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WATER RESOURCES OF ALGERIA
AVAILABILITY AND NEEDS

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SUMMARY -The climatic changes and the dryness which have prevailed for several decades in various areas of the world, touched particularly the countries of North Africa, Subsaharian Africa, and of the Middle East and had a negative impact on the water resources of these countries.
This dryness, which is likely to be accentuated during the centuries to come, could involve in these countries a true crisis of water.
The current situation in Algeria is characterized by an imbalance between the needs and the available resources. The needs expressed by the various users are definitely higher than the mobilized water resources, which generates conflicts of assignment and, requires sometimes difficult arbitrations.
Moreover, pollution of the underground water and the surface resources by the domestic, industrial and agricultural wastes exceeds by far the processing capacities of the systems of purification. These degradations reduce volumes of water likely to be used.
The various cause of the imbalance and rupture of a durable development related to the problems of water also appear in the taking away carried out in the underground waters, which exceed the limits of renewal of the natural resources and require to draw from the nonrenewable reserves.
This situation of water resources shortage and these constraints was often apprehended in terms of realization of infrastructures or more exactly in terms of construction of dams.
This approach proved to be insufficient, insofar as it did not allow a good satisfaction of the needs, in spite of the importance of the authorized investments. Also is necessary to consider new strategies of planning, adjustment and management of our resources, based on modern tools of investigation, forecast and management, taking account of the new hydro climatic and socio-economic conditions of the country.
The objective of this communication is:
-To present the problems of water in Algeria, taking into account the geographical and hydro climatic constraints, and of the constraints related to the climatic changes observed,
-To present a diagnosis of the current situation as regards confrontation "Resources - Needs",
-To develop the broad objectives and large axes of the new strategy of the sector and development prospects

Key words: Resources, needs, diagnostic, irrigation, scenario, drinking and industrial water supply, strategy water.

RESUME *- Les changements climatiques et la sécheresse qui sévissent depuis plusieurs décennies dans différentes régions du monde, ont touché particulièrement les pays d'Afrique du Nord, d'Afrique Subsaharienne, et du Proche-Orient et ont eu un impact négatif sur les ressources en eau de ces pays.*
Cette sécheresse, qui risque de s'accentuer durant les siècles à venir pourrait entraîner dans ces pays une véritable crise de l'eau. La situation actuelle en Algérie, se caractérise par un déséquilibre entre les besoins et les ressources disponibles. Les besoins exprimés par les différents utilisateurs sont nettement supérieurs aux ressources en eau mobilisées, ce qui engendre des conflits d'affectation et, nécessite parfois des arbitrages difficiles.
En outre, les pollutions des nappes et des ressources superficielles par les rejets domestiques, industriels et agricoles dépassent de loin les capacités de traitement des systèmes d'épuration. Ces dégradations réduisent les volumes d'eau susceptibles d'être utilisés.
Les différentes causes de déséquilibre et de rupture d'un développement durable liées aux problèmes de l'eau apparaissent aussi dans les prélèvements effectués dans les nappes souterraines, qui

dépassent les limites de renouvellement des ressources naturelles et nécessitent de puiser dans les réserves non renouvelables.
Cette situation de pénurie des ressources en eau et ces contraintes, a souvent été appréhendée en termes de réalisation d'infrastructures ou plus exactement en termes de construction de barrages.
Cette approche s'est avérée insuffisante, dans la mesure où elle n'a pas permis une bonne satisfaction des besoins, malgré l'importance des investissements consentis. Aussi est-t-il nécessaire d'envisager de nouvelles stratégies de planification, d'aménagement et de gestion de nos ressources, basées sur des outils modernes d'investigation, de prévision et de gestion, tenant compte des nouvelles conditions hydro climatiques et socio-économiques du pays.
L'objectif de la présente communication est :
-De présenter la problématique de l'eau en Algérie, compte tenu des contraintes géographiques et hydro- climatiques, et des contraintes liées aux changements climatiques observés,
-De présenter un diagnostic de la situation actuelle en matière de confrontation Besoins Ressources,
-De développer !es grands objectifs et les grands axes de la nouvelle stratégie du .secteur et les perspectives de développement.

