates Basin as a result of over-irrigation…. hence, Ministry of Agriculture gave special importance to cotton irrigation aiming at improvement of water uses and irrigation efficiency, consequently water saving and cotton yield increase by the introduction of modern irrigation methods and techniques The application research on cotton the strategic crop and other crops, bring out the following conclusion :

***- Drip irrigation vis-à-vis traditional surface gave the following results**:*

- *Applied water was 6113 m³/ha and 14446 m³/ha for localized and traditional irrigation respectively*
- *Yield increase 35%*
- *Irrigation water saving 58%*
- *WUE increase from 0.23 to 0.74 kg/ m³*
- *Application efficiency increase from 45-50% for traditional to 88.5% for localized*

- Sprinkler irrigation vis-à-vis traditional irrigation led to the following

- *Applied water by sprinkler was 8920 m³/ha and 14446 m³/ha for traditional*
- *Yield increase 31%*
- *Irrigation water saving 38%*
- *WUE increase from 0.23 to 0.49 kg/ m³*
- *Application efficiency increase from 45-50% for traditional to 78% for sprinkler*

- Improved surface irrigation vis-à-vis traditional irrigation led to the following

- *Applied water by improved surface was 10612 m³/ha and 14446 m³/ha for traditional*
- *Yield increase 18%*
- *Irrigation water saving 27%*
- *WUE increase from 0.23 to 0.37 kg/ m³*
- *Application efficiency increase from 45-50% for traditional to 62% for improved surface*

Sprinkler and drip irrigation shows great potential for maximizing the efficiency of water use and reducing irrigation-related environmental problem, as illustrated in figs 9,10,11.12, 13

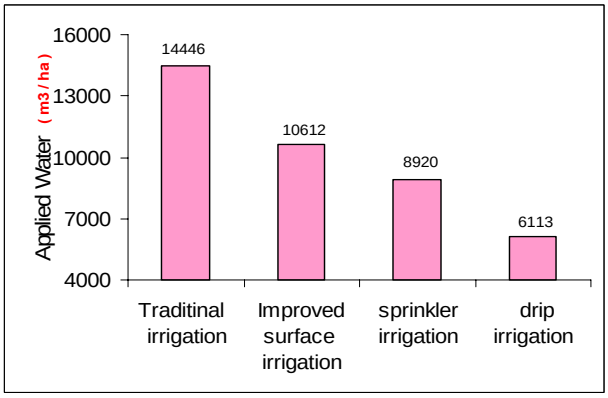


Fig.9: comparison of applied water between deferent method

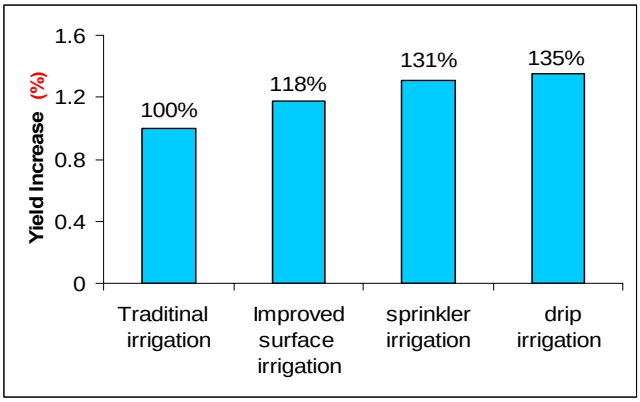


fig.10: comparison of yield increase between deferent method

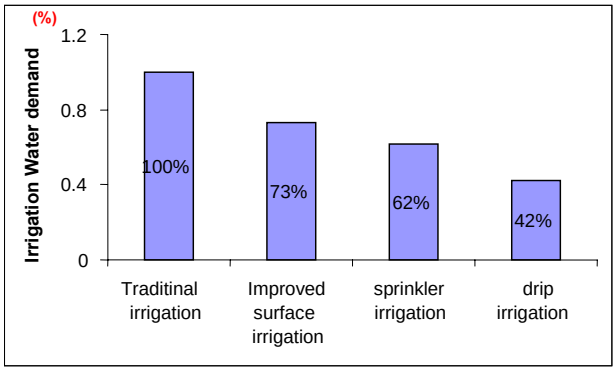


Fig1: comparison of water demand between deferent method

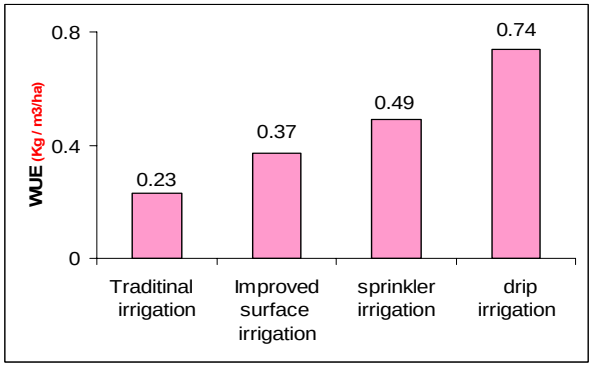


fig.12: comparison of WUE between deferent method

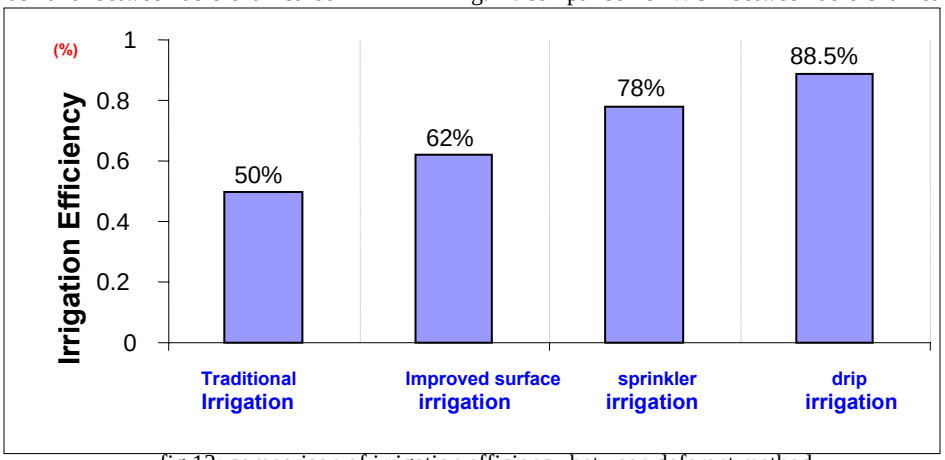


fig.13: comparison of irrigation efficiency between deferent method

Economic analysis aims at the interpretation of research results to physical data by estimating the revenues and costs per unit area as a result of productivity change and reduction of irrigation costs. Drip irrigation research had been done in (4) research stations where cotton is available; the moderate of results for all stations, and for all temporal duration had been taken, to reflect the actual cost and revenue, in order to make economic comparison between all irrigation systems

