



Casablanca Sewage Treatment Plant, Zaragoza

European Green Capital Award 2016

8. Water Management



An initiative of the
European Commission

2016



Spain

8. WATER MANAGEMENT

8A. Present Situation

Describe the present situation in relation to water management, including any relevant disadvantages or constraints resulting from historical, geographical and/or socio-economic factors which may have influenced this indicator area, including the situation of your river basin (e.g. if you are regularly experiencing droughts, scarcity and/or floods and expected future trends). Where available, information/data should be provided from previous years (5 – 10) to show trends.

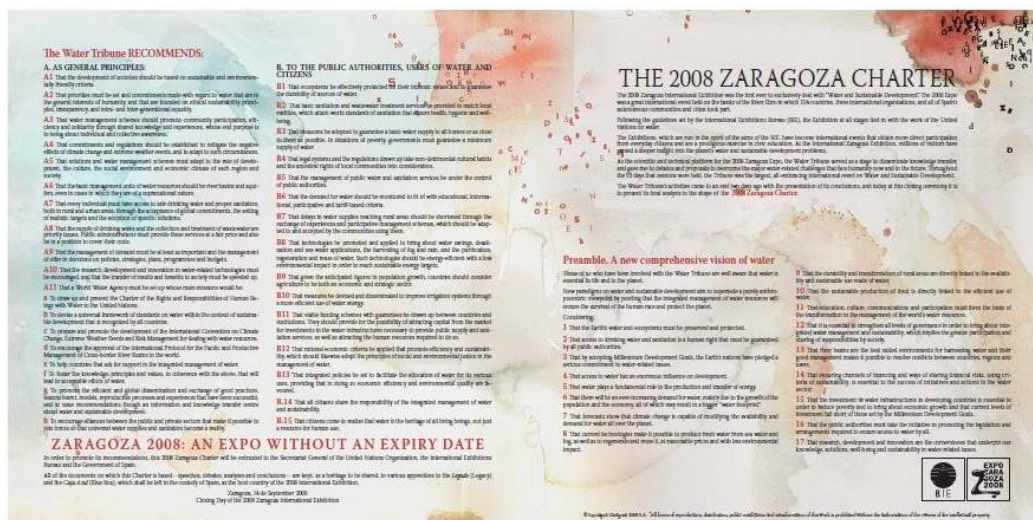
Detail the present situation regarding water demand of different sectors and describe plans currently in place to reduce water consumption.

Make reference to:

1. Total water consumption (in cubic meters/year and litres/capita/year) including a breakdown for different sectors (households, industry, energy, agriculture, small business, tourism, public sector);
2. Proportion of urban water supply subject to water metering, both for domestic and non-domestic metering;
3. Source of water (surface water, groundwater) – make reference to aquifers and river basin management;
4. Quality of drinking water (e.g. how many days of non-compliance with the Drinking Water Directive);
5. Water loss in pipelines, leakage management and network rehabilitation;
6. Storm water management;
7. How the links between water and energy consumption (water-energy nexus) (e.g. through pumping, treatment, heating) is taken into account;
8. Water recycling initiatives (grey water);
9. Compliance with the EU Water Framework Directive and other EU/national/regional legislation applicable at the city level.

The management of water is a strategic mainstay for Zaragoza and its citizens are very aware of its value.

The highlight was the ExpoZaragoza 2008, dedicated to Water, during which came the "Letter of Zaragoza" (graphic 1) accepted by the UN General Assembly 2010: "A clean drinking water and sanitation are essential to the realization of all human rights".

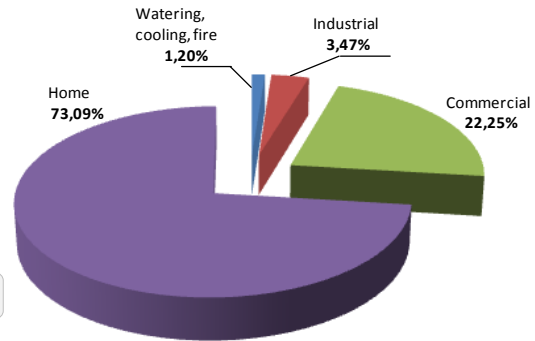


Graph. 1 Zaragoza Charter 2008

As a result, Zaragoza is siege of the UN Office for the Decade of Water and Documentation Centre for Water and Environment.

