



Water planning towards a green economy in the Ebro River Basin

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The challenges for water planning and the green economy in the Ebro

Spain is a pioneering country for water management at a basin level. Since its foundation in 1926 as a partnership of private users and public authorities to promote and exploit common interest public works, the Hydrographic Confederacy of the Ebro (CHE by its name in Spanish) was the first water authority created to coordinate water policy in a river basin in Spain. During the last century water and water management have played a central role in the process of economic development and particularly in transforming the pre-existing semiarid Ebro Valley and its influence area into a prosperous economy. Demography, agricultural expansion, energy and manufacturing development are all growth processes that cannot be properly understood without recognising the critical role played by water management.

The role of water management has gradually evolved through several stages. Its initial objective was to promote and coordinate the building and operation of water infrastructures to support productive transformation, initially based on the agricultural development. An intermediate stage saw water policy being used as an instrument to meet water demands stemming from economic growth. Today, the primary objective of water management is reconciling economic growth with the protection and improvement of the water resources which are critical to sustaining economic welfare in the long term. By focusing on the last two decades and ongoing innovative water planning processes, this case study illustrates the transition towards green water planning in the Ebro River basin.

Located in the North East of the Iberian Peninsula, the Ebro river basin covers 85,700 square kilometres (17.3% of the Spanish soil). The average rainfall of 622 mm/year is unevenly distributed both in time and space. The spatial distribution can vary from 3,800 mm/year up in the Pyrenees to just 100 mm/year down in the central river valley where the main economic activities are located. A Mediterranean river basin rainfall is variable through time and may range between 800 and 450 mm in wet and dry years.

Meeting the challenge of governing this uneven and uncertain supply of water lies at the heart of both the relative success and the current challenges of economic development in the Ebro River



basin. To adapt the available water resources to the times, locations and quantities of services demanded by the economy, the Ebro has been gradually transformed into one of the most regulated river basins in the world. The 108 big dams built provide a storage capacity of 7,580 million cubic metres, equivalent to more than half of the average long-term renewable water supply of the river basin (estimated at 14,623 million cubic metres).

By building collective facilities to support the accumulation of capital in agriculture, manufacturing, energy and drinking water provision industries, water policy has played a role as an engine of growth in the region. Indeed the availability of water infrastructures has so far been perceived as the critical factor underlying both the constraints and the opportunities of economic growth in the region.

The complex agro food system which gives the economy of the Ebro River basin its main competitive advantage now accounts for one fifth of the agrarian production and about one third of the meat supply in Spain. The decline in agriculture in the upper ranges of the Pyrenees is accompanied by the modernisation and transformation of agriculture in the lower valleys.

Irrigated agriculture, covering an area of 700,000 hectares in the valleys of the Ebro and its main tributaries, is the basis of the agro food system. Apart from the financial support provided in the past by the Common Agricultural Policy of the European Union, the market advantages are based on the availability of land, a relatively cheap labour supply, the proximity to markets in Spain and central Europe and also on the capacity of using crops as inputs for livestock activity in the upper river basin and the low Pyrenees. The viability, profitability and success of agriculture in the region relied on the development of water-related infrastructure for storage, transport, distribution and irrigation.

Water development has also played an essential role in the emergence of a highly competitive power generation sector in the river basin. Currently the basin produces about one third of the nuclear power of the country, it has one fifth of the installed capacity of hydropower of the country shared between 360 plants across the basin, and one tenth of the country's thermal generation capacity. This important contribution to the generation of electricity is based on a heavily engineered hydrological system, providing a convenient supply of stored and running water, turbinating 38,000 million cubic metres per year (four times the average water runoff in the basin) and using more than three thousand million cubic metres to refrigerate nuclear and thermal power plants.



Although the amount of water used in the manufacturing sector represents a minor fraction of the total water used in the basin, the sector depends on raw materials produced by the agricultural sector (for food production) and the local demand of inputs for that activity (agrochemicals, equipment, etc.). The Ebro valley is an industrial corridor and the sector provides almost 30% of the value added in the basin economy (compared with a contribution of less than 23% of the same sector to the entire Spanish economy).

Water development is also an important factor influencing the dynamic of population trends in the basin, both directly through the provision of drinking water and sanitation, and indirectly through the development of employment and production opportunities as above mentioned. The Ebro River basin has only 34 inhabitants per square kilometre, less than one fifth of the average in the European Union and only two fifths of the Spanish population density. However, thanks in part to water development the Ebro valley has become an important settlement axis linking the rich industrial economies of the north of Spain, from the Basque Country to Catalonia, along an economic corridor.