Table.11: Economic comparison of irrigation methods by water source on cotton (pump 40 m³/h)

Statement		Government irrigation projects	Pumping 50 m	Pumping 100 m	Pumping 200 m
Total revenue SP/ha	**Traditional surface**	**127760**	**127760**	**127760**	**127760**
	Improved surface	**158080**	**158080**	**158080**	**158080**
	Sprinkler	**175040**	**175040**	**175040**	**175040**
	Drip	**180640**	**180640**	**180640**	**180640**
Total cost SP/ha	**Traditional surface**	**78928**	**88319**	**102909**	**114321**
	Improved surface	**77293**	**93207**	**103081**	**113015**
	Sprinkler	**74468**	**86064**	**95252**	**112378**
	Drip	**74202**	**83677**	**90096**	**101770**
Net profit SP/ha	**Traditional surface**	**48831**	**39441**	**30751**	**13439**
	Improved surface	**80787**	**64873**	**54999**	**45063**
	Sprinkler	**100572**	**88976**	**79788**	**62662**
	Drip	**106436**	**96963**	**90544**	**74113**
Profit/cost%	**Traditional surface**	**62**	**45**	**30**	**12**
	Improved surface	**105**	**70**	**53**	**40**
	Sprinkler	**135**	**103**	**84**	**56**
	Drip	**143**	**116**	**101**	**73**

Through data on relative significance of irrigation technique using financial analysis, the following can be concluded:

- *Drip irrigation ranked the first for the irrigation technique economics in terms of Revenues, net Profits per unit area and profit/cost ratio, followed by sprinkler irrigation for all prevailing irrigation sources in Syria*
- *Differences among irrigation techniques increase by increasing irrigation expenses i.e. high Pumping level as traditional surface costs increases as a result of using higher amount of water*
- *Net profit of irrigation techniques is increasing forward with high irrigation costs as Compared to traditional irrigation.*

Hence, the main essential orientation and effective instrument was encouraging the usage of modern irrigation techniques to minimize water consumption. The Council of Ministers has agreed (in September 2005) to establish national monetary fund (about 52.2 milliard S.P) to support the modern irrigation projects which aims at:

- Limiting the planting of the crops which need great amounts of water.
- Inventing new dryness-resistance races of plants.
- Minimizing the use of fertilizers and insecticides to prevent water pollution.

Domestic Water

There is a uniform tariff throughout the country for water supply, thus having no relationship with actual production costs in each utility. The tariff level is very low and does not encourage households to save water. For example, consumption up to 20 m^3/month/household is charged by a tariff of 3 SYP/m^3 only. Household water tariffs range from 0.05 to 0.28 Euro/m^3 for domestic use based on an increasing block tariff.

This structure of the water tariff for supplying water partially covers the costs of water treatment, network maintenance and operation. This tariff structure accounts for the social conditions of the Syrian population. And the principle of progressively increasing tariff rates is adopted in the tariff structure in order to promote water rationing by the general public in the domestic sector, while, the industrial and commercial sectors pay a fixed-rate fee regardless of quantities of water consumed.
However, despite the fact that some water authorities have managed to cover their operational costs (not the capital investments), in general the cost recovery system is not sufficient and the economic burden is expected to increase in the future due to sewage network expansions and the operation of new wastewater treatment plants.

Based on available information, some Water Authorities suffers from a deficit, whereas others are able to meet operational costs. The collection mechanism is considered to be effective in most cases as the consumers face the threat of water delivery cut in case of non-payment.

Although the production costs vary significantly from place to place due to location problems the same rates are applied to all areas countrywide leading to significant deficits, which apparently limit the capacity of water authorities to improve their services.

Furthermore, extra economic burdens are imposed by the following factors:

- uncharged consumption responding to some 15% of total volume of water produced
- construction of illegal connections to networks
- industrial discharges in sewers creating operational problems in the WWTPs and cost increase.

Overall, economic instruments already used in Syria for households include:

- Increased block tariff for water supply
- Subsidies (for the operation of water authorities and indirectly subsidized water prices for low consumers).

Wastewater charges do not exist in Syria, but in the cities having wastewater treatment in operation, some 15-20% of customer's water bill is allocated to cover part of the wastewater collection and treatment costs. Industrial plants are generally not connected to the public water or wastewater network. They often have boreholes of their own and sometimes a wastewater treatment plant.

Syria had a success story in water demand management in the field of domestic water sector development, concerning the process of substituting the damaged networks with a new one to increase its efficiency, the matter which led to decrease the percentage of physical leakage from Damascus networks from 35% in 1998 to 22% in 2005.

Industrial Wastewater :

The industrial sector in Syria formed about 31% of the set-up of the GDP in 2003. At the same time the industrial enterprises produce wastewater with substantial pollution load. According to the" **Environmental Protection Law**" the industrial enterprises must treat their wastewater. If there is no public sewer in the vicinity of the enterprise, the enterprise has to treat wastewater in order to meet the national standard of irrigation water. Where there is a public sewer, the wastewater must be pre-treated to meet the standard of the maximum acceptable concentration for discharging into public sewer

One of the main causes of water pollution in Syria is the direct discharge of industrial wastewater (with or without pretreatment) into natural waters. The uncontrolled discharge of industrial wastewater occurs on a large scale leading to a considerable damage in the quality of water and affect the possibility of use it for drinking purposes The discharge or disposal of waste into water resources imposing an extra cost to other water users, since they lose the chance to use the resource for their own purposes, or have to treat the water before they can use it. This is a key issue in a water-stressed country like Syria, where competition for available water is growing fast

The industrial sector consumes only 4% of total water demand so the potential of water pricing as a tool for water demand management is not considered to be significant.

Currently in Syria, there are modern industrial sites under construction close to Damascus, Homs, Aleppo and big cities. The industries are sited based on proper classification of activities and common treatment facilities are foreseen. The Syrian strategy aims at gradually relocating all the manufactures to these industrial cities.

It is obvious that the use of new instruments for water quality management is essential. These will complement the existing regulatory framework. The development of new tools like the 'polluter pays' principle and cost recovery schemes - possibly in combination with incentives for environmentally-friendly activities or a subsidy system that can be funded by such initiatives as charges for polluting industries – is required. The proposed tools should:

- discourage environmentally unfriendly behavior such as uncontrolled discharge of industrial waste that may impact on water quality
- provide incentives for industry to conserve/recycle water and treat produced wastewater and
- Assist small and medium size businesses to improve environmental performance and invest in technologies that favor minimum water use and maximum recycling.