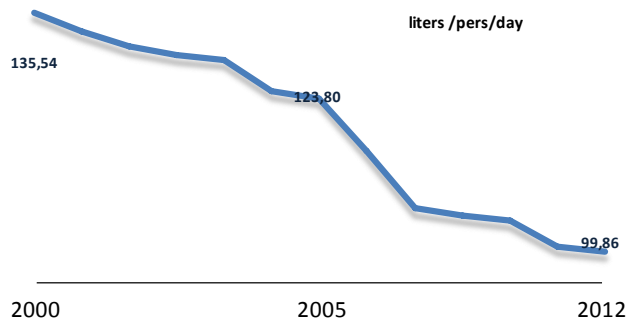
(1) In 2010 consumption was 25.475.989 m³, 36,450 liters/person/year. (graphic 2) A fall of a 12% in absolute terms o/2000, 24% per person (graphic 3).

Sector	m ³ /year	nº of policies
Home consumption	25.475.989	307.931
Commercial consumption	7.781.980	26.163
Industrial consumption	1.212.708	843
Watering, cooling, fire	418.578	1.295



Graphic 2. Water consumption by Sectors

year	m ³ tot	inhabitants	liters/pers day
2000	30.348.390	613.433	135,54
2001	30.152.510	622.601	132,68
2002	29.905.184	628.400	130,38
2003	30.233.534	641.581	129,11
2004	30.504.197	650.592	128,46
2005	29.864.630	660.895	123,80
2006	29.882.252	667.034	122,74
2007	28.581.816	682.283	114,77
2008	26.879.816	693.086	106,25
2009	26.769.055	696.658	105,27
2010	26.741.780	701.502	104,44
2011	25.773.956	701.888	100,61
2012	25.475.989	698.917	99,86



Graphic 3. Water consumption at home and similar uses

Present consumption is 99.86 l/person/day, under national average and that of many European cities (graphic 4).

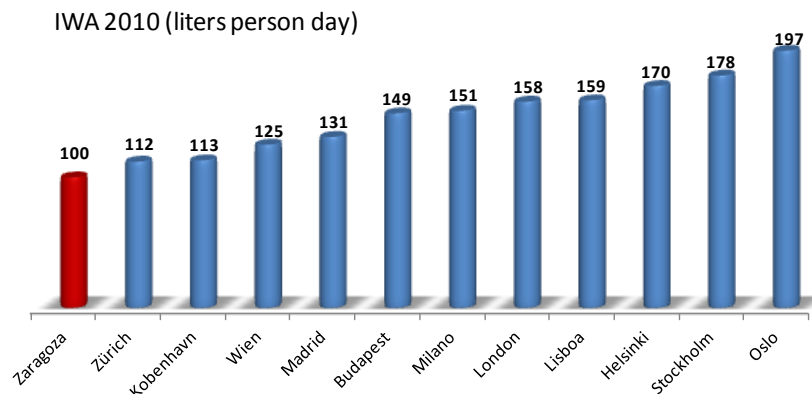


Fig 4. Consumo doméstico de agua en ciudades europeas

(2) There is a counter by every 2 inhabitants (*graphic 5*). Only 1 of 600 citizens does not have due to technical or monetary difficulties. Counters can differentiate types of consumption:

	Nº of counters	Percentage
Home consumption and similar	307.931	91,44%
Commercial consumption and similar	26.163	7,77%
Industrial consumption and similar	843	0,27%
Watering, cooling, fire	1.295	0,38%
No counter (by hand)	507	0,15%
Total Counters	336.739	

Graphic 5. Supply with water measuring

Counters are also used for phreatic collecting in industrial facilities with the municipal collectors as its final destination.