The drivers of change

The collective success in making water an integral part of economic development in the Ebro River basin has been accompanied by the emergence of new problems, requiring changes to traditional water policy in order to cope with them. New challenges include the limited ability to cope with increasing water demand as the population and the size of the economy grow, the limited ability to meet these new demands with the traditional means of new infrastructures and subsidised water facilities, the difficulty of meeting competing demands from different sectors and reconciling these demands with the available supply of resources, and increased vulnerability to droughts as water withdrawals increase.

The emergence of new challenges is the main driver of the gradual transformation of water planning and policy in the basin, from the early focus on building water infrastructures, to meeting the needs of an expanding economy and population, to the introduction of integrated water management to ensure water use is compatible with the preservation of the ecosystems and the ongoing provision of services underpinning economic growth. It is in this context that the connection between this new kind of water planning and green growth can clearly be established. Before showing how water planning is coping with emergent water problems, the following insights about the interlinkages between water and economic growth in the Ebro River basin can illustrate the current challenges for water planning.



The consumptive use of water in the river basin each year already represents more than 34% of the average long term renewable resources of the basin (5 billion cubic metres of 14.6). According to the European Environmental Agency, the water Exploitation Index of the Ebro, although high when compared with other central European river basins, is lower than in other southern Spanish river basins, such as the Guadalquivir and the Segura where the water used every year exceeds 50% of the long term renewable resources and where, due to a competitive agricultural sector and higher water scarcity and drought vulnerability, water is perceived as more valuable than in the Ebro.

Apart from regional disagreements, water development is also a growing source of potential conflict between the different economic sectors and water users within the river basin. Although the figures mentioned in the previous paragraph indicate that available resources are sufficient to cover all the existing demands, water demand and supply vary in space and time and in fact deficits and vulnerabilities have increased over time. For example 200,000 out of the 700,000 potentially irrigable hectares (mainly in the right margin of the Ebro River) suffer from structural deficits meaning that their needs cannot be met in all years.

In the new European water policy framework, the main long-term objective of water policy is making the maintenance and expansion of economic uses of water compatible with the improvement and adequate protection of water providing ecosystems. Thanks to this development, the environmental objectives, which were already considered in the hydrological plans legislation of 1985, are not only more stringent and more precisely defined but are the dominant criterion to judge the success or failure of water policy in the years to come. The setup of the Water Framework Directive has allowed for a systematic analysis of the detrimental impacts caused by the pressures of the economy on water bodies. The prospective analysis of water use and its pressures and impacts resulted in the identification of surface and ground water bodies in risk of non-compliance with the good status requirements for the years 2015 and 2021.

The challenges for change

Motivated by the importance of promoting rural development, all public authorities are reluctant to give up ambitious plans for developing new irrigation areas, despite the lack of water regulation infrastructures and decreased guarantee of supply. The number of projects approved or under study for the years to come is still considerable and new provisions are required to coordinate this effort with the existing water resources and the other actions required in order to make them viable in economic and financial terms (see CHE, 2008 EPTI, p. 92).



Given the priority given by national policy to drinking water, the irrigated sector supports the risk associated with the variability of water supply in the river basin. Although the average long-term resources are about 14.6 cubic kilometres per year, they may range from 24 on wet years to only 8.4 cubic kilometres during meteorological droughts. In spite of the stabilising effect of the 7.6 cubic kilometres of storage capacity, the expansion of the agricultural sector is associated with an increasing insecurity in the water supply which affects the profitability of existing and new irrigation developments. This has contributed a shift in focus from increasing irrigation capacity to growing concerns over the guarantee of supply.

Meeting the increasing demand for water means diverting greater amounts of the resource, resulting in a reduction in river flows and in the water effectively stored in the system. Aside from the environmental impacts, this represents another source of potential conflict as there is less water available for non-consumptive uses (particularly for the more than 360 hydropower plants along the river network). In fact due reduced water availability, the hydropower system delivers a volume of energy every year which falls short of its installed capacity (no more than 50% even in rainy years and falling to only 11% in dry years). These stylised facts show the importance of coordinating the investments in infrastructure in the different sectors such as irrigation and hydropower as well as the potential gains from improving the conservation of water resources.

An analysis of the factors driving water demand in the river basin shows, in the business-as-usual scenario, a trend towards a significant increase in water demand for drinking water (fostered by population growth, better living standards and urban growth), irrigation water (from new developments despite the considerable gains from current programmes for modernising and improving irrigation technology) and for power generation (from existing hydropower and thermal projects). Without actions to reduce water demand or improve water use efficiency, these new developments are generally feasible within the range of the existing resources nor compatible with the improvement of the ecological status of the water bodies in the basin.

All the above mentioned factors are also associated with an increased risk of hydrological droughts (distinct from meteorological droughts which are associated with natural causes, these refer to the ability of the system, given a natural rainfall, to cope with existing water demands). Furthermore, simulation and statistical models shows some evidence of a likely reduction in water runoff attributable to climate change. A reduction of 5% flow in the Ebro River basin is projected by 2027, based on studies carried out by CEDEX on assessing the potential impact of climate change on water resources. The combination of increased scarcity, higher drought risk



and uncertain supply due to climate change is a powerful argument for prioritising water resilience and security in the water policy agenda.

