

European water and sanitation services
vs. Sustainable Development

**Potable Water Services in
Morocco –China –Austria –Iran**

Content

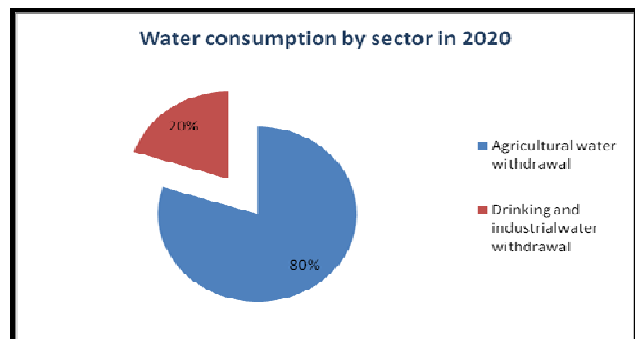
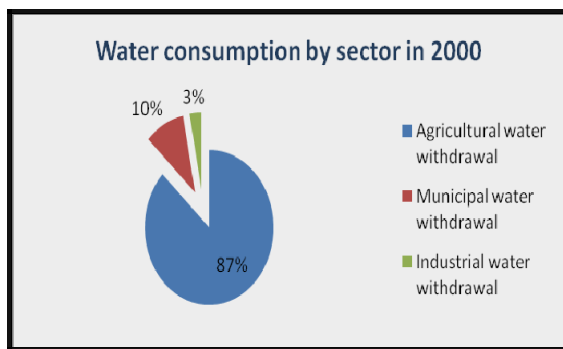
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Water Services in Morocco

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Morocco has limited water resources. Renewable resources are estimated at 29 billion m³ / year, slightly more than 1 000m³/hab/an. However, the resource that may be technically and economically mobilized does not exceed 21 billion m³. In terms of intensity of use of water resources by industry, agriculture remains the sector with the highest consumer of water.



Sources: Aquastat, Water FAO

Source: National Office of Potable

The comparison of mobilized water resources and needs of agriculture, industry and population announced a general deficit in 2020. Water demand is projected for the General Directorate of Hydraulics (DGH), would range in 2020 to nearly 14,500 million m³ or 411 m³/hab/an 2020 (830 m³/hab/an 1990).

Consumption of drinking water in Morocco

The drinking water supply is for three categories of people:

1. The urban population connected to the drinking water system: the connection rate has reached 93% in 2008.
2. The urban population not connected to the drinking water system and fed for the most part by stand pipes: it is about 7% (1.2 million). This kind of consumption is a source of imbalance for the water utilities since it is a collective mode of supply and free.

3. The rural population: the connection rate in rural drinking water in 2008 is 86% and 33% are served by individual meters and 67% by standpipes.

However there is a wide disparity between urban and rural areas. The delay of the water supply in rural areas is due to habitat structure dispersed, type of construction (dry stone) and essentially the weak capacity of the rural population to bear the costs.

Sector of management of water in Morocco

The management of water differs depending on rural or urban areas. It is performed by autonomous administrations and dealers in major cities and ONEP in small urban and rural areas.

The work of public water and sanitation in major cities is conducted by Municipalities (direct control). But several financial problems related to direct control by the town were highlighted. So it has delegated the service of self-governed. Their number is 13, and provide in the main cities of Morocco on: distribution of water, sanitation management Liquid since 1991 and the partial production drinking water.

The National Office of Potable Water is the leader producer of drinking water. It produces water for 3.1 million people with 2.8 are rural ((including 690,000 connections per individual).

On the other hand, the management of public water services, in 4 major cities of Morocco, is delegated to private companies.

City	Private leaders	Year of delegation
Casablanca	Lydec –SUEZ Group	1997
Rabat-Salé	Redal- VEAOLIA Group	1999
Tanger	Amendis Tanger- VEOLIA Group	2002
Tétouan	Amendis Tétouan- VEOLIA Group	2004

The concession contracts with those companies are spread over periods of 25 to 30 years. However private operators are not interested in the areas or sites to economic risks (insolvency dominant economic or political instability). Authorities are therefore required to ensure access to water in its spatial and social areas unprofitable.

Water Pricing in Morocco

For the tariff system in Morocco, there is vertical equalization based on a tariff pricing for each. It incorporates 3 types of uses:

- The first one is Domestic use: it concerns individual subscribers and governments. Water is charged at a price that depends on the level of consumption. Thus three groups were established which correspond three progressive rates. The principle is to shift to large consumers the shortfall by applying a relatively low tariff for small consumers.
- The second one is Preferential use: Water is charged at a single price tends towards the cost of operations and distribution and the Industrial use.

But given the economic trend based on tourism, it remains to consider a specific tariff to hotel use.

The ONEP spoke also on the tariffs, it sets the price at a lower level for smaller urban centers and the resulting deficit is compensated by a national solidarity applied to any m³ of water sold by ONEP to municipalities and authorities.

To conclude, Morocco illustrates the example of countries where the mobilization of resources for drinking water and sanitation remains a major problem. Clearly, the financing urban service is not resolved. So, the idea that private sector has overcome the shortcomings of funding will certainly failed. In fact, private operators - focused on profitability – are not interested in these social strata and could not provide satisfactory answers regarding access to water and urban sanitation. In otherwise, if the conditions of profitability and solvency are not met, the business logic will certainly reveals its limitations.

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Potable Water Services in China

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Total water resource

In 2007 the total water resource of China is $2.53 \times 10^{12} \text{ m}^3$, 8.9% less than normal years.