3.3 Prospective

In 2005 policies, strategies & objectives of the 10th Five-Year Plan [2006-2010], were developed aiming at:

For Agriculture Sector

General Objectives:

- Set a comprehensive national plan for the integrated use of available water resources, and concentrate on preserving groundwater aquifers as an important reserve for food security.
- Increase in the efficiency of various water uses to improve the participation of water sector in the Gross National Product.
- A comprehensive evaluation of the various water facilities in the sanitation and the irrigation including dams.
- Establishment of integrated water resources monitoring system.

Quantitative Objectives:

- Transfer about 50% of irrigated lands to modern irrigation method.
- Increase water use efficiency in irrigation of about 50% to 80% of the modern irrigated lands
- Increasing the use of treated wastewater
- Effective reduction of depleting of ground water by reduction of lands percentage irrigated with non renewable ground water and not licensed well by 10% yearly.
- The content of pollutants in water must be within allowable limits
- Increase Gross Product value with fixed prices about 3.5% and increase national Product by Market price about 3.2% yearly.

The future prospective for irrigation sector:

1. horizontal extension:

- in the field of land reclamation:

  The 10th five year plan determined the principle to extend in the new reclaimed areas in view of continuous water supply; accordingly concentration will be to increase reclaimed areas in the Euphrates basin as there is unexploited water, in addition to Tigris & Khabour basin in view of possibility to ensure waters from Tigris river to return balance to ground water.

- In the field of dams:

  Achievement should be done to study the possibility of erection dams in all places of water prospective as the coastal and Euphrates basins.

2- Vertical extension:

The sector plan aimed to accelerate the programs to transfer into modern irrigation for the remaining area amounting about 1219 thousand ha, which will be executed within 10 years commencing in 2006 with a reduction of water consumption for the irrigated hectare from 12800 to 8000 m^3/year

3- Supporting activities:

- Qualifying, training and research - Complete water observatory network - Operating and maintaining of irrigation projects - Transfer from offer management to demand management

Expected achievement in agriculture sector:

1- Increasing of the rate of Gross Domestic Product of about 4.5%.

2- Contributing in agriculture comprehensive development, elevating poverty, and improvement of human resources.

3- Contributing in creating new chances for work of about 70 000 ones.

For Domestic Water Sector

General Objectives:

- Provision of safe drinking water and treated sewage for rural and urban population centers and their developing areas, based on the principle of integrated and sustainable resources between all water users within the hydrologic basin
- Reduction of water losses in drinking water establishments
- Providing customers with quality services funded through cost recovery for operation and maintenance, applied gradually, based on subsidies between different segments of society in a governorate served by a single establishment

Quantitative Objectives:

- Provision of safe drinking water for 96% of the population
- Provision of sewage networks for 81% of the population
- Provision of treated sewage water for 46% of the population
- Reduction of water losses in water establishments to 25%
- Achieving a cost recovery ratio for operation and maintenance for water supply services between 2006 to 2010 as follows:

2006	2007	2008	2009	2010
55%	60%	65%	75%	90%

- Achieving a cost recovery ratio for operation and maintenance for sewage collection and treatment services between 2006 to 2010 as follows:

2006	2007	2008	2009	2010
25%	30%	35%	40%	50%

- Training 100% of workers in upper administrative levels
- Training 20% of technical workers
- Achieving 80 liters daily consumption of water per capita

The Syrian government aims at gradually improving cost recovery of operation and maintenance cost in water supply and wastewater service provision. As well as an increasing recovery of depreciation and capital cost at long term, through the development of economic instruments.
Based on problem analysis in Syria, the following options of EIs are selected for further analysis:

1- Restructure of current water pricing system to cover the O&M costs of water supply and gradually to cover part of investment costs. Water tariffs in Syria are too low to encourage rational water use and to provide financial means for development works in the water supply and treatment sector; the tariffs are uniform in Syria despite the fact that production costs vary

significantly from place to place due to geographical conditions and resource management. For household consumption, there is an increasing block water tariff applied including 4 blocks. But despite this increasing tariff, the figures show that the average price is very low and water authorities in most cases operate with a deficit.

In order to improve water demand management policy in drinking water sector, many scenarios have been set for the developing of water pricing system in Syria, based on a financial evaluation of the present O&M cost for selected Establishments and wastewater Companies. Due to the lack of available data, the government used a normative approach to develop the tariff scenarios. The nationwide average cost recovery for water supply is in the range of 70% and only few Establishments are able to cover the operating costs.
The existing tariff scheme is characterized by the fact that the first block is very large and the average water price is too low. This large first block at a low rate neither targets the rational use of the scarce water resources in Syria, nor allocates subsidies specifically to poor households.
An international comparison of tariff show that the average water tariff is extremely low compared to countries with a similar socio-economic profile. Most of the countries apply a more progressive block system.

Approach for definition of tariff options

According to the analysis of the existing situation, the government came to the conclusion to elaborate the options for short-term tariff adjustment not directly on the basis of the available demand/production data and the cost/revenue figures as provided by the establishments. But to apply a "normative approach". This approach considers and takes into account:

- *Adjusted water demand data*
- *Adjusted operation and maintenance cost*
- *benchmark / target figures for the financial performance of the establishments (ratio of unaccounted for water [UFW], billing efficiency, collection efficiency)*

In the proposed tariff options wastewater charges are not considered in form of a surcharge on water tariff , but calculated as separate tariff , to be paid by all customers (independent whether they are connected to a WWTP or not) on the basis of their water consumption.
For tariff option (3) wastewater charges are calculated as separate tariffs just for the customers actually connected to a WWTP.

The short-term tariff study is carried out for the following scenarios:

(A) **Low Scenario**: annual revenues cover annual O&M cost(without depreciation/replacement cost)
(B) **Medium Scenario**: revenues cover O&M cost plus replacement cost of equipment
(C) **High Scenario**: revenues cover O&M cost plus total replacement cost
(D) **5 Year-Plan Scenario**:
   I. For water services revenues should cover 90% of O&M cost plus depreciation of existing and new assets
   II. For wastewater services revenues should cover 50% of O&M cost plus depreciation of existing and new assets

Based on international standards and on the findings of many workshops the government has studied the following water & wastewater tariff options for each of the defined scenarios:

Tariff Option 1

Is just a kind of reference option, which keeps the relatively ineffective "**4-block tariff pattern**" of the existing water tariff scheme. It is just calculated for water supply (not for wastewater), but separately for each Establishment and for each of the three scenarios (Low, Medium, High). In addition it is aggregated for the total of all 14 Establishments.

