Part 4

Possible mechanisms and enabling conditions

Chapter 16

Water trading in Spain

Alberto Garrido[1], Dolores Rey[2] & Javier Calatrava[3]
[1] *Water Observatory of the Botín Foundation; CEIGRAM, Technical University of Madrid, Madrid, Spain*
[2] *CEIGRAM, Technical University of Madrid, Madrid, Spain*
[3] *Department of Business Economics, Technical University of Cartagena, Cartagena, Spain*

ABSTRACT: This chapter reviews Spanish water market regulation established in the Water Law Reform of 1999. It also provides an overlook of the type of exchanges that took place between 2004 and 2008, when market exchanges were more frequent. While exchanged amounts were not very significant in absolute terms, those that involved inter-basin transfers raised the most concerns and significance. The chapter describes in detail various market mechanisms used in different basins, including the exchanges that took place through Water Exchange Centres run by the basin agencies. All market inter-basin exchanges involved transfer of water from the Southern Castilian Plateau and from the headwaters of the Guadalquivir basin to the most arid areas in the Southeast of Spain (Murcia and Almería). The chapter summarizes the findings of two workshops devoted to discuss the market experiences, with water officers, market participants and scientists. A list of recommendations to reform water markets regulation and monitoring is offered in the concluding section.

Keywords: water markets, regulation, inter-basin transfers, market price, water banks, water exchange centres

1 INTRODUCTION

The Mediterranean region will probably be among the areas most affected by climate change in terms of reduced precipitation and increased frequency of extreme events (see Chapter 15). Market mechanisms that value water resources and provide compensation through voluntary transfers of water rights or water use rights can become an essential instrument for coping with water scarcity challenges. Establishing water markets (WMs) is an alternative means for improving water economic use and efficiency. Nevertheless, in Europe, most Member States do not envisage establishing WMs to fight water scarcity, except UK, Belgium and Spain (EC, 2011).

In 1999 the Spanish Water Law was reformed to allow holders of water rights to exchange their water by leasing-out temporally or till maturity their concessions. But exchanges were very rare before 2004, when the onset of the 2004–2008 drought created conditions for private gains-from-trade and the Government gave clear support to the proposed exchanges. This chapter reviews the Spanish WM experience, including its weaknesses and opportunities. It concludes with a number of proposals to upgrade WMs and make them more efficient, liquid and sustainable.

2 WATER MARKETS IN SPAIN

2.1 Institutional set-up

Water rights issued by the Water Authorities are made available through publicly built infrastructures or privately built with permission of the State (hydroelectricity). According to the 1985 Water Act, rights can also be granted to pump groundwater or divert resources directly from surface water bodies. A competitive process (public tender for licenses) for potentially interested agents is used only for hydropower applicants. Irrigators and urban users must go through a technical and administrative process, which aims at establishing the socio-economic interest of the request and its technical and environmental feasibility.

Water use rights are defined by the abstraction point, type of use, calendar, plots and crops to be irrigated and irrigation technologies, usable volume or flow and return flows. The type of use, location, abstraction or return points cannot be changed without an explicit approval by the River Basin Agency (RBA). Rights differ in the priority of their access to water depending on the type of use (domestic, environmental, agricultural, hydropower or industrial).

With the approval of the 1985 Water Act, water became a good under the sphere of the public domain. Nonetheless, holders of private rights over groundwater were given the choice of keeping them as a private right or else converting them into temporal water concessions. A vast majority (more than 80% of right holders according to Llamas *et al.*, 2001) opted for the first option. Any new rights over groundwater granted after 1985 would exclusively be a concession of use of a public good – water. The 1999 reform of the Water Act introduced the legal possibility of voluntary exchanges of public water concessions, but with many restrictions. It only allows the temporary exchanges of public water use rights. Before the 1999 reform only private rights could be formally traded; water flows pumped from private wells could be leased, auctioned or sold.

The 1999 Water Law Reform identified only two ways to exchange public water use rights: i) Right-holders that voluntarily agree on specific terms of trade and jointly file a request in the Agency to lease-out for a number of years the water to which right-holders are entitled; ii) Water banks operations (or *water exchange centres*, as they are called in the 1999 Water Law). Initiated and administered by the RBAs, water banks are set up as public tenders for interested right-holders who would be willing to relinquish their water rights temporally or for the remaining maturity period. The bank's water supply operation involves procuring volumes from voluntary sellers, and making them available for other users, including environmental restoration purposes. Bank's operations may also acquire permanent water rights and operate in exceptional situations of drought or overexploitation of aquifers (WWF, 2005). In practice, these *water exchange centres* have only functioned as buyers of water or water rights. Water has not been sold to other users. Instead, purchased water has been made available to other users free of charges in the form of new water concessions or devoted to maintaining environmental flows.