Total water supply

In 2007, the total water supply is $5.82 \times 10^{11} \text{ m}^3$, that is 23% of the total water resource. Surface water supply takes 81.2%, groundwater 18.4%, the others 0.4%.

River water quality

In 2007, according to the Environmental Quality Standard for Surface Water of China, about 140,000 kilometers of river water quality were monitored and evaluated. Rivers of Class I accounted for 4.1%, Class II 28.2%, Class III 27.2%, Class IV 13.5%, Class V 5.3%, worse than the Class V 21.7%. Compared with 2006, the National Water Quality changed little in the overall situation.

Based on national surface water quality standard (GB3838-2002), the water use is divided into five classes (five function zoning):

Class I : headstream water, water in national natural reservation zone.

Class II : central drinking water sources protection zone (class I), scarce biology habitats waters, fishery spawning waters;

Class III: central drinking water sources protection zone (class II); fishery waters; swimming waters;

Class IV: industrial water use, non-contact recreational waters.

Class V: agricultural water use, scenery waters.

That is, in 2007 nearly 50% of the river water in China is not suitable to drink.

Water supply fee

WANG Hao, a water expert of Chinese Academy of Engineering, says that a study on water expenditures psychological impact on people shows that when the water accounts for 1% of household income, there is no psychological impact; 2% makes a certain influence, people began to care about water; 2.5% makes people pay attention to water conservation; 5%, the impact become larger, carefully saving water; 10%, there is a great impact, people begin to consider the water reuse.

"At present, China's urban water is generally lower than 0.8% as a proportion of income. Usually it does not arouse the user interest in water. Wang Hao says that if the water in accordance with 2% of household income to calculate, Beijing, Tianjin, Shanghai, Nanjing, Guangzhou, Urumqi, the price per ton of bearing capacity of water can be followed up: 11.57 yuan, 9.09 yuan, 13.12 yuan, 11.28 yuan, 12.48 yuan, 6.32 yuan; the price of water present were: 3.7 yuan, 3.9 yuan; 2.11 yuan, 2.8 yuan, 2.22 yuan, 2.06 yuan.(1 Euro = 10.30 Yuan)

We can compare these figures as following:

Proportion of income	Beijing	Tianjin	Shanghai	Nanjing	Guangzhou	Urumqi
2%	11.57	9.09	13.12	11.28	12.48	6.32
Present price (yuan)	3.7	3.9	2.11	2.8	2.22	2.06

It is reported that "Shanghai's residential customers" integrated water price is 1.84 yuan per cubic meter. Among them, potable water prices has remained the same after adjustment since December 2001, the current price of 1.03 yuan per cubic meter. The price of this level is considerably "low" between the major cities.

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Specifics of Water Services in Austria

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austria - 8.355.260 – 2.600hm³/y - 1,3€/m³

○ 87% - central water supply

2357 municipalities

- 1900 municipal waterworks
- 165 water syndicates
- 3300 water cooperatives

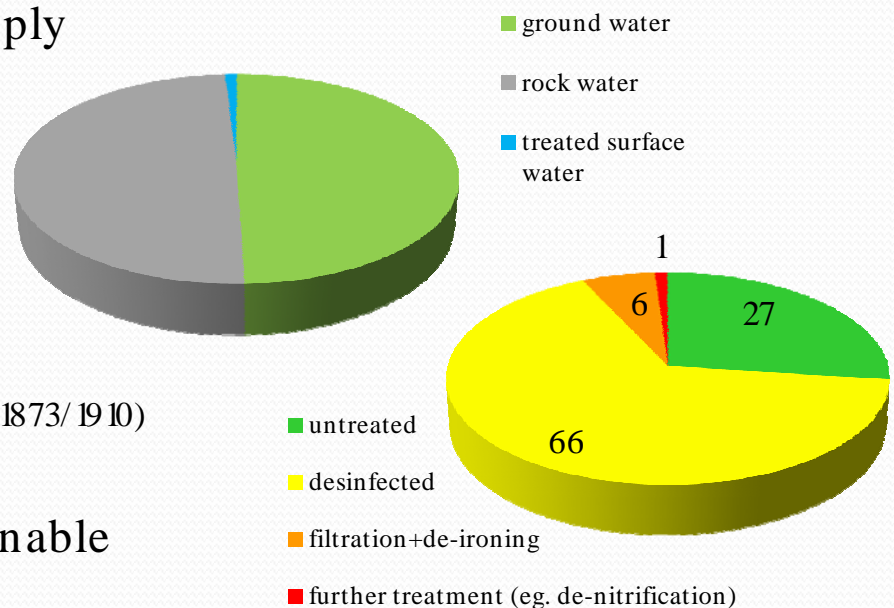
○ 1170mm rain/y

○ Vienna:

- 97,5% rock water (120/200km – 1873/1910)
- 130l/p.d

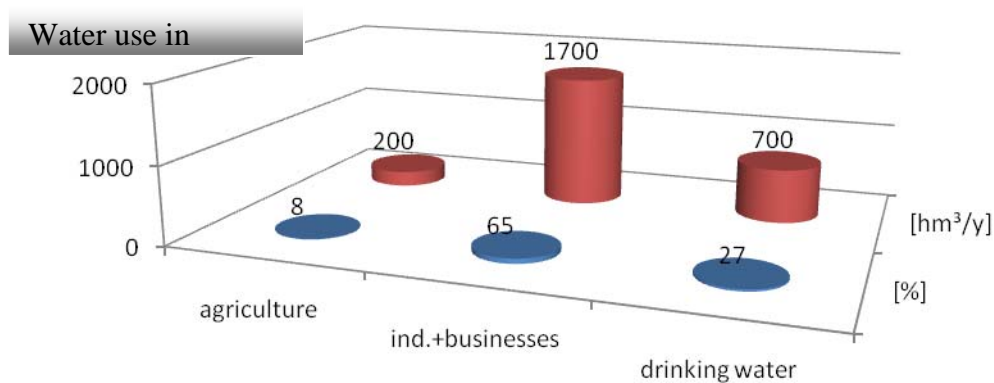
○ Environmentally sustainable usable water potential = 6 times the consumption