(3) The city has three sources of water supply (*graphic 6*):

- Canal Imperial of Aragón,
- River Ebro
- System of dams Yesa-Bardenas; the main present source of water of high quality directly from Pyrenees. A tube of 73 km between Yesa and Zaragoza allows a reduction of a 70% in the content of the main salts.

YEAR	Canal	Ebro	Yesa	Loteta	TOTAL	m ³ /day
2008	54,72	4,87	1,49		61,09	166.909
2009	44,61	1,63	13,66		59,90	164.117
2010	21,22	1,09	38,65		60,95	166.986
2011	30,75	0,03	16,80	11,73	59,31	162.491
2012	45,86	3,72	9,45	1,57	60,60	165.564

Graphic 6. Distribution of the quantity obtained by water supply sources

(4) Municipal Institute of Public Health monitors the water supplied to the city.

The supplying system fulfills 100% the water health criteria of the Plan for Sewage Treatment. The installation of intermediate rechlorination keeps a correct level of the permitted chlorine.

(5) Water loses in the network are 9 hm³, a 15% of the total, but it will be reduced after an adequate valuation of consumption in public gardens.

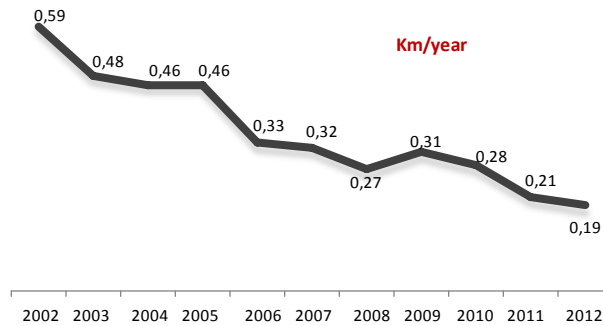
The number of bursts has passed from 0.70 burst/km year to 0.19 right now.

212 km from the 1,024 km of the network have been renovated and the number of bursts has been reduced to 350 from 750.

The materials considerate as adequate have gone from a 37% of the total to a 66.2%. The most difficult materials have gone from 48.3% to 24.5% (*graphic 9*)

The actual renovation and rehabilitation of pipes rhythm is 33 km/year.

Graphic 7. Rotura de tuberías en la canalización del



(6) The network of collectors is unitary; a system adapted to the local climate with periods of drought / heavy rains / flood. Lamination deposits have been built for pouring the water to the sewage system.

Only new industrial areas have a separated network with collection of water rain, reused subsequently for watering its own green areas.

(7) The sewage treatment plant has a photovoltaic installation of 2 MW that produce 3,413 MWh/year, partially compensating the energy consumption of the plant (9,722 MWh).

(8) Only rain water is recycled and used for watering gardens.

The reuse of grey waters has started to be applied in a hotel, but regulatory controls make it too expensive and complicated for private activities.

It has been studied the reuse of treated sewage water for watering, with a treatment for removing impurities, but the results are not viable economic and environmental due to the transportation and pumping.

(9) The Municipality is developing and applying municipal bylaws (Saving and Efficiency: Tax System), assuming the principles of the Guideline 98/83/CE (Spain RD140/2003) in relation to the municipal jurisdiction.

The Municipal Institute of Public Health monitors the quality of water for human consumption and the Municipality applying a system of penalties/rewards depending on polluting charges.

8B. Past Performance

Describe the measures implemented over the last five to ten years for improving water management. Comment on which measures have been most effective.

Make reference to:

- 1. Technical, economic and institutional measures adopted and their effectiveness in achieving reduction of total water consumption;*
- 2. Byelaw implementation in relation to efficiency in water usage, tariff and metering systems;*
- 3. Awareness raising campaigns.*

(1) The starting situation in the year 2000 is characterized by the following aspects:

- Problems with the quality of water: high levels of dissolved salts and trihalomethanes, and lack of uniformity in the level of free chlorine
- Wide quantities of water available
- Enough networks and facilities but old-fashioned and in need of repairing
- High water consumption, over average values
- From an economic point of view, low prices for users and an important economic deficit in the provision of services.