2.2 Barriers and limits to trade

The Spanish regulatory framework can be best defined by reviewing the barriers that limit the type of exchanges. Three different barriers can be distinguished: legal barriers, institutional barriers and environmental barriers.

There are two kinds of legal barriers: i) market barriers, that may be erected based on evidence of monopoly power; market barriers result from public agencies' responsibilities and service, and without them, the market would be environmentally harmful and poorly enforceable; ii) barriers related to water rights' definition. In Spain, legal specialists differ in interpreting whether the rights definition necessarily hampers the market (Ariño & Sastre, 2009) or simply enforces the Water Act tenets (Embid Irujo, 2010). Water rights in Spain were originally not designed to be tradable (Garrido & Calatrava, 2009); they were made tradable under certain circumstances in the 1999 Water Law Reform.

Among the different regulatory elements identified by Ariño & Sastre (2009: 100–101) there are some that can restrict the functioning of WMs. First, rights to consumptive uses cannot be sold to holders for non-consumptive uses (hydropower) and vice versa. Second, there are restrictions on potential water buyers, as rights can only be leased out to other rights holders of an equivalent or higher category in the order of preference established by river basin planning or in accordance with the Water Act. Third, there are limits to the spatial extent of trading: licenses for the use of public infrastructure connecting different river basin areas may only be authorized if they come under the National Hydrological Plan or other specific laws. Fourth, there are limits on price setting; regulations may determine maximum price limits for water licenses. Competitive pricing can be substituted by administrative intervention.

The following institutional barriers can be identified: i) regional or area-of-origin barriers. These barriers result from the restrictions, or even upfront opposition, to trading by area-of-origin representatives. For instance, the Regional Government of Aragón blocked water transfer to the Barcelona area during the 2008 drought. It also has in its Autonomy Statute (more or less a regional Constitution) an explicit obligation on Aragón's President to prevent any water transfer out of the region's borders; ii) inter-sectoral barriers occur when representatives of one sector collectively fights exchanges that go against its political standing within the hierarchy of water rights and political priorities. This is generally the case of irrigators. A huge literature (see Easter *et al*., 1998) exists that shows farmers being initially reluctant to sell water out of the sector. For example, irrigators in the Ebro basin made their water rights available to the Barcelona city during the severe water supply crisis of the 2005–2008 drought, but they would not accept any monetary payment for transferring their resources. There are strategic reasons for combating out-of-sector water sales, chief among them the fear that eventually their tradable rights will be questioned and perhaps irrigators will be deprived of them.

Environmental barriers are those enforced by public agencies responsible for the stewardship of the ecological quality of rivers and water bodies. In general, these barriers, such as minimum environmental river flows, are based on modelling evidence, and are hardly contested. Occasionally, an *environmental tax* is imposed as a proportion of the volume/flow to which the traded right is entitled and which should be left in the natural source.

2.3 A review of Spanish water market experiences

Since 2005, WMs have become more frequent in Spain, although traded volumes represented less than 1% of all annual consumptive uses. During the 2005–2008 drought, WM exchanges alleviated the conditions of those basins where water scarcity was

most severe. Water trading takes place in many different ways. First, there are informal exchanges at the local level in many southern and eastern regions, taking place even before the 1999 Reformed Water Law was enacted. Second, there is trading of private groundwater pumping rights. Third, there are formal lease contracts and trading of public concessions under the 1999 Reformed Water Law. Some of these exchanges take the form of purchases of land upstream to transfer the water to other downstream areas of the same basin. Fourth, during the 2005–2008 drought the government allowed, under Royal Decree 15/2005 and subsequent Decrees, inter-basin temporary trading. Last, *water exchange centres* have been used to make purchases by Water Agencies (Offers of Public Purchase of Rights) for environmental or urban uses. These different types of water exchanges are not necessarily exclusive but complementary, as they satisfy different users' supply needs (Garrido & Calatrava, 2009).

Table 1 summarizes some of the existing market experiences and schematically lists both the currently existing exchanges typology and their characteristics.