○ 22% of people know how much they pay for water

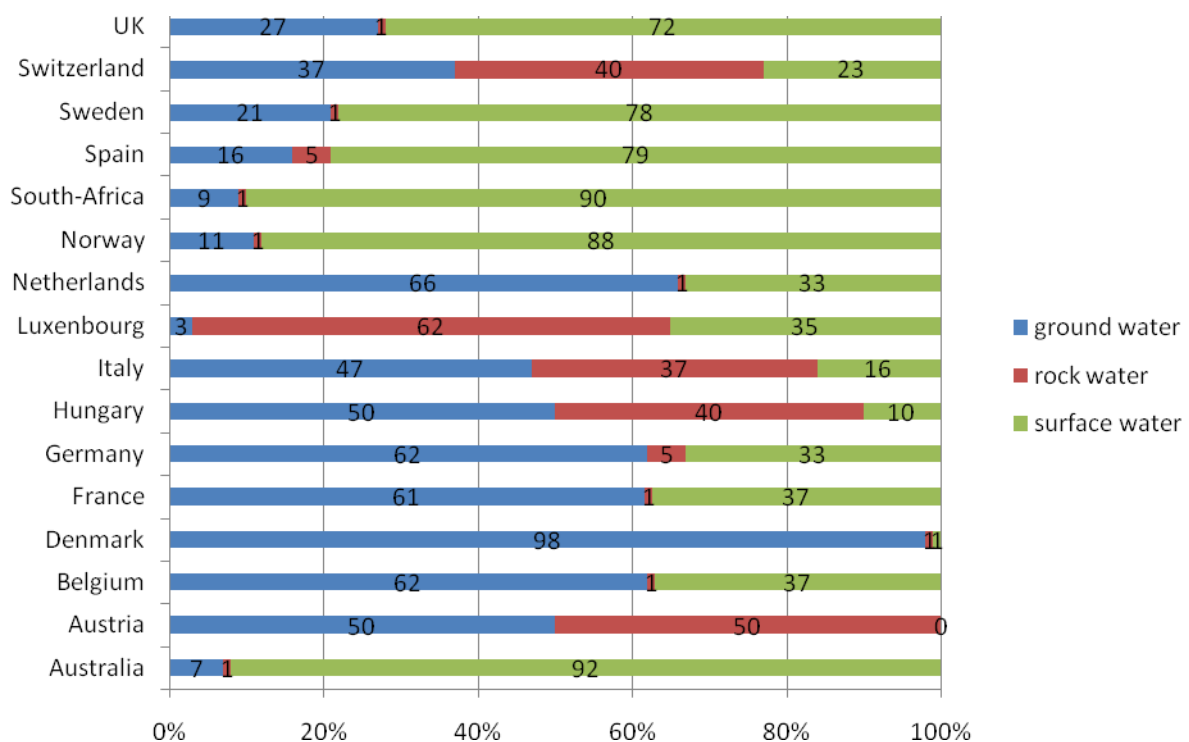


Austrian drinking water service is supplied by diverse forms (from municipality-run over diverse forms of public private partnerships to full concession contracts) of most of the time municipality sized providers. 87% of Austrian population is therefore connected to a central water grid. There exist 1900 municipal waterworks while Austria counts a total of 2357 municipalities. Moreover there are 165 syndicates of supra-municipal level and a significant number of 1900 infra-municipal water associations. The 14 biggest water suppliers in Austria (> 50.000 customers) provide water to 3,6 million users (~260.000 users per provider), medium sized water providers supply an average

population of 9.600 inhabitants each while 1,8million Austrians are supplied from 5.200 local- to very small sized providers with an average of 350 users.



Due to a favorable geographic and climatic situation 99% of drinking water used in Austria comes from rock- or ground-water while only the remaining 1% has to be taken from surface water bodies.



This figure is exceptional for Europe and even in Switzerland, that can be considered being in a similar geographical as well as climatic situation, this numbers are by far not reached. While the water consumption reaches about 2600hm³ per year, the environmentally sustainable usable amount is 16000hm³

whereas the theoretical potential would be 84000hm³. Given this figures the water consumption of 135l/p.d can be considered modest. In this context, it is important to know that 22% of customers in Austria know how much they pay for water and that water consumption is metered by building.

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WATER SITUATION IN IRAN : CHALLENGES AND ACHIEVEMENTS

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WATER SITUATION IN IRAN : CHALLENGES AND ACHIEVEMENTS

Water is the key of life. Supplying water has always been a great challenge in Iran, with technical, political, economic, and social dimensions. The socio-economic changes in Iran over the last few decades have led to increased per capita demand for water imposing a high pressure on the limited water resources. This article deals with water resources and its related problems, as well as some achievements during recent years.

The Country

Iran, with a surface area of 1.48 million km², is located in the northern hemisphere between 25, 40 longitude and 43.5, 64.5 latitude. There are two mountain ranges, the Alborz and the Zagros, and down lands of Persian gulf, Oman sea, and Caspian sea. Thus, Iran has a high differential elevation of about 5000 meters. About 73% the land is arid and semiarid.