Several strategic objectives were established: Improvement in the quality of water, reduction of consumption, and adaptation of prices to the cost of the service.

The improvement of the quality was reached taking water from the Pyrenees, more concretely from the river Aragón, regulated by Yesa reservoir. The Canal of Bardenas and the Ditch of Sora are used to channel the water to the consumption area, and Loteta dam is used as an intermediate reservoir to mitigate cuts in the canals. This work was made by the state company Acuaebro.

The action has been developed from 1998, and in 2010 the whole water consumption of Zaragoza is coming from this infrastructure, replacing water with low quality taken from the Canal Imperial of Aragón. This action has received funding from the Fund of Cohesion of the EU.

The use of this water has produced the following improvements:

- Reduction on the levels of suspended matters and bacteria pollution in brute water
- Reduction on the level of organic matter and the level of trihalomethanes
- Very important reduction in the levels of dissolve salts
- Reduction of water hardness.

Additionally to the new water supplying, the Plan for the Improvement of Quality and Management of Water (2002-2009) had these aims:

- Renovation of installations and old networks in bad shape
- A bigger control of the water supplied
- Uniformity of chlorine levels
- Reduction of water consumption in the city to 65 Hm³/year.

98 million euros were invested, specially for renovating the networks (53 millions) and the reservoirs, and for improving other facilities (29 millions).

(2) We are trying to balance all the costs and incomes of the tariff system of the integral water cycle. The adjustment between costs and incomes of the cycle has not been fulfilled. Despite a yearly increase of the tariffs over the IPC, the strong reduction of water consumption with the economic and social incentives applied for a responsible consumption, have produced that the incomes have not increased in the foreseen quantity.

The municipal policy of the City of Zaragoza tries to redistribute charges in a non-homogeneous way, and reflected in the Fiscal Bylaw that revised every year according to social parameters:

- favoring citizens with a lower rent (pensioners, unemployed, large families, etc.)
- fostering an efficient use of water (families that have reached a 10% reduction on water consumption obtain also a 10% reduction on the water bill. This year, the reduction is also applied to more than 33,000 citizens from the 325,000 existing contracts)
- favoring families, since the 6 firsts m³/month consumed have a reduced rate of over a 50% of the cost price. This reduction is applied to a 30% of home consumption in Zaragoza
- penalizing the excess of consumption, the price of m³ in the third stretch is nearly 5 times over that of the first one.

On the other hand, strong investments continue to be done to renovate the distribution network and to reduce loses.

(3) The different campaigns to make people aware of the necessity of a responsible consumption of water have produced a fall of home consumption less than 100 l/person day. This strong reduction indicates that the majority of the population has assimilated a rational use of water at home and the use of saving devices.

It is difficult to reach the foreseen goals without a complex information process and the participation of the citizens to modify the consumption habits of the population.

The campaigns have been planned for homes and school children, as well as for professionals, companies and institutions. The goal is that the citizens can be the protagonists of a change in the water policies implemented by the City.

The approximate cost of the campaigns from the year 2002 is around 2,500,000 euros. Two basic lines have been established for the campaigns:

- ✓ orientation and spreading of the campaigns shared with non-government organizations
- ✓ development with the own resources through the participation of the different municipal departments, and more concretely with the Cabinet of Environmental Education of the Agency of Environment and Sustainability.

These are its main projects:

- “Zaragoza, Water Saving City” Project
- “50 Good Practices for Water Using” Project
- “Zaragoza, a Water Saving City: 100,000 commitments”
- “Optimizagua” Project
- Switch Project, chaired by Unesco-IHE
- “Aquanet” Project
- Green home
- Educational proposal for commitment with the rivers.

(4) In order to foster the green economy, the City has boosted the creation of ZINNAE, an urban cluster for an efficient use of water, and an association that includes the main economic agents

of the city for an efficient use of water: companies from different fields take part in the whole integral water cycle (technology for saving water, technology for gauging and reading, companies related to the supply of drinking water, drainage and cleaning, installing firms, etc), and the main research and training centers of the city and the public local and regional administration (*graphic 8*).