Tariff Option 2

Is designed as a modified "**progressive 3-block tariff pattern**" with a significantly smaller first tariff block for residential consumption (0-10 m^3/month) and a significant lower tariff rate for the first block, in order to enable poor households to keep their monthly water bill at an affordable level. It is calculated both for water supply and for wastewater separately for each Establishment and for each of the three scenarios (Low, Medium, and High)

Tariff Option 3

Is designed for the requirements defined in the 10^{th} 5 Year-Plan , for water supply cost for O&M and depreciation are to be covered to 90%, for wastewater network and treatment to 50%. Option 3 is calculated separately for water supply and wastewater in form of a "**unified tariff scheme**".

Results of elaborated tariff options/scenarios

The comparison of the tariff options / scenarios shows that the present average water & wastewater treatment tariff of 8.2 SYP/m^3 of water sales has to be increased by the year 2010 as illustrated in the table.12 to:

19.3 SYP/ m^3 if at least the effective O&M cost should be covered
24.3 SYP/ m^3 if O&M and replacement cost of equipment should be covered
35 SYP/ m^3 if O&M and total replacement cost should be covered, and to
27.7 SYP/ m^3 if option 3 (5 Year-Plan option) should be applied

Table. 12 : the scenario for the development of water & wastewater tariff by the year 2010

Scenario	Water [SYP/ m^3]	Wastewater treatment [SYP/ m^3]	Total [SYP/ m^3]
2004	7.1	1.1	8.2
2005	11.9	2	14
2A Low scenario-2010	13.1	6.2	19.3
2B Medium scenario- 2010	15.9	8.3	24.3
2C High scenario - 2010	25.2	9.8	35
3(5 year-plan)-2010	14	13.7	27.7

The consultants proposed to start with tariff option 2A (recovery of adjusted O&M cost) and switch later, if the economic situation might improve to tariff option 2B (recovery of adjusted O&M cost plus replacement cost of short-term equipment)

2- Setting up a wastewater charge. At present, there no user charges for the sewerage services. Considering the low performance indicators of sanitary services in Syria and the need for upgrade and expansion of services (both sewerage and treatment), a wastewater charge must be urgently introduced. Such charges are applied in most countries. Usually, the water price includes two components, one for the water supply and a different component to cover the costs of wastewater collection and treatment, in accordance with the "polluter pays" principle

It is proposed that the wastewater charge, at first stage, is introduced as a proportion of water tariff (e.g. 60% of water bill). Although the proposed charge for sanitation services is lower than water services, based on real costs, it may become necessary in the future to raise significantly the wastewater tariff (considering that the investment program for the coming years is enormous). To correct this failure, at a later stage, a volumetric charge based on water consumed and in accordance with real costs related to the collection and treatment of domestic wastewater must be established

3- Governmental financial assistance provided to water and wastewater authorities to apply an integrated management system including quality and environmental management system according to ISO9001 and ISO 14001 (or EMAS) accordingly. The focus of an EMS is to ensure that all processes related to the environment are identified, managed, and reviewed on a routine basis. An EMS, if applied properly, will provide a way to water companies in Syria to discover and control their environmental aspects (from leakages to solid waste disposal) and to establish environmental metrics and indicators for monitoring performance, as well as to find ways to improve this performance.

Linking or integrating the ISO 14001 environmental management system with the ISO 9001 quality management system will provide with several advantages, including potential cost savings and improved efficiency and effectiveness.

4-Corporate income tax relief for commercial business and hotels applying water conservation measures. Hotels, resorts or spas, restaurants are the major water consumers of the tourist industry, and usually little thought in conserving water supplies is given.

This scheme may provide for 100% enhanced capital allowances for water-efficient investments. This scheme aims to encourage businesses to invest in water-efficient equipment to help reduce their water use and improve water quality. Capital allowances allow the costs of capital assets to be written off against a business's taxable profits. First-year allowances 100% of the cost of an investment to qualify for tax relief against a business's profits of the period during which the investment is made.

Development of initial proposals:

A shortlist of four policy options that can help towards addressing the defined problems given the specific conditions in Syria was made. These tools are not alternative options therefore, no comparative analysis is made. Below, the specifications of each instrument are defined. The key points are presented in table.13.

Table 13: Structure of proposed EIs

Proposed economic instrument	SPECIFICATIONS OF TOOLS					
	Object of intervention	**Level of payment/subsidy Exemptions**	**Who has to pay or will be subsidized?**	**Revenues raising mechanism**	**Proposed Revenue use**	**Key Stakeholders for consultation**
Restructuring of current water pricing system	**Water supply**	• **Increased water tariffs for 2nd to 4th block so as to cover maintenance and operation costs of public water companies. The latter should decide on these rates following the general social policy framework set by government.** • **A fixed part in the water bill set at 10SP per month.** **Special rates only for charity foundations not governmental bodies**	**All domestic consumers**	**Through existing water companies**	**To cover operation and maintenance costs of public utilities**	o **Ministry of Local Administration and Environment** o **Ministry of irrigation** o **Ministry of housing and Construction – Water departments** o **Ministry of Economy and Trade** o **Water authorities and wastewater companies**
Introduction of new wastewater charge	**Wastewater collection and treatment**	• **60% of water bill at the beginning presented as different component in water bill and then setting a volumetric charge (SP/m^3) based on operation and maintenance costs of wastewater companies.**	**Domestic consumers**	**Incorporated into water bill of water companies.**	**To cover operation and maintenance costs of wastewater companies**	
Application of Integrated management system (ISO14001 and ISO9001) at water and waste water authorities	**Operation of water and wastewater Companies**	**Full cost of consultancy services for system development and application. Estimated cost for integrated system 40.000 €**	**Public water and wastewater companies**	**-** **(Incentive tool, not providing revenues)**	**-** **(Incentive tool, not providing revenues)**	
Corporate Income tax relief for commercial business and hotels applying water conservation measures	**Water consumption in business sector**	**100% capital allowance on water efficient investments**	**Business with focus on hotel industry.**	**-** **(Incentive tool, not providing revenues)**	**-** **(Incentive tool, not providing revenues)**	

For Industrial Wastewater Sector

Based on problem analysis in Syria and specific characteristics of the various types of EIs, there is a clearly need for introduction of the polluter pays principle for any deterioration of water quality, in addition to compensation that shall be paid in proportion to the degree and extent of the impact on water quality..

The costs of industrial water pollution should be reflected in the water pollution charges. The implementation of this effluent charge would generate positive effects in terms of building administrative capacity, improving the information of water polluters, as well as for the innovation and diffusion of technology for water pollution control.