Water Resources

The main origin of water resources is precipitation, which is quite varied due to differential elevations. *About 90% of precipitation is in the humid and cold seasons in the north and west. Fifty two percent of annual raining and snowing occurs in 25% of the land, resulting in water limitations in large areas. Precipitation mean varies from 50 mm in the central, southern, and eastern areas to 1500 mm in northern and western parts. In 6% of the land it is less than 50 mm, in other parts it varies between 200 and 1000 mm, only in 1% of the land it being more than 1000 mm.*

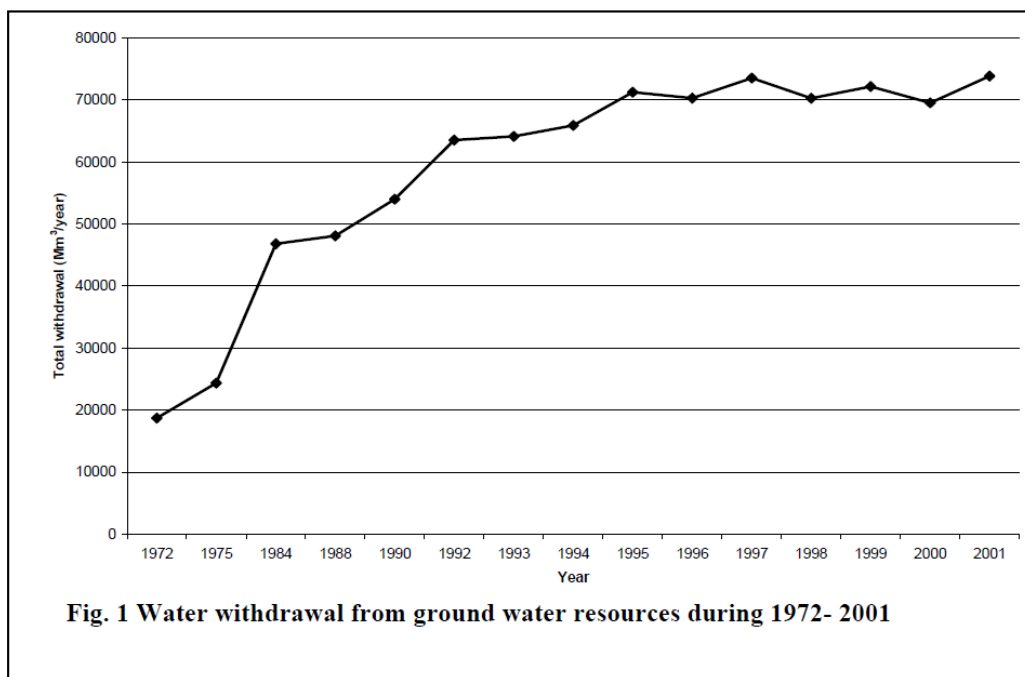
Compared with Asia and the world with a precipitation mean of 732 and 831 mm, respectively, Iran is considered an arid region. About 30% of precipitation in Iran is snow and the rest is rainfall.

The following illustrates the status of water:

Average precipitation in the country: 400 billion m³
Evaporation, percolation and transpiration: 270 billion m³
Run-off: 130 billion m³
Recharge to ground water tables: 38 billion m³
Exploitation from the ground water tables: 59 billion m³
Surface water acquisition: 33 billion m³

Recent information on water usage in the country shows that the total use is 93.1 billion m³. The shares of agricultural, drinking and industrial water use are 86, 6 and 1 billion m³, respectively. It is supplied through ground water (55%) and surface water (45%).

Information on water withdrawal from groundwater resources during the period (1972- 2001) is shown in Fig.1. Withdrawal has had an increasing trend, the over charge leading to many problems, for example increasing TDS, and dropping groundwater table.



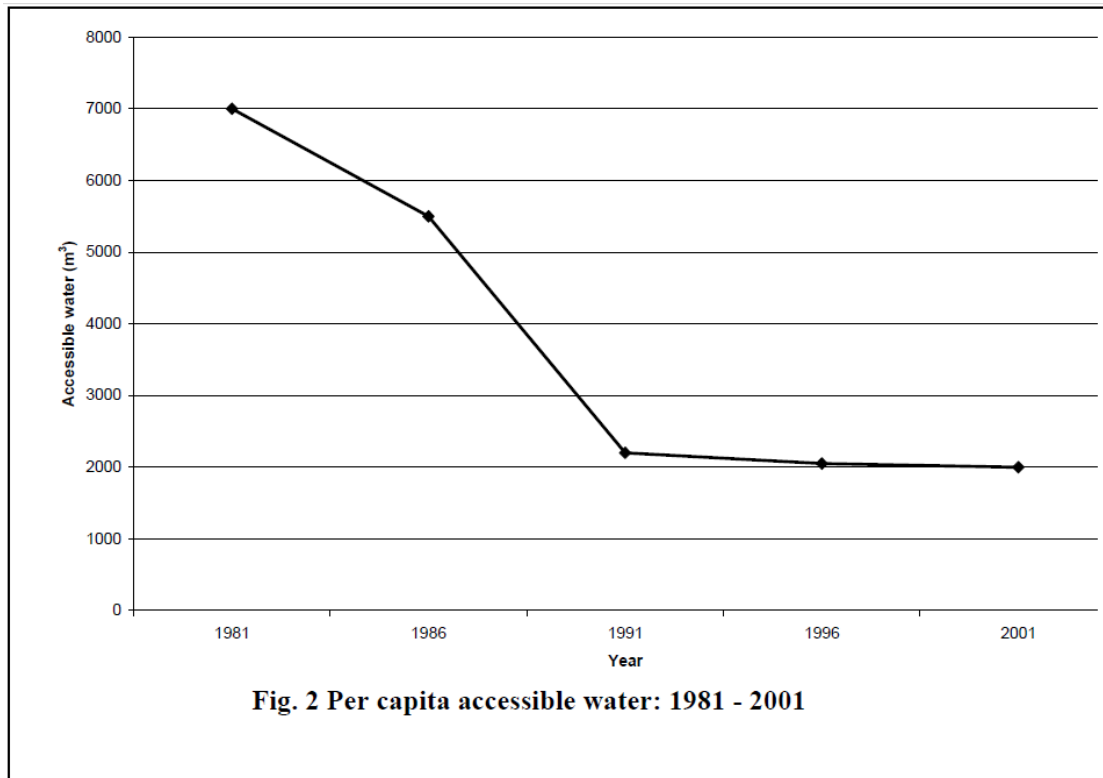
According to the UN definition, if the total volume of water used in a country is more than 40% of the total volume of renewable water, the country has water shortage. Worldwide, about 54% of renewable water was withdraw in 1996 and it is predicted this will increase to 70% by 2025. The corresponding ratio in Iran was 70% in 2003. Therefore, our country is faced with serious water shortage and, as said earlier, overcharge of groundwater has been a problem. Therefore, emergency measures for water resources management are absolutely necessary. Considering the role of groundwater in water supply in arid and semiarid areas, artificial recharge and quantity and quality protection for its preservation are very important.