ZINNAE Cluster (Zaragoza Innovates in Water and Energy)
Companies and Institutions



Graphic 8. ZINNAE cluster for innovation in the water cycle

The Commission 21 of the integral water cycle is a place of working and meeting for the different social agents of the water sector that want to participate voluntarily in the process of consultation and municipal information.

There is another municipal inner commission coordinated by the Agency of Environment and Sustainability with the participation of all the municipal services working in the management of water. This commission has been a key for the elaboration of the present Bylaw and for the elaboration of the water audits.

Zaragoza has participated and is taking part in many initiatives and alliances for improving water management. Among them:

- Project LIFE 2003 ENV/E/000164 “Optimizagua. A Reference Model for the Efficient Management of Water, shortlisted as best environment project by the EC.
- There has also been implemented Aquanet project ES/07/LLP-LdV/TOI/149053), with the elaboration of an international didactic guidebook for an efficient water management.
- Zaragoza has taken part in the project SWITCH, forming part of the 6th Master Plan “Global Change and Ecosystems”, focusing on innovation in the integrated management of water in 12 cities of the world.

The actions carried out in recent years have been internationally recognized as an example of good practice in water management.

8C. Future Plans

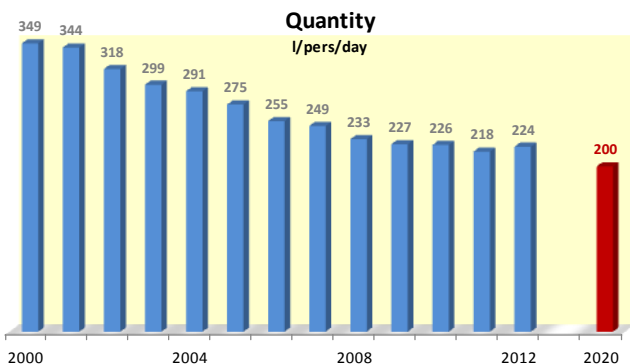
Describe the short and long term objectives for water management and the proposed approach for their achievement, including how they are influenced by the expected impacts from climate change and other long-term trends. Emphasise to what extent plans are supported by commitments, budget allocations, and monitoring and performance evaluation schemes.

Place particular emphases on key water saving and reuse targets for the future and the proposed approach to achieve these, including measures incorporating water infrastructure to deal with future impacts of climate change.

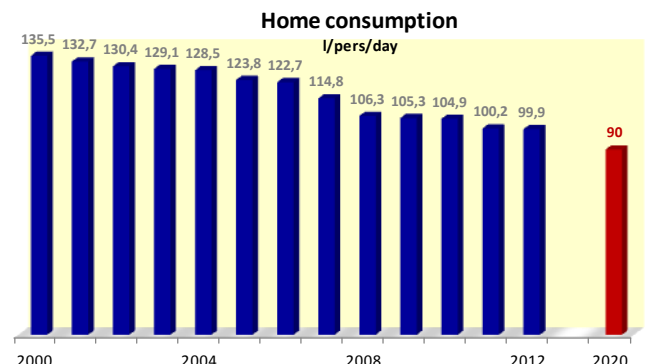
The work implemented for the year 2020 is, for example, the planning of the new goals for water management taking into account that the long way already done makes it difficult to reach gradual reductions in water consumption. Therefore, the objective is to reach:

- a total consumption of water in the city under 58 million m³/year. We are now around 60 million m³/year, but the number of citizens keeps increasing.
- a home consumption under 100 liters/person/day, arriving even at 90. We are right now around 100, but citizens are aware that there exists a wide number of saving devices, and will be difficult to keep on improving this parameter
- a reduction reaching 200 liters/person/day. It can be important the reduction that can be made from the services sector and above all thanks to a more efficient municipal consumption, the biggest consumer of drinking water of Zaragoza.

The following graphics show the evolution of these basic parameters in the management of water and the objectives for improvement for the year 2020.



Graphic 9. Evolution water available. Objective 2020



Graphic 10. Evolution home consumption. Objective 2020

All the municipal departments participating in water management are working in the framework of a new action plan for reaching the objectives established.