Careful consideration must be made for direct and indirect industrial discharges. The policy options supporting towards this direction are selected for further analysis below:

1-Introduction of a Waste Discharge Charge System (effluent charges) for the industrial sector combined with an integrated permit procedure for industrial activities.

The effluent charging system is one method to manage water resources efficiently and effectively. It addresses the pricing of water used for waste disposal. This system does not focus on water use in terms of volumes abstracted or discharged, but addresses the impact that is caused by the effluent and the waste that it contains. The intention is to reduce the damaging effects of waste on water resources.

The effluent charging system will have four main aims. These are to:

- promote sustainable development and the efficient use of water resources
- promote the internalization of environmental costs by impactors
- recover some of the costs of managing water quality, and
- Create financial incentives for dischargers to reduce waste and use water resources in a more optimal way.

The effluent charges cannot be a stand-alone instrument for water protection. It needs to be combined with environmental permitting system in relation with environmental quality objectives/standards. Furthermore, increasing effectiveness and efficiency of institutions and instruments for environmental enforcement/compliance assurance is needed.

For the effective implementation of the charging system, a discharge permit system needs to apply for direct discharges to the environment. Each industrial plant must obtain a permit for discharges to water bodies. The permit should set minimum requirements (emission limit values for pollutants) for each individual industrial company considering also the environmental quality of receiving water by case. The permit must be renewed in case of changes in the industrial processes or in specified intervals (e.g. every 5 years).

The water pollution charges will be applicable to all discharges to national waters that exceed the applicable standards. The charges will be based on **volume of flow, and discharges of specified pollutants.** The objective of the pollution charge is to encourage organizations to comply with effluent standards, and those organizations that do not comply will be subjected to pollution charges. Thus, the charge system should cover industrial effluent discharges into water bodies and comprise of two components, a very low charge for within-permitted discharge concentrations (annual water protection fee covering administrative costs of the charging system) and a penalty (over and above the tariff) for above-permitted discharge concentrations.

In the long term, the charging system will also be a source of information about users' activities, offering more precise knowledge of how water is used and a better understanding of the natural environment.

Effluent charges will provide the environmental authorities in Syria with a source of finance which they may control directly. This helps to build the administrative capacities needed for water resource management (analyses and monitoring, funds for staffs, outside services and expertise). In addition, financial resources become available for a range of water management activities, such as research and development, or the modeling of aquifers. Overall effluent charging systems provide the administrations with the resources they need to carry out their functions more effectively than before.

2- Introduction of contact agreements between wastewater utilities and industrial enterprises for the discharge of industrial wastewater to sewerage system.

In the case of discharge through the municipal sewage system, industry should be obliged to pre-treat the effluent in order to reach the maximum allowed values (standard 2580) for discharging into municipal sewerage. These values may be lower than those for discharging wastewater directly into the receiver for hazardous substances in order to discourage industries that use hazardous substances in their technological processes (e.g. textile, tanneries, metal etc) to discharge through the public sewerage system under specific conditions, These conditions must be clearly defined in an agreement between the plant and the utility, The purpose of the agreement is to allow the industrial enterprise to discharge wastewater to the municipal sewerage system provided the conditions stipulated in the agreement are met and the agreed wastewater charges are paid by the industry.

Although centralized treatment of industrial and municipal wastewater is generally a more economic and effective option than advanced on-site treatment, provided that industrial pre-treatment is carried out as necessary to remove pollutants (such as heavy metals, substances that might damage the fabric of sewers, or substances that might interfere with WWTP treatment processes), careful consideration and assessment must be made to avoid problems. The wastewater utility must ascertain that a given industrial discharge can be handled by the municipal wastewater system, in the following respects:

- The industrial flow and the concentrations of pollutants to be discharged do not overload the sewerage system and WWTP, or otherwise lead to damage or create safety hazards.
- The agreement with the industrial enterprise allows the wastewater utility to recover all incremental costs in carrying out the additional treatment required.
- The proposed discharge does not prevent the WWTP from meeting its required effluent discharge standards.

The general policy framework (where maximum pollution charges are set for the entire country) could be co-defined by the Ministry of Housing and Construction and the Ministry of Local administration and Environment. Then locally specific rates -so as to take into consideration the environmental quality of the receiving water bodies- could be set either by the regional authorities e.g. Sewage Disposal Directorates or at local level by Utilities within the framework and cap price defined by the Central authorities.

The collection of discharges will be made by the Sewage and wastewater treatment facilities.

3- Clean production programme

Cleaner Production is the continuous application of an integrated preventive environmental strategy to increase overall efficiency, and reduce risks to humans and the environment. Cleaner Production can be applied to the processes used in any industry.

The Clean Production Programme will provide grant aid, to encourage companies in Syria, particularly, to adopt a high standard of environmental performance by adapting or improving production processes and services in order to minimize negative impact on the environment. The Progarmme will focuses on avoiding and preventing adverse environmental impact rather than treating or cleaning up afterwards. In order to make CP more attractive to industry,

The programme may also provide training certified courses organized by the Ministry of Industry in the fields of waste prevention and minimization. This will lead to a greater awareness and indeed practice of waste prevention and cleaner production

It is stated that although at present companies do not receive economic aid from the State, a joint programme has been started by the Ministries of the Environment and Industry in order to achieve financial support with a view to setting up a Cleaner Production Centre the aim of which will be to help companies to get economic aid either by means of “soft loans” or tax relief. If this Center is set up, the Programme may be administered by this body. At present, if existing structures are to be used, the Ministry of Industry with the support of the Ministry of Local Administration and Environment should run the Programme.

The resources for running the Programme may be secured partially from governmental aid but also from the revenues collected from the pollution charges. A part of pollution charges collected must be channeled to the Programme so as to minimize the cost impact on industry by recycling the money paid back to tax payers for environmental purposes.

4- Subsidy scheme within the context of the Development Law supporting the relocation of polluting industries

Provision of grant or reduced business taxation to support investment projects for the relocation of tanneries from polluted places to industrial and business zones offering appropriate environmental infrastructure.

Financial assistance should be provided for expenditures related to disassembly, transport and reassembly of the existing equipment for enterprises which relocation for environmental reasons. This scheme could be included in the Development Law and may cover other industries as well as long as the relocation is fully justified on environmental causes.

5- Subsidy scheme providing grants to companies applying for environmental management systems (EMS)

The focus of an EMS is to ensure that all processes related to the environment are identified, managed, and reviewed on a routine basis. An EMS, if applied properly, will provide a way to industrial companies in Syria to discover and control their environmental aspects (including emissions to water bodies) and to establish environmental metrics and indicators for monitoring performance, as well as to find ways to improve this performance. A prerequisite for the provision of the grant or tax reduction is that the company is certified according to a valid standard such as the ISO14001 or EMAS by an accredited body.