Population Growth

The population of Iran (66% urban) has increased from 19 million in 1955 to 68 million in 2005 and is predicted to increase to 100 million in 2025 and 121 million in 2050.

As in many other developing countries, urbanization has had an increasing trend in the recent decades. Urbanization is a major concern of economic and social development plans: Migration of villagers to large cities has created many problems. As in other developing countries, some of the problems are inadequate services, e.g., supplying safe drinking water and wastewater collection and treatment.

Due to increased water needs, the per capita accessible water has decreased from 7000 m³ in 1981 to 2000 m³ in 2001 (Fig. 2). Therefore, water shortage in some parts of our country is serious.



Water pollution

Population growth and industrialization have caused water pollution from different sources. Domestic, industrial, and agriculture wastewater are discharged into the water resources.

According to the Water Deputy of the Ministry of Energy of Iran, 1890 industrial units polluted water resources in 2003. The main polluting industries are located in three provinces, including Tehran, Isfahan, and Khozestan, having the major water resources in Iran. This shows that unsustainable industrial development threatens the existing water resources.

This imposes extra cost for water quality conservation and treatment.

In some cities of Iran, nitrate concentration is more than 200 mg/l (five times the respective standard). Based on the studies conducted, the concentrations of pesticides and heavy metals in the Karoon River, are higher than the world averages. Another problem in water quality is the entry of unknown and new pollutants into water. These pollutants are mainly refractory materials. Their detection is difficult and expensive, and advanced systems are required for their treatment, because conventional systems cannot remove them effectively.

Water transmission

As described above, water quality and quantity has declined every year. Therefore, in order to supply large volumes of good – quality water, we should transmit water from long distances. This is costly but In Iran, like in other countries, water is transported from inter-basins, for example: from Zayande Rood to Yazd and Kashan.

Urban water and wastewater (1978- 2002)

Population potable water coverage has increased from 17.5 million people in 1978 (74.6%) to 44.5 million 2003 (97.8%), an increase of more than 15.4%. According to plans, the whole population in urban and rural areas should be covered by safe water services in 2021.

As regards with wastewater, there was an increase of 5.27% during the same period in the population under coverage, from 1.5 to 9.4 million people. It is predicted that in 2021 about 60% of the urban population and 30% of the rural population will be covered by wastewater services.

The available information also shows that the urban water supplying capacity increased from 1.5 billion m³ in 1978 to 6.98 billion in 2003. the number of water treatment plants have been increased from 27 units in 1978 to 82 units in 2003. On the other hand, the number of wastewater treatment plants, which was 24 in 1978, is now more than 50 units, 26 of which went into operation between 1997 and 2001.

Rural water and wastewater

The volume of water used in villages was 490 million m³ in 2001, which is low compared to the total consumption in the country. The number of villages is very large (about 68000), in some regions, they are scattered over wide areas.

Due to lack of adequate infrastructure, economic limitations, and lack of qualified personnel, water and wastewater management is more complicated in rural than in urban areas. In 2003, only 50% of villages with more than 20 families (representing 69% of the total rural population) were covered by services offered by the rural water and wastewater companies.

A pilot study in 14 rural areas in 2004 showed the residual chlorine and water microbiological quality to be desirable in 81.5% and 83.2% of the cases, respectively. The most important causes for the low quality of drinking water in the village are old water supply systems, high water wastage, low quality operation and maintenance, design and implementation failures, branch networks and technical failure.

Decision-Making: Ministry of Energy is responsible for water supply, distribution, and conservation. Ministry of Health and Medical Education is in charge of supervision and quality control of drinking water from the physical, chemical, biological and bacteriological aspects from its source to consumption points. These two ministries by their well-trained and the experienced personnel, laboratories and facilities could apply the existing national and international standards to hopefully attain their objectives.

Programmes and Projects :

Water and sanitation: National strategy to control the quality of drinking water is adapted to improve national health level by training required human resources for water, wastewater and environmental health laboratories and research activities.