Mots-clés: *Ressources, besoins, diagnostic, irrigation, scénario, demande en eau potable et industriel, stratégie du secteur de l'eau.*

INTRODUCTION

The climatic changes and the dryness which have prevailed for several decades in various areas of the world, touched particularly the countries of North Africa, Sub Saharian Africa, and of the Middle East and had a negative impact on the water resources of these countries.

This dryness, which is likely to be accentuated during the centuries to come, could involve in these countries a true crisis of water.

The current situation in Algeria is characterized by an imbalance between the needs and the available resources. The needs expressed by the various users are definitely higher than the mobilized water resources, which generates conflicts of assignment and, requires sometimes difficult arbitrations.

Moreover, pollution of the underground water and the surface resources by the domestic, industrial and agricultural wastes exceeds by far the processing capacities of the systems of purification. These degradations reduce volumes of water likely to be used.

The various cause of the imbalance and rupture of a durable development related to the problems of water also appear in the taking away carried out in the underground waters, which exceed the limits of renewal of the natural resources and require to draw from the nonrenewable reserves.

THE PROBLEMATIC OF WATER IN ALGERIA

In the current state of knowledge, the water potentialities of Algeria are estimated overall at 19.4 billion m3/year:

(i) 14.2 Billion m3/year in the areas North
(ii) 5.2 Billion m3/year in the Saharan areas.

It should however be recalled that:

(i) The surface water potentialities, are evaluated on the basis of time series corresponding to a relatively wet period, and are likely to be re-examined with the fall, taking into account the dryness which persists,
(ii) The underground water potentialities of the steppe areas are still known little about,
(iii) The underground water resources of the septentrional Sahara, are evaluated to 5 billion m3/year, but the in-depth studies, and of the models of simulation, are currently carried out, within the framework of a Maghrebin Project, and will have to allow bettering specifying the potentialities and

the exploitable resources of these underground waters. So Algeria is located following the example 17 African countries touched by the hydrous stress, in the category of the countries low in hydrous resources in comparison with the threshold of scarcity fixed by the World Bank at 1000 m3/ hab./year.

The weakness of our resources moreover is worsened by:

(i) The bad space distribution of this resource.
(ii) The seasonal and interannual irregularity of the contributions.
(iii) Hydrous erosion and the silting of the stopping.
(iv) Enormous losses due to the out datedness of the networks and to the bad management.
(v) Phenomena of pollution.
(vi) The insufficiency of the existing infrastructures in spite of the significant investments authorized by the country.
(vii) Significant costs of the investments necessary to the mobilization and the transfer of the water resources.
(viii) The absence of maintenance and maintenance.

THE DRYNESS OF THE LAST 25 TEARS

Algeria knew during the last 25 years a period of intense and persistent dryness, characterized by a significant pluviometric deficit evaluated to nearly 30%, on the whole of the country, This dryness had a negative impact on:

(i) Modes of flow of the rivers,
(ii) Level of filling of the reserves of stopping.
(iii) Food of the underground waters.

This dryness was still accentuated during the 02 past water resource years (2000-2001, and 2001-2002), with pluviometric deficits reaching 50 to 60% in the Centre and eastern areas of the country. Indeed on an annual average of contribution to the stopping = 2,84 Billion m3, recorded contributions: Year 2000-2001: 802 Hm3 and Year 2001-2002: 515 Hm3.

Taking into account its persistence and of its intensity, this dryness cannot be regarded any more as a phenomenon of the economic situation.

It is indeed a structural climatic change, of which it is necessary to hold account in our strategy of planning, installation and stock management of water

DIAGNOSTIC OF THE SITUATION

Current situation as regards to mobilization

To date the surface resources, mobilized by the 57 stopping in exploitation, are 2.8 billion m3/year, on a storage capacity of about 5.7 Billion m3.