This plan starts from two axes:

implementation of the Municipal Bylaw for Water Saving and Efficiency passed in February 2011,

and development of a R&D&i program generated through a cluster of ZINNAE companies for the efficient use of water, aiming at becoming an international reference

in knowledge and innovation. The goal is to obtain an efficient and sustainable use of water in the city, as well as becoming a booster of qualified employment for Zaragoza.

Zaragoza is a national referent in the management of water. Right now, with its Plan for the improvement of the Management of the Water Cycle 2012-2019, it aims at improving its present parameters, advancing in the renovation of water networks and the sewer system with adequate materials, reaching an optimum quality of drinking water thanks to water coming from the Pyrenees, reaching also a better energy and environmental efficiency in the management of the Cycle of Water, reducing the number of bursts and also the quantity of water used by person and day.

8D. References

Byelaws

- Royal Decree 140/2003 establishing the sanitary criteria of the quality of water for human consumption.
http://www.boe.es/diario_boe/txt.php?id=BOE-A-2003-3596
- Municipal Bylaw for the eco-efficiency and quality of the integral management of water.
http://www.zaragoza.es/ciudad/normativa/detalle_Normativa?id=1542
- Zaragoza Sustainability Indicators
<http://www.zaragoza.es/ciudad/medioambiente/agenda21/observatorio/indicadores.htm>

Water Centres

- Chart of Zaragoza (document commitment, synthesis of the work of the Water Tribune, 2008)
- United Nations Office to Support the International Decade for Action "Water for Life" 2005-2015
<http://www.un.org/spanish/waterforlifedecade/index.shtml>
- Water Tribune. International Exhibition 2008. Archive
<http://www.zaragoza.es/ciudad/medioambiente/centrodocumentacion/cajaAzul/>
- Documentation Centre of Water and Environment
<http://www.zaragoza.es/ciudad/medioambiente/centrodocumentacion/>

Documents

- Plan of Renovation of Infrastructures related to the Management of Water in the City of Zaragoza
http://www.zaragoza.es/ciudad/medioambiente/detalle_Noticia?id=95811
- Municipal Program of Environmental Education 2011-2012
<http://www.zaragoza.es/contenidos/medioambiente/educacionambiental/PROGRAMA1112.pdf>
- "LIFE Optimizagua" Project. A reference model for an efficient management of water LIFE03 ENV/E/000164. Layman's Report
http://www.life-optimizagua.org/documentos/Layman_es.pdf
<http://www.life-optimizagua.org>
- "Zaragoza, Water Saving City" Project
<http://www.zaragozaconelagua.org/>
- "50 Good Practices in the Use of Water" Project
<http://www.aqua-dulce.org/html/portada/50BP/>
- Zaragoza, a Water Saving City: 100,000 Commitments
www.zaragozaconelagua.org
<http://ecodes.org/agua-y-ecodes/100000-compromisos-con-el-agua#.UiYCY9y2rM>
- Switch Project
<https://www.zaragoza.es/ciudad/medioambiente/switch/>
http://www.zinnae.org/phocadownload/articulo_usos_del_agua_en_el_hogar_en_zaragoza.pdf
- Green Homes
http://www.zaragoza.es/ciudad/medioambiente/educacionambiental/hogares_verdes.htm
- Educational proposal of commitment with the rivers.
<http://educambiental.educa.aragon.es/file/CursoR%C3%ADos.pdf>

Interesting Links

- Environment and Sustainability Agency. Council of Zaragoza
<http://www.zaragoza.es/ciudad/medioambiente/>
- Municipal Institute of Public Health
<http://www.zaragoza.es/ciudad/IMSP/>
- Public information on water quality
http://www.zaragoza.es/ciudad/IMSP/sanidad/listado_IMSP
- Water bill
<http://www.zaragoza.es/ciudad/encasa/facturaagua/>
- Ebro Basin Hydrographic Confederation
<http://www.chebro.es/>
- ZINNAE Cluster:
www.zinnae.org