This has been done with using more than 500 bacteriological and about 200 chemical laboratories (the number of private laboratories and 100 soil and water laboratories from other sectors to be established within next year are not included). Furthermore, protection and promotion of health, improvement of wastewater network, and access to safe and sufficient

drinking water for people in accordance with the existing standards are emphasized based on sustainable development principles. The basic objectives are:

Other main policies and strategies are:

- Supporting healthy environment through sound and coordinated management of water resources and wastewaters.
- Strengthening the local government to provide community services (regarding water & health) and to support implementing agencies.
- Taking appropriate financial measures for a better management of existing investments and utilizing reasonable and appropriate technologies.
- Adopting fundamental reforms through sound and coordinated methods.
- Raising awareness among people through necessary guidelines and distribution of sufficient information about water.
- Implementation of Water Comprehensive Plan with short, middle and long term programs (the Third and the Fourth National Development Plan).
- Implementation of National Policies related to development of Water resources(the Approval of Council of Minister-18 Articles).
- Implementation of appropriate reforms and revising the law about water, urban management rules and regulations(e.g. the disposal of surface water and wastewater, the development of cities in areas with limited water reserve & etc.).
- Reduction of water usages through applying appropriate technologies and necessary reforms, wastewater treatment and recycling water.
- Reduction of waterborne diseases in the emergency conditions in the rural and urban areas.
- Paying attention to rural and low income areas and marginalized cities
- Prevention and controlling water pollution.
- Development and strengthening intersectoral collaboration.
- Increasing productivity of existing resources and facilities in health services, water distribution system, public education, etc.
- Strengthening the role of research in development and taking advantage of the experiences of countries with similar regional conditions in related fields.

- Designing policies to provide the required funds for public education, planning and implementation.
 - Incorporating environmental considerations in the development programs in accordance with the national economic goals.
 - Strengthening the management and planning of sustainable utilization of sea and domestic water resources for fishery and related activities.
- The topics of proposed national strategies are:

- Macro management.
- Water Resources Management.
- Consumption Management.
- Economic Value.
- Quality Control.
- Water Supply Costs.
- Water Exchange.
- Land Use Planning.
- Interbasin Water Transfer.
- Management of Structure.
- Watershed/Basin compositions.
- Risk Management.
- Urban Water Distribution.
- Public Training.
- Shared Waters.
- Information Management.
- Preservation of Historic Hydraulic Structures.
- Interdepartmental Management.

Water management: Water management has a long history in Iran. Since centuries ago with implementation of the river-bed treatments (in Karoon and Karkheh), diversion dams (Karoon, Korr, Zayandeh Rud,...), construction of reservoir dams over the Korbali River, Shesh Taraz, Tabas, Kashaf Rud, Saveh,... and construction of more than 30,000 Qanats, access was provided to attainable water resources. Beside these infrastructures, the traditional regulations have been written as guidelines over the portal of the grand mosques, public squares and occasionally as portable hand written guidelines. Also, the portable hand written guidelines of “Sheikh Bahaei” and “Amir Kabir” about dividing the water of Zayandeh Rud and Karaj Rivers have been used until recent years. In these handwritten guidelines, the “Mirab” was assigned as the water distribution manager and the people and/or villages were considered as the beneficiaries. With this background we can nominate the Iranians as the pioneers of participatory management of water resources

considering the role of beneficiaries in the Middle East.

As was indicated above, in the past centuries, management of water resources was accomplished at the community level (local Governance) for Qanats and rivers. In the recent years, however, the management of water resources in the framework of urban potable water, water supply and the operation of large projects has been carried out at the national level (National Governance). For this reason, different issues of water resources management such as quality and quantity conservation, planning for water allocation for agricultural uses, industry and drinking water issues have faced with complexity at the local, regional and national levels. Since these issues have roots in the past history of Iran, the integration of water management has been considered as one of the big challenges for the government.

With the implementation of three National Social and Economic developmental Plans and considering two five years plans before the Islamic Revolution, *80 large dams have been constructed with the total capacity of 27 billion m³, which could have controlled and regulated of 33 billions m³ of renewable surface water per year.*

Regarding the ground water exploitation, utilization of new excavation technologies, has reduced the important role of Qanats gradually as the results of the increasing usage of deep and shallow wells. It is estimated that there are about 500,000 deep and shallow wells and almost the same amount of hand excavated open wells with the capacity of 59 billion meters in the country. However, uncontrolled excavated wells and inappropriate usage of the existing wells have resulted in water depletion and water draw down. Lack of sufficient recharge of ground waters have caused serious damages and have adversely affected the water resources in the country. In many regions, serious draw down of water level and decreasing of well discharges, acidification, water intrusion and worse than that, land depletion due to over exploitation of aquifer have made extra pressures to these kinds of water.

Regarding the population growth and decreasing agricultural lands, the water supply and food products will be Iran's two major challenges in the future. In this context, the following issues are to be considered:

- Prevention of losing water in agricultural and urban water sectors.
- Increasing water efficiencies.
- Changing the consumption patterns.
- Renovation and remedial actions of urban water supply networks.
- Recycling and treatment of waste and used water.
- Utilizing the uncommon waters.
- Prevention of water resources pollution.
- Prevention of water aquifer depletion.
- Increasing of infiltration rate.

- Artificial groundwater recharge operations.
- Water delivery from far resources to draught region.
- Regulated plans for draught combating.
- Water supply in crisis conditions.

Most importantly uncontrolled population growth and the draught could increase the problems of water shortage and lack of fresh water resources. Hence, the government should take actions to deal with those who do not obey the existing laws and regulations.