With regard to subsoil waters, volumes currently exploited are estimated at 3.5 Billion m3/year

(i) 1.8 Billion m3/ year in North
(ii) 1.7 Billion m3/ year in the Saharan areas.

Total Mobilizes: 6.3 Billion m3/ year

Current situation in the field of the AEP

Distributed volumes: estimated at 2.1 billion m3, of which 30% come from the stopping and 70% of drillings and sources.

(i) Capacity installed of surface water treatment. 900 Million M3/ year
(ii) Storage capacity: 5 Million m3/ year
(iii) Rate of average connection: 90%

Current situation in the field of the cleansing

Principal indicators of the cleansing

(i) Linear of the network of cleansing 33 000 km
(ii) Volume of worn water rejected: 600 Million m3/ year
(iii) Rate of average national connection 85% (2005)

In the field of the purification of water

(i) Number of stations in exploitation: 14
Volume of worn water purified: 160 000 m3/day is 58 Million m3/year
(ii) Number of workstations: 07
Volume to be purified: 115 000 m3/day is 42 Million m3/ year
(iii) Stations to be rehabilitated: 24
Volume to be purified: 390000 m3/ day is 142 Million m3/ year
(iv) Total: 45 Stations
Volume to be purified: 665 000 m3/ day *is* 242 Million m3/ year

Current situation as regards to irrigation [1]

(i) Large perimeters of irrigation (GPI): A number of perimeters: 16
Surface equipped: 170 000 ha
Irrigable surface: 100 000 ha Irrigated surface: 40 000 ha
Allocated average volumes (1991/2002): 300 Hm3
(ii) Small and average hydraulics (PMH): Irrigated surface: 380 000 ha, allocated average volumes: 1.5 billion m3

Diagnosis of the current situation

One notes a difference between the mobilized volumes and volumes used:

(i) Annual average mobilized volumes: 6.3 billion
(ii) Annual average used volumes average: 3.9 billion
(iii) The variation is evaluated with: 2.4 billion/year

This variation comes in particular:
(i) Stopping carried out not used (bad synchronization of the projects)
(ii) Losses in the networks
(iii) The dryness

NEW STRATEGY OF THE SECTOR

To improve the existing

Better stock management

(i) Mastery of the knowledge on the allocated resources, needs, volumes
(ii) To improve the performances of the establishments of management of public utility of water (counting rate, elimination of the illicit connections, and rate of covering.)
(iii) To continue the implementation of the institutional, legal and organizational reforms
(iv) To introduce new formulas of partnership (leasing, concession,).
(v) Improvement of the control of work,
(vi) Better integration of the projects (to reduce the shift enters the realization of the works of mobilization and that of the works of use,
(vii) Control management of the request, in an objective of economy of water,

Quantitative and qualitative safeguarding of the Resource

(i) Rehabilitation of the networks,
(ii) Fight against the illicit escapes, wasting, pricking
(iii) Introduction of the techniques of irrigation to drop by drop
(iv) Control of pollution
(v) Implementation of a program of communication and sensitizing to the economy of water and the safeguarding of quality.

To continue the program of mobilization of news

(i) To continue and accelerate the construction schedule of stoppings and collinear reserves
(ii) To introduce new ideas of installations:
- Inter-connected stopping,
- Use of technique likely to trap the streaming of rising,
- Systematization of the techniques of artificial refill of the underground waters

Usage of non conventional resources

(i) Reusage of purified worn-water in irrigation
(ii) Recourse to the desalinization of the sea water to reabsorb the deficit of the drinking water supply of the agglomerations of the coastal zones

PROPOSALS OF LONG TERM REAFFECTATION OF THE RESOURCES

Proposal for a new regional cutting

The water shortage which currently affects the whole of the country as well as regards drinking water as of water intended for the irrigation is primarily due to the conjugation of three factors:

(i) Period of dryness which seems to fall under the duration, in particular since 3 years with reduction of 50 % on average of the pluviometric contributions
(ii) Delay and weakness of the infrastructures of mobilization and transfer
(iii) Losses in the distribution networks and maladjustment of the current systems of management

The hydrous assessment of Algeria emphasizes an alarming situation with the present stage, and being able to be catastrophic in the future if major decisions are not made:

(i) To mitigate in the immediate future the emergencies known as urban (drinking water supply - Cities)
(ii) To mitigate the increase in needs in the medium term, to put an end to the losses (saving in water) and to set up new systems of management of water.
(iii) To contribute in the medium and long term to the concretization of the option of regional planning known as "high plateaus, High plains", for which the requirements out of water for irrigation are enormous.

We then have voluntarily definite four great zones gathering several basins slopes, differentiated by their resources, the nature of the resources and the needs, at the present time and in 2020.

The needs are evaluated according to an average drinking water consumption and small industry for 150 liters per day and per inhabitant .The needs for agriculture and industry (industrial parks) are evaluated according to the sectoral programs of development.

The resources are evaluated according to two scenarios:

(i) One according to an interannual average pluviometry.
(ii) One in function of a persistence or a significant periodicity of the dryness of the three (2000, 2001, 2002) years, with reduction of 50 % of the surface contributions last.

Confrontation needs – resources (2)

Basic Scenario

Table 1. Interannual average pluviometry

	Coastal Zone	Tellian Atlas	High Plateaus	Sahara	Global
1.RESOURCES Hm3/ year					
Stopping					
2002	15	28	10	1	54
2020	35	46	18	1	100
Capacity (Hm3/year)					
2002	1371	2873	401	300	4945
2020	3000	5686	594	300	9580
Regularisable Volume Hm3/year					
2002	890	1136	118	100	2244
2020	2338	2348	254	100	5040
Underground Waters Hm3/year					
2002	670	609	648	1800	3227
2020	670	609	648	5000	6927
Total Resources Hm3/ year					
2002	**1560**	**1745**	**766**	**1900**	**5971**
2020	**3008**	**2957**	**902**	**5100**	**11199**
2. NEEDS Hm3/ year					
Large perimeters of irrigation(GPI)					
2002	310	329	64	2000	2703
2020	1055	774	960	4000	6789
Small and average hydraulics PMH					
2002	500	500	500	-	500
2020	500	500	500	-	500
Drinking and industrial water supply A.E.P.I					
2002	761	418	494	159	1832
2020	1170	650	790	300	2910
Total Needs, Hm3/ year					
2002	**1571**	**1277**	**1058**	**2159**	**6035**
2020	**2725**	**1924**	**2250**	**4300**	**11199**
3.ASSESSEMENT (Hm3/ year)					
2002	***-11***	***+498***	***-292***	***-259***	***-64***
2020	***+283***	***+1033***	***-1348***	***+800***	***+768***

Scenario dryness

Table 2. Reduction of 50% of the contributions

	Coastal Zone	Tellian Atlas	High Plateaus	Sahara	Global
1.RESOURCES Hm3/ year					
Stopping					
2002	15	28	10	1	54
2020	35	46	18	1	100
Capacity (Hm3/year)					
2002	1371	2873	401	300	4945
2020	3000	5686	594	300	9580
Regularisable Volume Hm3/year					
2002	445	568	59	100	1172
2020	1169	1174	127	100	2570
Underground Waters Hm3/year					
2002	670	609	648	1800	3227
2020	670	609	648	5000	6927
Total Resources Hm3/ year					
2002	**1115**	**1177**	**707**	**1900**	**4899**
2020	**1839**	**1783**	**775**	**5100**	**9497**
2. NEEDS Hm3/ year					
Large perimeters of irrigation(GPI)					
2002	310	329	64	2000	2703
2020	1055	774	960	4000	6789
Small and average hydraulics PMH					
2002	500	500	500	-	500
2020	500	500	500	-	500
Drinking and industrial water supply A.E.P.I					
2002	761	418	494	159	1832
2020	1170	650	790	300	2910
Total Needs, Hm3/ year					
2002	**1571**	**1277**	**1058**	**2159**	**6035**
2020	**2725**	**1924**	**2250**	**4300**	**11199**
3.ASSESSEMENT (Hm3/ year)					
2002	**- 456**	**-70**	**-351**	**-259**	**-1136**
2020	**-886**	**-141**	**-1475**	**+800**	**-1702**