4- Towards Integrated Policies for Water Resources and Demand Management. Take into Account the Environmental Objectives, Integrate WDM in Water Policies

According to figures provided by Ministry of Irrigation about RWR, ARWR and water consumption by various sectors during the period [1992 - 2003], we could formulate an average water balance sheet which is not completely similar to the Balance Sheet of Water Use provided by Blue Plan , but more adaptable with available data in our national situation. Figure.14 illustrates water balance sheet as an average in Syria.

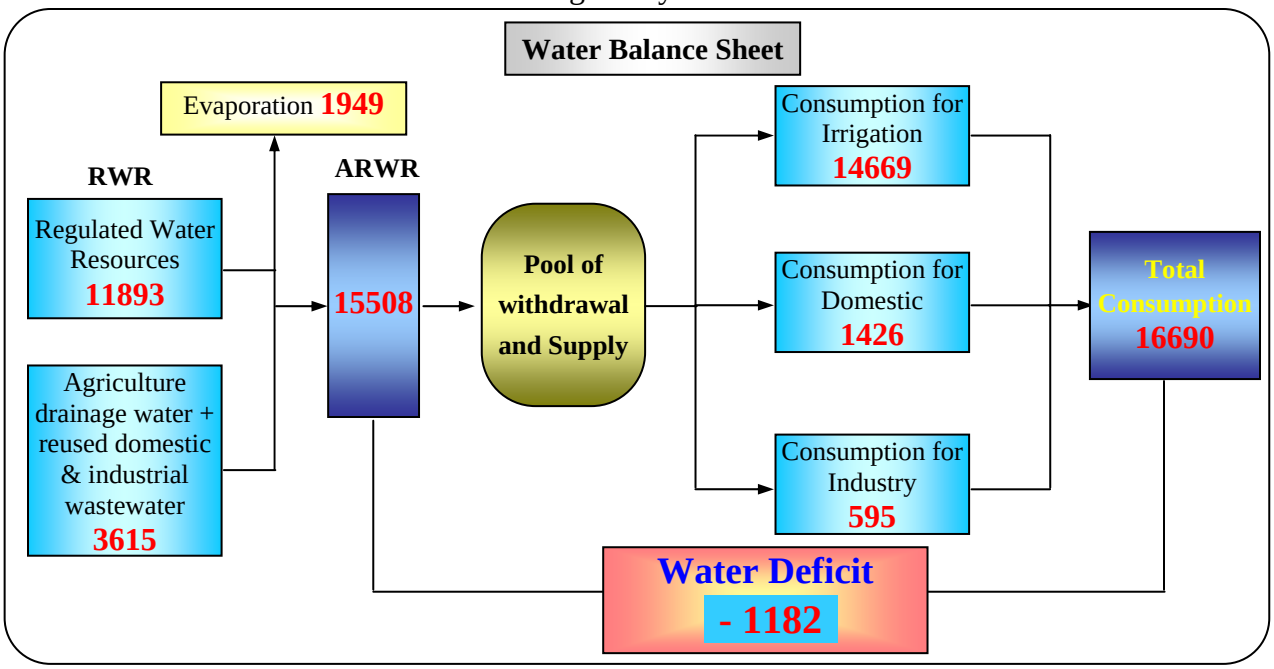


Figure.14 : Water Balance Sheet- Ministry of Irrigation 2006.

The above negative water balance (with probability of 75% of rainfall) enable us to stand for reviewing the current situation of water allocation and stimulate us to think in more sufficient trend within water policy reform.

Since allocation between uses does not reflect the national priorities, a water policy reform, which includes the **re-allocation of water** from irrigated agriculture (considered economically inefficient) to industry and the improvement of legal water aspects, has yet to be introduced in Syria. This is particularly important since reducing the share of water allocated to agriculture is commonly acknowledged as a good way to lessen the dependency situation of a downstream riparian of international rivers. The need to **shift from supply to demand management** and abrupt irrigated agricultural practices has been advised by some experts. Demand management also depends on control of population growth, the restructuring of the economy, redistribution of supplies, and the use of water conservation techniques vs. supply management which can affect water supply by increasing the catchments of winter floodwater, reclaiming wastewater or desalinating.

Until last decade, Syria did not appear to have an incentive to adopt a demand management approach under conditions where there are considerable supply opportunities to exploit. On the

other hand, the value of agriculture exceeds its economic value, it is "culturally embedded, highly symbolic, with political significant". The significance of agriculture has to be viewed against the background of national objectives such as food security, a policy priority which has symbolic overtones and which, moreover, is intimately connected with efforts to enhance economic growth and maintain independence. In addition, there are social dimensions which can explain why agriculture continues to be of high important. For instance, a particular social aspect of agriculture is that it prevents mass exodus of the rural population to the already burgeoning cities.

The past national strategies in Syria have favored supply side policies through the construction of dams and boreholes, while over-exploitation or exploitation of non-renewable fossil water (Barada basin) and some times irreversible degraded by saline intrusion (Damsarkho-north of Lattakia), were the dominant situation in many basins.

The emergency situation of water shortage and water deficit, has led the government to make a turn point in its policy towards water demand management which is illustrated in the 10th five-year plan , some general objectives were set **taking into account the environmental objectives and water demand management in water policies**, as :

1. Application of the principles of integrated water resources management, and achieving the harmony between water sector and other sectors, so as to reach reciprocal relations, those lead to sustainable development of water resources.
2. Shifting to the principle of demand management and rationality, so as to achieve a balance between limited supply and rational demand on water.
3. Take action plan towards rational economic exploitation of natural resources and preserve them from pollution, misuse and declining, to ensure environment safety.
4. Raise the efficiency of various water uses and increase agriculture lands proceeds to improve the contribution of water sector in the Gross National Product
5. Stabilize water demand through the reduction of water losses and the wasteful use of water reduction in demand and controlled increases
6. Adopting an environmental policy targeted to promoting sustainable development, strengthening environmental institutions, and institutional capacity-building, improving the managerial and technical capabilities in the field of development environmental policies, application of environmental standards, increasing environmental awareness,.
7. Establishing a network of environmental monitoring on water resources and centers for information, and provide all related materials, to ensure its continuity and sustainability.
8. Enforcing the application of laws and legislations to protect water sources from pollution.
9. To develop among the public, economic stakeholders , managers and decision-makers awareness of the importance of loss and waste of water, both in economic terms and in volume of water, and to awaken a sense of responsibility among users with a view to better management of water demand
10. Sensitizing each user about waste and water-saving opportunities, through simple behavior
11. To improve among the public, economic stakeholders, managers and decision makers, knowledge and evaluation of the potential advantages to be gained from more economical management of water demand.
12. Percentage population with access to safe drinking water should be 99% in urban areas and 90% in rural areas by the year 2010
13. Cost recovery should be achieved for drinking water and sanitation services