Challenges in the field of water:

- The decrease in the quality of water because of environmental and ecological changes, disposal of solid wastes and wastewaters, and lack of sufficient equipments
- The increase of the population and per capita consumption of water - Difficulties in the provision of safe drinking water for villagers in the small community centers - Uncontrolled usage of water.
- Unsanitary disposal of wastewater in some urban and rural areas.
- Lack of appropriate consumption patterns of water and shortage of adequate plants and infrastructures to face with crisis during draught.
- Lack of sufficient facilities for measuring the agricultural, industrial and urban pollutants in the water resources.
- Pollution of rivers and ground water resources in the cities especially because of uncontrolled expansion of industries over the ground water tables.
- Uncontrolled consumption of water for agricultural production and low water efficiency.
- Lack of economic consideration for water.
- Poor draught combating at the national level.
- Limited financial resources for water supply (potable, agricultural and industrial).
- Lack of integrated water management in the urban areas.
- Lack of services and supporting industries for water.
- Lack of financial self-adequacy and economical vision for water management system as there is in the private sector.
- Pollution of water resources used in agricultural sector due to the variety of sewage disposals from industrial, agricultural and urban sectors.
- Necessity for recycling and reusing wastewaters for agricultural usage.
- Lack of adequate consideration to water economy for agricultural usage.
- Improper water usage in agricultural production and low operation rate.
- Lack of consideration to the rate and type of water consumed in agriculture from water economy aspects.
- Lack of coordination between existing laws, regulations and their operational

methods related to water.

- Shortage and lack of coordination in codes, regulations and their executive methods about water in relation to agriculture and commerce.
- Inappropriate utilization of pesticides and chemical substances and discharging the pollutants into the water resources.
- International tensions and conflicts arising from trans-boundary rivers.

Challenges in the field of sanitation:

- Decrease of potable water quality as a result of ecological and environmental changes and wastewater disposal and insufficient growth of equipments.
- Increase of population and total and per capita volume of water consumption - Provision of healthy water for nomad tribes and rural population in small and dispersed settlements.
- Non-optimum water consumption for hygienic use.
- Inhygienic disposal of sewage in some urban and rural centers
- Inadequate water consumption patterns and shortage of installations and infrastructures to face with crises in drought periods.
- Shortage of test facilities for measuring agricultural, industrial and urban pollutants in water resources.
- Contamination of rivers and underground water resources in cities particularly as a result of unregulated industrial expansion on water tables.

Waste Management: Approximately 40,000 tones of waste is produced daily in Iran. Seventy percent of this amount is organic materials and the rest are dried and non-organic materials. Municipalities are responsible for solid waste management in urban areas and until recently there were no waste management in rural areas.

Recycling is only carried out in small amount in metropolitans and recently in few small cities. In some cities separation of wastes from their source is exercised. The waste collection and disposal method in most of human settlements are traditional.

Composting is the conventional method of recycling projects in many cities, which is often done through old technologies. Recently, in few large or small cities, composting projects with new technologies have been undertaken.

Estimates shows that in Iran, generally 90 percent of all produced wastes are sent to land fills and only 10 percent are recycled, of which 8 percent are disposed by composting. Future Constraints: The following cases can be mentioned as present constraints to improve solid waste management in the country:

- Inadequate equipments for dried and wet waste collection
- Financial bottlenecks of municipalities and high cost of solid waste management

and recycling.

- Lack of sufficient awareness of some authorities and communities to participate in the solid waste management programs.

In order to tackle these problems, some solutions have been presented as below:

- Providing facilities for private sector in order to encourage their partnership in recycling activities. In this regard, the financial support of public sector and expansion of privatization in this field are parts of state policies in the 4th National Development Plan.

- Determining long term and mid term objectives in the 4th National Plan to decrease the production of solid waste to a certain level.

- Assessment of municipalities' environmental performances and monitoring their allocated funds in this sector.

- Execution of legal bill of Solid Waste Management and attempting to introduce related guidelines: a) to decrease the volume and weight of buried waste, b) to increase recycling portion, c) to separate at source, d) to reduce the costs, e) to manage the hazardous solid waste disposals, f) to promote public participation.

- Establishment of regional level management for solid waste in Iran.

According to agenda 21 and Johannesburg Plan of Implementation, the following activities are to be targeted and executed to resolve solid waste problem of human settlements in Iran:

- Reduction of solid waste to a minimum per capita.

- Recycling of solid waste and development of cost effective recycling methods.

- Increase of the proportion of solid waste disposed through environmental friendly methods.

- Expansion of the coverage of the collection services and the hygienic disposal of solid waste in the rural areas.

TEHRAN'S WATER TREATMENT PLANTS

1. Jalaliée



One of the oldest water treatment plants in tehran, founded in 1954.
The water is supplied by *Karaj* river, and is transfered to the plant through 2 steel pipes with deiameter of 1000 mm, and length of 40 km.



Designer: Degremont / France

Capacity: 7 m³/s

Filter: Garvity Rapid Sand

Coagulator: Chlorure de feric

Disinfectant: Chlore

2. Kan (West of Tehran)



The Biggest water treatment plant of Iran, founded in two phases between 1962-69. The water is supplied by *Karaj* river, and is transferred to the plant through 2 concrete pipes with diameter of 2000 mm, and length of 33 km.

Designer: Degremont / France

Capacity: 8 m³/s

Filter: Garvity Rapid Sand

Coagulator: Chlorure de fer

Disinfectant: Chlore

3 & 4. Tehran Pars:



These two plants were founded in 1966 & 1983 in Eastern part of Tehran. The water is supplied by *Latian* Dam, and is transferred to the plant through a 10 km tunnel with diameter of 7,2 m.