The planning approach for transitioning to a green economy in the Ebro River basin

Water planning has played a key role in the productive transformation and economic development in the Ebro River basin. The perceived role of water planning has changed through time as new challenges have emerged. The transition towards integrated water resource management in the last decades shows how water planning can make a real contribution to sustainable development and green growth. Water planning has responded to the aforementioned challenges in many different ways that can be summarised as follows:

The setting of an institutional framework for transparent stakeholder involvement and public participation

There has been a long tradition of public participation in the Ebro basin since the foundation of the Hydrographic Confederacy of the Ebro: regions, municipalities, central government agencies and civil society are represented in several participatory bodies of the Ebro Water Authority and take part in the decision making process.

The Water Framework Directive has demanded even more active public participation. An extensive public participation network was created reaching all the sub-basins in the river basin. This network has proven successful in providing a forum to share information and fostering a common understanding of water challenges and measures to be taken. Public participation has also provided a means to pursue the coherence of water policy with other public policies (e.g. land use, urban and rural development, energy). Public participation is a learning-by-doing process and substantial advances are expected as information and skills improve over time.

Public participation is also a proven institutional framework for agreeing on practical, observable and enforceable environmental objectives. This has been demonstrated in the Ebro River basin, for example through the setting of targets for the status of water bodies and minimum flows, as well as drought indicators. Since 1998 thousands of initiatives (public and private projects) have been studied by the river basin authority in order to determine their compatibility with the environmental objectives of the river basin management plan.

Establishing ambitious environmental objectives

In the Ebro River basin, the institutional decision has been made to give primary importance to the environmental objectives of water planning. This has resulted in the setting of precise



environmental objectives in terms of the quality of water bodies. It is against these objectives that competing demands of water users and other stakeholders must be accommodated. Once these objectives are set, they become the criteria that the water authority adopts to allow new water uses.

The new water policy framework allows for the actions and measures that guarantee the achievement of environmental objectives and that generate minimum economic losses (i.e. cost effective analysis used to choose the set of measures in the river basin management plan) or maximum welfare gains (e.g. from more efficient water provisioning systems or alternative water supply sources).

So far the still ongoing public consultation is addressing the objective of achieving good status in 85% of the water bodies by 2015. By comparing information on the current status of water flows with that of the natural conditions, an agreement is expected to be reached on the minimum environmental flows needed to be maintained in the different rivers. This agreement must consider the uses affected by minimum flows and the potential benefits of improving the habitat conditions. The minimum environmental flows decided upon will be verifiable and enforceable through the monitoring network of gauging stations.

The allocation of water resources needs to be balanced in such a way that by 2015, total water consumption will not exceed 34% of the long term available resources.

Creating opportunities for productive uses whilst respecting environmental standards

Water policy is an instrument to advance sustainable development. In the Ebro basin, water has a particularly important role in strengthening the agro food complex, as a source of renewable energy, and increasingly for new uses such as recreation and tourism services.

Without discarding current plans to expand water using activities (such as existing urban or irrigation developments) the plan conditions their implementation to the proven existence of available resources. This way the emphasis is placed on an ambitious programme to modernise the irrigation systems as a necessary condition for increasing water efficiency and reducing diffuse pollution.

Building a strategy to manage uncertainty including drought management and flood control

So far the institutional response to drought has been reactive and usually late reactive actions. Recent institutional changes have been aimed at replacing unplanned emergency management responses with new anticipated, preventive and planned responses.



The Special Action Plan in Situations of Alert and Temporary Drought for the Ebro Basin has been approved and incorporated as an integral part of the river basin management plan. The drought contingency plan defines a set of observable indicators to classify the drought situation (as normal, pre-alert, alert and emergency) and outlines a clear set of actions to be taken in each case, including the reduction of water use rights. The replacement of discretion by decision rules is considered a positive step forward in water governance.

The identification, assessment and selection of projects to restore the water environment

The water planning process for the Ebro River basin has contributed to the selection of a combination of projects aimed at restoring the water environment. They include an ambitious programme for water quality improvement through a mix of effluents treatment and water reuse projects combined with a zero tolerance programme to monitor and control pollution discharges.

A set of water saving measures have also been identified, combining intake, transport, treatment, distribution and efficiency projects throughout the entire river basin. These programmes are accompanied by a set of projects focused on the restoration of rivers and river banks, the recovery of wetlands, the restoration of sediment balances and hydrological regimes, the removal of polluted sediments, the control of invasive species and other measures aimed at improving the ecological status of the river basin ecosystem.