14. Reduction of physical and administrative losses
15. Accelerating the transformation programs to the use of modern irrigation methods on the remaining areas, in order to implement them during 10 years starting in 2006. By establishing specialized departments for implementation. Especially after the existing of the special fund for the transition to modern irrigation methods to support beneficiaries (and will focus initially on the most water basins deficit in water balance).
16. Decisions should be based on socio-economic appraisal and environmental impact assessment
17. To start cooperation with the private sector in the performance of tasks which increase the effectiveness of water related establishments technically and financially
18. Studying the possibility of dams' construction in all hopeful water places, especially in the Euphrates, coastal basins. Based on the results of the economic, technical, and environmental feasibility studies of these dams.
19. Reform water sector in Syria through the application of institutional and regulatory procedures. Including the addressing of weaknesses in the functions, structure and existing operations.
20. Raising the capacity and efficiency of working staff in water sector, through developing time schedules taking into account the expected development in this field.
21. Increasing the efficiency of the existing governmental irrigation projects, and developing the use of modern irrigation methods, and giving them the needed ratio of water to address the issues of losses and infiltration in the Governmental irrigation systems.
22. Seeking to obtain our fair share of the Tigris and Euphrates rivers.
23. Orientation to economic and rational investment of natural resources, and conserve them from degradation, depletion and pollution. To ensure environmental safety and achieve sustainable development.
24. Seeking to reduce the losses of water through the application of the national program of the transition to modern irrigation methods.
25. Taking decisions based on feasibility studies of economic, social and environmental impact assessment for water projects.
26. Adoption of the principle of non-expansion in areas newly reclaimed, only in case of water resources sustained, focus will be on increasing the reclaimed areas in the Euphrates basin (Aleppo southern plains), because of the presence of water non –invested, in addition to the Tigris and Khabour Basin.
27. Provide services that meet the Citizens demands so as to guarantee the right of everyone to have access to safe drinking water and treated sanitary. Through highly skilled institutions working on water resources management for drinking purposes and water conservation, and working to reduce physical and administrative water losses.
28. Cost recovery of operation and maintenance of potable water and sanitation.
29. Orientation to a financial and administrative autonomy in the management of drinking water and sanitation institutions. And to the decentralization of executive decision-making and at the lower administrative level.
30. Adoption and activation of participatory approach and communicate with all concerned bodies in drinking water and sanitation projects to ensure the optimum manner of providing services to all segments of society. And cooperation with the private sector in the performance of the functions and activities increasing the institutions efficiency technically and financially and administratively.

Prospective analysis has been done by some experts in order to draw the expected scenarios of water demand in the year 2025. The process started by determination of expected population in the year 2025 according to growth rate and social trends, it concluded to an estimation of population about 26.822 million inhabitants in the year 2025.

According to some available data within the project of Syria 2025, an attempt to draw the scenarios of potential water use in each sector and potential available water resources that should be available for High , moderate, and slow trends of development to achieve water balance in the year 2025 had been done, taking into account that Syria will have an agreement with neighboring countries concerning the portions of each country from international waters (table.14)

Slow development	Moderate development	High development	2004	unit	indicator	
3712	3712	3712	3712	m.m³/y	Surface renewable water resources	Water resources
4828	4828	4828	4828	m.m³/y	ground renewable water resources	
8540	8540	8540	8540	m.m³/y	total	
10000	10000	10000	6627	m.m³/y	Euphrates + Tigris	
11908	11908	11908	8988	m.m³/y	Regularized surface water	
4490	4490	4490	4480	m.m³/y	Regularized ground water	
16398	16398	16398	13468	m.m³/y	Regularized water	
2003	2378	2678	1443	m.m³/y	Domestic & industrial wastewater reuse	
2578	2556	2539	2246	m.m³/y	Agriculture drainage reuse	
1949	1949	1949	1949	m.m³/y	evaporation	
19898	20251	20533	15208	m.m³/y	Available water resources	
17228	17081	16963	15608	m.m³/y	water consumption in irrigation	Water consumption
1470	1470	1470	1453	m.m³/y	Water consumption in domestic	
1200	1700	2100	608	m.m³/y	Water consumption in industry	
19898	20251	20533	17669	m.m³/y	total	
0	0	0	-2461	m.m³/y	Water balance	

Table.14 : expected water balance for the year 2025- Syria 2025

5 – taking into account of water demand management in the cooperation and development aid policies

In this regard, we could say that most of the cooperation and development aid policies in Syria are aiming at incorporating water demand management principle and its indicators in cooperation aid projects, as:

- Syrian-German Development Cooperation SGDC for supporting water sector in Syria in a comprehensive modernization process of the water sector which aims at sustainable use of water resources. Essential criteria for the implementation of GDC are:
  - *The introduction of sustainable, socially, compatible, and poverty-reduction oriented tariff schemes.*
  - *As well as measures to achieve cost recovery for operation and maintenance, that ensure water saving and enable water utilities to operate in an economically viable manner.*

  An important task of the GDC is assistance in introducing IWRM. This implies:
  - *better administrative sectoral services,*
  - *an increased protection of the scarce water resources concerning quantity of consumption and water pollution,*
  - *higher availability rates of safe drinking water, and an improvement of the environmental situation*

Taking into consideration that supporting the water sector in Syria, as a key issue of the development cooperation, falls under Goal No.7 of the Millennium Development Goals, i.e. protecting the environment. Of particular relevance is the target to halve the proportion of the people without sustainable access to safe drinking water by 2015. Furthermore, the activities of Syrian-German Development Cooperation are targeted towards achieving economic efficiency, ecological sustainability and social justice in the water sector. They correspond to the principles of IWRM as agreed during the conferences in Dublin, Rio and Johannesburg.

SGDC has already created an impact on the Syrian water supply and sanitation policy; the results have been the guiding principles and the milestone concept. The 10^{th} five-year plan integrated some of these principles and marks a clear shift from a supply –oriented approach towards a demand-management approach. It includes measures to reduce technical and administrative losses, to increase tariffs and to improve customer services relations.