Analysis of the results of this confrontation

Basic case with an inter annual average pluviometry

(i) It is noted that for the coastal zone and the Tellian Atlas, there is balance between needs and Resources, and even a light surplus in 2020, likely to be transferred towards the High Plains, High plateaus where the deficit is of - 292 million m3, currently and -1 348 million m3 in 2020.

(ii) The Saharian zone currently records a deficit because of a simple exploitation of the Gault below its capacities, whereas it is supposed that they can reach 5000 million m3 in 2020.

(iii) All should however be balanced that precedes by the current losses in the distribution networks, which can reach 30% of affected volumes, and will then induce a significant deficit in the three (03) zones of North, that is to say:
(iv) 468 million m3 of losses, for the coastal zones, is a deficit of 479 million m3,
523 million m3 of losses, for the Tellian Atlas, is a deficit of 25 million m3 only,
(v) 230 million m3 of loss for the high plateaus, High plain, is a deficit of 522 million m3.
(vi) If one does not consider the Saharian deficit which does not have any current impact, the total deficit of with the losses would be thus approximately a billion m3.
(vii) In 2020, one can consider that the losses will be in majority, or completely repaired, and there will be practically total balance with obligatorily however transfer of resources of North (coastal zone and Tellian Atlas) towards the high plateaus

It should however be noted now, that in the immediate future, the enormous deficit observed in coastal zone cannot be reabsorbed only through the recourse to the mobilization of new resources such as the desalination of sea water.

More realistic case taking account of the current dryness

(i) By supposing only one reduction of 50% of the contributions, over a three years period like the preceding one, and even if one was not to take account of the current losses, the deficit of the three zones of North is enormous and will reach 877 million m3.
With the losses, this deficit will reach 1777 million m3.
(ii) In this case, it appears clearly that in spite of the effort of construction of stoppings which will continue, and even a restoration total of the distribution networks the total deficit for the three (03) North zones in 2020, will be approximately 2 500 million m3.

CONCLUSION

(i) The current, significant deficits observed on the three areas of the North of Algeria, will grow hollow with horizon 2020, in spite of the effort of construction of programmed stopping (46 stopping in project)
(ii) Alone the Saharian areas presents an exceed
(iii) Need for resorting to the no conventional resources
(iv) To privilege as of now the drinking water supply AEP in coastal zone in particular in Oranie, and in the Coastal DAHRA by the desalination of sea water, by envisaging one (01) million m3/day, in the medium term and three (03) with long term
(v) To reallocate the stopping of the coastal zone and the Tellian Atlas, either with the drinking water supply AEP of the interior cities, or with the irrigation of the perimeters of the coastal zone (Habra-Sig, Mitidja, Isser, Soummam, Saf-Saf, Bou-Namoussa, Tarf), in accordance with their initial destination
(vi) To transfer the surplus of the stopping from the Tellian Atlas towards the high plateaus.
(vii) To study the possibility of transfer of the albien underground waters, towards the high plateaus
(viii) To continue and accelerate the construction schedule of stopping (forty), in particular on the coastal zone and the Tellian Atlas,
(ix) To implement an intensive policy of construction of reserves collinear on the whole of the territory.
(x) To affect the hydro-electric stopping of Erraguène and Ighil Emda, with the wilayas of Sétif and Bordj Bou Arreridj (transfer Project of Sétif-Hodna)
(xi) To impose plans of culture and processes of irrigation based on the economy of water.
(xii) To take care systematically to re-use purified worn water

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