The twelve key elements of the Ebro River Basin Management Plan 2010-2015:

- **A social opportunity** to build a management system that is ethical, efficient and sustainable within the whole framework of the basin, creating a symbolic reference point for the Ebro.
- **Integrated management**, under innovative principles of public participation and a historical cooperative model that includes all stakeholders within the shared authority of the watershed organisation.
- **Ambitious environmental objectives**. At least 85.3% of river water bodies will attain good status by 2015.
- **A firm commitment to reducing pollution**, both from diffuse agricultural sources and other sources, such as urban centres and industry.
- **A proposal for realistic environmental flow regimes**, set for the main gauging stations, allowing habitat conditions according to prescribed methodologies. These should be enforceable and verifiable.



- **Sustainable development** that contributes to strengthening the agro-food complex in the Ebro valley, strengthens the role of water as an energy source in a future which relies on energy from mostly renewable sources, and encourages the inclusion of new water uses, such as recreational uses.
- **The modernisation of irrigation** as a necessary action for efficient water management and the reduction of diffuse pollution.
- **Balanced allocation of resources.** By 2015, water consumption will be around 34% of the available natural water resources.
- **Participation** is the cornerstone, from start to finish and from bottom to top. The Water Council of the River Basin leads the project, but with a participatory network that reaches throughout all the sub-basins of the main basin.
- **A financial effort** shared by all administrative bodies.
- **A commitment to cost recovery** through the prism of socioeconomic territorial balance and targeted rural development programmes.
- **Vigilant and adaptive monitoring.** Implementation of extensive monitoring networks and procedures to verify the adoption of measures and achievement of objectives.

Evaluation: economic, social and environmental benefits

Social

Public participation has been particularly important for increasing understanding of the tradeoffs between the environmental, economic and social objectives that need to be considered in water policy. Water has been key rural development, for example by providing alternative development opportunities such as rural tourism. These ambitions sometimes conflict with the limited capacity of rural areas to finance their own water management projects or even to pay for the entire cost of the water services they receive. For this reason, with the support of public participation processes, the development of the river basin plan focused on identifying actions with the highest potential for promoting local development in sensitive rural areas. The planning process also assessed and identified low income areas where social objectives should be prioritised and exceptions to full cost recovery of water prices permitted.

Economic



Although significant progress has been made, the coordination of agricultural, land use, energy and other sector policies in the water policy framework is still to be achieved. Around 70% of the new irrigation areas proposed in the 1998-2008 planning period were carried out. Many irrigation expansion projects are still pending for implementation or under study, and some of them have been implemented but unable to achieve their objectives due to a lack of sufficient water resources. The importance of sustainable water management and environmental conservation is increasingly being recognised and accepted, in contrast to the sole promotion of local development.

Environmental

Significant advances have been made in controlling diffuse pollution, mainly through changes in agricultural practices and also through the management of pollution from scattered livestock in the upper reaches of the river basin. In 2008, already 74% of the water bodies assessed were of a good ecological status.

Lessons learnt

The approach	Lessons learnt from implementation
<i>Reaching a social agreement on the desired balance between water use and water resource conservation</i>	Setting the achievement of a good or fair ecological status of the water bodies as the main objective of River Basin Management Plans in the European Union has been an important element of water planning in the Ebro River basin in Spain and has helped make economic development compatible with environmental objectives.
<i>Harnessing development opportunities and coping with water and development challenges</i>	Water planning has played an essential role in the development of the agro food and energy complex that now represents a competitive advantage and a defining characteristic of the Ebro River basin in



	Spain.
<i>Building governance and institutional capabilities</i>	Transparency, regulation and enforcement, and building technical competences have been key to successfully building governance capabilities in the Ebro River basin.
<i>Improving the information and analysis base</i>	The Ebro River basin boasts an efficient hydrological information system open to stakeholders, researchers and private and public institutions.
<i>Coordinating public policies</i>	The simultaneous development of the energy, the agro food industry as well as urbanisation and the expansion of the manufacturing industry have been possible within the capacity of the limited water resources available in the Ebro river basin.
<i>Stakeholder engagement and public participation</i>	Active participatory mechanisms have contributed to the design of water management plans in the Ebro River basin.
<i>Aligning private decisions with collectively agreed goals</i>	There are clear regulations for water abstraction and quality requirements, a transparent playing field and indicative planning for private investments.
<i>Establishing collective responses to scarcity and risk</i>	The Water Framework Directive is a promising example of a collective response that has served to develop and coordinate efforts at a national and local level to respond to water challenges.
<i>Monitoring progress and compliance</i>	The acquisition of technical skills, the development of information systems, the building up of reporting strategies, etc. are



	all elements that have contributed to the reputation and credibility of river basin authorities in the Ebro basin.
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