Meanwhile, many projects were initiated in Syria, in cooperation with foreign agencies, as:

- Bilateral grant aid cooperation with JICA to support water sector which includes water resources studies, establishment of water resources information center, rehabilitation of water distribution networks in Damascus, promotion of water saving irrigation devices, establishment of Master Plan for wastewater at national level.
- The Dutch-Syrian water cooperation included four projects during the period [2001-2007] in the areas of wastewater reuse, coastal water resources management. Italy is supporting Syria in introducing modern irrigation technologies.

It was clear through cooperation projects with German and Dutch governments, that the most important tool that should be emphasized on was the use of economic tools in the water sector, especially that mobilization of additional surface water resources in Syria is very limited, so the only suitable solution is to:

- Invest in improving the efficiency of the existing irrigation and water supply systems,
- Provide incentives for reducing the specific consumption through the introduction of a well adapted but affordable new pricing policy.

Within this vision, Syria is looking for getting more benefits and to learn lessons from success stories in implementing WDM policy in other developing countries or developed countries.

6- Overview and Conclusion:

6-1: The main challenges confronted by water sector

Challenges mean the matters that require drawing up of policies or changing existing policies as water policy, agriculture policy, demography policy, hence, the main challenges in water sector:

1- Provision of safe drinking water as a response to increasing demand: taking into consideration that the population of Syria is redoubling every 22-25 years, while the matter which intensifies the problem is the existence of heterogeneous distribution of water availability in Syrian water basins, and unbalanced distribution of localities, it means irrelevant distribution with the population. This situation simply led to intensive pressures on water resources, consequently, to imbalance in water equation.

In order to overcome these challenges, a list of procedures should be crackdown as:

- Adopting and implementing a suitable, realistic, disciplinary, and applicable demographic policy.
- Depending on regional planning in national development plans.

2- Using economic tools: for implementing water demand management policy, in order to reduce demands, and reserve the money of increasing supply, the matter which need a real turn point in the political, socio-economic considerations.

3- Insuring food security and water security in parallel: it is acknowledged that food security is consider one of the stakes of agriculture policy in Syria, in practical, food security could be achieved on the account of water security, the matter which threats the sustainability of agricultural development on long term.

In order to overcome this challenge it is necessary to review the development and economic priorities, and to create radical changes in agricultural policy, the crucial matter which need taking intrepid decision at the governmental level.

4- poverty eradication: the relations between poverty and population is complicated and have many-sided, this relation could be more deep in agriculture sector, since poverty may lead most of poor farmers to increase their pressures on natural, fragile resources in order to survive. The illegal random settlements nationwide is one phenomenon which originated from poverty, hence, the eradication of the poverty is one of the main challenges.

5- Non-enforcement of laws and legislations: which is one of the main obstacles confronted the protection of the environment and the implementation of sustainable development.

It is manifested in iillegal connections to water networks as a result of illegal housing and, discharging of liquid and solid waste in surrounding environment and water recipient bodies.

6-2: The main long-term targets of the 10th five-year plan

The future prospective for irrigation sector:

1. horizontal extension:

- in the field of land reclamation:

  The 10th five year plan determined the principle to extend in the new reclaimed areas in view of continuous water supply; accordingly concentration will be to increase reclaimed areas in the Euphrates basin as there is unexploited water, in addition to Tigris & Khabour basin in view of possibility to ensure waters from Tigris River to return balance to ground water.

- In the field of dams:

  Achievement should be done to study the possibility of erection dams in all places of water prospective as the coastal and Euphrates basins.

2- Vertical extension:

The sector plan aimed to accelerate the programs to transfer into modern irrigation for the remaining area amounting about 1219 thousand ha, which will be executed within 10 years commencing in 2006 with a reduction of water consumption for the irrigated hectare from 12800 to 8000 m³/year

The future prospective for the Drinking Water Supply and Sewage Sector

It is planned for the drinking water supply and sewage sector to develop such as to achieve by 2020 the following targets:

- Percentage population with access to sustainable and safe drinking water is 99% in urban areas and 90% in rural areas.
- Cost recovery for operation and maintenance for drinking water supply and sewage services.
- Financial independence in the management of drinking water supply and sewage establishments.
- Water demand management.
- Reduction of physical and administrative losses
- Reuse of sewage water in other production sectors.
- Autonomy in administrative decision making.
- Decentralization in the implementation of executive decisions
- Decisions based on socio- economic appraisals and environmental impact assessments
- Cooperation with the private sector in the performance of tasks of the establishments.

6-3: The main obstacles confronted the implementation of objectives

- Lack of coordination between concerned ministries in the integrated management of water resources which has a negative impact on the sustainability of drinking water sources.
- Technical and administrative weaknesses in the skills and competence of existing human resources which may not be qualified to take decisions at the lowest administrative level
- Waste of drinking water due to lack of awareness of people as to the importance and need to preserve this precious resource which is caused by the reduced water tariff fees.

- Lack of awareness of people as to the importance of the sewage sector and its role in preserving water resources from contamination in addition to protecting them from disease.

6-4 Indicators for Follow- up

The 10th five- year plan may be followed- up by the following indicators:
- Percentage of people served by drinking water supply & sewage networks
- Percentage of people served by wastewater treatment plants
- Number of cases of water- born diseases resulting from water pollution (diarrhea …)
- Percentage of people migrating from urban to rural areas which were serviced by drinking water and sewage treatment.
- Physical & administrative losses in water networks
- Cost recovery as a percentage of operation and maintenance
- Cost recovery as a percentage of operation and maintenance and investments
- Customers' satisfaction on provided services
- Water consumption per capita per day
- Percentage of water demand management projects to water supply projects
- Percentage of trained persons in the upper administrative levels
- Percentage of trainees in the technical level
- Bills' payments collection efficiency

In conclusion, there are some issues which need to be tackled:

- Syria has not addressed seriously the most important factor that is putting the highest pressure on the country's water resources, namely the population growth rate which considered amongst the highest in the world
- Many contradictory policy issues need to be settled, as government policy for encouraging farmers to invest in modern on-farm irrigation technologies is at odds with the government irrigation tariff policies which do not provide incentives to farmers to conserve water since the operation and maintenance charge for the public surface water irrigation schemes is a flat fee based on field size and unrelated to actual water consumption
- Communication and information systems are essential to bring the message of water demand management to the end users. long term investment programmes to transfer knowledge on actual crop water needs and the development and adaptation to higher value and less water intensive cropping patterns from research centers to farmers need to be implemented

In this context, policy makers play an important role. Actually they have to legitimate their water strategy introducing allocative efficiency measures at a rate that is socially and politically acceptable.

Institutions have to answer to the challenges coming from the water crisis which risk of compromising economic development and the welfare of the population.

It is only the fair distribution of the resources; conservative consumption by users, raising awareness can change a scenario when water is becoming a factor of territorial unbalance and social inequality.

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