No. 3: 1966

Designer: Degremont / France

Capacity: 4 m³/s

Filter: Garvity Rapid Sand

Coagulator: Chlorure de feric

Disinfectant: Chlore

No. 4: 1984

Designer: Degremont / France

Capacity: 4 m³/s

Filter: Garvity Rapid Sand

Coagulator: Chlorure de feric

Disinfectant: Chlore

5. (North-east of Tehran)



Founded in 2003, water source is *LAAR* damn, water is transfered to this plant through 40 km pipes with diameter of 3600 mm. In this plant water is treated through physical and chemical processes. The 5th water treatment plant of Tehran is equipped with the best Process Control technologies, all parts of plant, valves, elctro motors,gates,... are controled by PLC system.

Designer: Peyman Aab Gostar / IRAN

Capacity: 5,7 m³/s

Filter: Garvity Rapid Sand

Coagulator: Chlorure de feric

Disinfectant: Chlore

Financial aspects

Investment

Until 2005, the national budget for the water sector stood at 1,400 billion rials while it has reached 3,500 billion rials (US\$ 350 million using the official exchange rate) in 2008. This budget apparently includes multi-purpose dam and irrigation as well as water supply and sanitation.

Cost recovery

On average, the service providers do not recover operation and maintenance costs due to low tariffs and low bill collection. For example, the Provincial Water and Sewerage Companies for Ahwaz and Shiraz have been incurring significant net losses at least prior to 2004. The financial performance of the companies is further aggravated by high water losses of 38% in 2002/03 in Ahwaz and about 30% in Shiraz. Of the water that has been billed, only about 73% was collected in 2002/03 in Ahwaz, while it was higher in Shiraz.

Tariffs

The current urban tariff system is based on a fixed fee that depends on the size of the connection pipe and on the type of customer (household or other types), and on a volumetric charge based on increasing block-tariffs. *The fixed fee, or the subscription fee, was about 2,000 Rials in 2004 (25 US cents) for most domestic customers while the structure of variable tariffs is based on a complex formula. The formula is the same for all companies and there is no volumetric charge if consumption falls below 5 cubic meter per month. Above this minimum, the tariff increases with the level of consumption and generally varies across companies. The average volumetric tariff for the country stood at about 6 US cents in 2002. It varied from 2 cents for monthly consumption below 20 cubic meter, to about 4.5 cents and 12.5 cents respectively for 20-40 and for more than 40 cubic meter of monthly consumption.*

According to the World Bank, the rate structure is needlessly complex for both volumetric rates and connection fees. Volumetric tariffs are based on complex formulas that differ across consumption brackets and water and wastewater companies. Because of this complexity the tariff structure lacks transparency. Moreover, the structure is such that rates increase by more than threefold when consumption rises from 20 cubic meter or less to slightly higher volumes. Regarding sewage bills they are currently levied and collected only in neighborhoods where a network exists and are a percentage of water bills (70%).

Average connection fees are about US\$310 for the whole country and the minimum fee is approximately equal to US\$150. With a few exceptions, the connection fee for

wastewater is the same as that for water. These fees have been regularly increased between 1999 and 2003, at the rate of 10% annually with the exception of the year 2000 in which the fee was increased by 15%. In addition to connection fees, the water and wastewater companies charge the customer the full cost for house connection.

External cooperation

Among the main external partners of the Iranian water and sanitation sector are the World Bank and the United Nations.

World Bank

Since 2005 the World Bank has not approved any new projects in Iran. In 2008 it still had two active projects in the Iranian water and sanitation sector:

The **Ahvaz and Shiraz Water Supply and Sanitation Project** (2004-2009), supported by a US\$ 279m loan approved in 2004 aims to improve access to satisfactory water supply and significantly increasing coverage of sanitation services; and improve environmental, hygiene and health conditions, as well as promoting reuse of treated effluents. It also aims to strengthen and develop the capacity of Ahvaz and Shiraz Water and Wastewater Companies, and assist the latter in improving their efficiency, sustainability and financial autonomy. It also aims to initiate sector reforms, particularly with respect to institutional arrangements, the regulatory framework, demand management, as well as prepare a sanitation strategy. The **Northern Cities Water Supply and Sanitation Project**, approved in 2005 and supported by a US\$ 224m loan, aims to enhance the quality of life in the four northern cities of Rasht and Anzali in Gilan Province, as well as Sari and Babol in Mazandaran Province. It aims to do so by improving the operational efficiency and financial sustainability of the two Provincial Water and Wastewater Companies (WWCs). The project will finance the extension and improvement of water distribution systems including metering, sanitary sewers, and a wastewater treatment plant (in Sari). It will also provide consultant services for institutional development and an environmental management plan.

A third project, the **Tehran Sewerage Project** (2000-2008) supported by a US\$ 145m loan, closed in 2008. Its objective was to improve the environmental conditions in the Greater Tehran area, through the installation of wastewater collection, and treatment facilities, to improve public health, and enable unrestricted irrigation practices in the surrounding areas. Secondary treatment chlorination would disinfect treated effluents for suitable irrigation purposes, and a further tertiary treatment was to be extended if required. Treated effluents, and sludge were to be reused for agricultural purposes.

United Nations

UNESCO-IHE in Delft, The Netherlands, together with the Power and Water University of Technology (Shahid Abbaspour) in Iran, will train 2,100 Iranian professionals in water and wastewater technologies, planning and management. The training will consist of 59 courses to take place in 2008 and the first half of 2009. In addition, 20 study tours to European water and wastewater companies for senior managerial, financial and technical staff will be organised. [\[16\]](#)

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