2.4 Exchanged volumes and prices: economic interpretation

In this section, we report the exchanged volumes and prices in the most important typologies of WMs in Spain. These are the most recent and relevant market experiences in terms of exchanged volumes.[1]

Case 1 Operations of the Guadiana exchange centre

In the Guadiana basin (central Spain) the *Special Plan for the Upper Guadiana* was approved in order to solve the environmental problems affecting groundwater bodies due to aquifer overexploitation (see Chapter 20). A public water bank was established to acquire rights to reduce pumping rates by 250 hm^3 by 2027 [hm^3 = cubic hectometre = million m^3 = 10^6 m^3]. There were three public offers (October 2006, March 2007 and September 2007) targeted to irrigators, but required the means to acquire land rights with appurtenant water rights, to prevent further irrigation consumption in these lands. Right-holders located in areas closer to river banks or protected areas were prioritized among the lowest bidders. Maximum prices were set at 10,000 €/ha for land without permanent crops, 6,000 €/ha with permanent crops; the minimum price was 3,000 €/ha. In 2010, six operations were completed. With a total budget of 84.5 M€, only 66 M€ were spent to acquire 6,900 ha, with 29 hm^3 of registered groundwater rights, of which 13.6 hm^3 were transferred to the Regional Government of Castilla-La Mancha, which then allocated them in the form of public concessions to farmers that complied with certain requirements. The remaining 15.4 hm^3 correspond to the difference between the nominal water allotment of the purchased water rights (4,500 m^3/ha) and the effective amount of water available to farmers because of existing pumping restrictions (about 2,200 m^3/ha).

1 Some types of water markets, such as informal trading or trading of groundwater rights, are very difficult to document. The reader will find more information in Calatrava & Gómez-Ramos (2009) and Garrido & Calatrava (2009).

Table 1 Current Spanish water trading experiences.

Features										
Type exchanges	*Geography*	*Hydro-logical settings*	*Agents*	*Exchanges*	*Market structure*	*Potential environmental impacts*	*Regulatory framework*	*Role of water agency*	*Current existing trading*	*Observations*
Informal trading of surface resources	Intra-basin (same irrigation district)	More frequent in dry years	Farmers within the same irrigation district (same public water concession)	Temporary	Bilateral agreements	Unlikely	Limited to the same district. Require permission of the irrigation district	None	Limited. Very difficult to document	Irrigation districts allow these exchanges only if no monetary compensation exists
Trading of private ground-water rights	Intra-basin (same area)	Drought and normal water availability periods. More frequent in dry periods	Sellers: holders of private groundwater rights. Buyers: other farmers, private societies, etc. Temporary buyers of water: mostly farmers	Permanent and temporary	Bilateral agreements	Excessive pumping and aquifer overdraft	Trading restricted to the same hydrological area. Prices in permanent trading must be above a minimum legal price established by regional governments. Restricted by the existence of transportation infrastructures	None	Very active in dry periods in the South-East basins	Low market transparency. Difficult to assess the extent of trading. Speculative nature of the market: in many cases right-holders are not users but only sellers. Large gains-from-trade, especially for sellers
Formal lease contracts	Intra-basin	Drought and normal water availability periods	All type of users	Temporary	Bilateral agreements	Only if environmental and/or return flows from upstream uses are affected	Water agency must permit the change in the place of use of the water. Restricted by the existence of transportation infrastructures	Gives permit to the water transfer. Owns main Transportation infrastructures. Establishes transportation fees	Very little activity documented	Potential was expected to be significant. In practice it has been quite limited

(*Continued*)

Table 1 (Continued).

Features										
Type exchanges	*Geography*	*Hydro-logical settings*	*Agents*	*Exchanges*	*Market structure*	*Potential environmental impacts*	*Regulatory framework*	*Role of water agency*	*Current existing trading*	*Observations*
Purchases of land	Intra-basin	Drought and normal water availability periods	Sellers of land: individual landowners. Buyers of land: irrigation districts. Buyer and seller of water is the same agent (irrigation district)	Permanent	Bilateral agreements in agricultural land markets	Only if environmental and/or return flows from upstream uses are affected	No limits to irrigated land trading. Water agency must permit the change in the place of use of the water. If the purchased land belongs to an irrigation district, this must permit the transfer. Restricted by the existence of infrastructures	Gives permit to the transfer of water. Owner of transportation infrastructures. Establishes fees for transportation	Some cases (e.g. *Totana and Aguilas* irrigation districts, Segura basin)	Potential for this type of trading is quite reduced. In terms of regulation they are similar to the formal lease contracts
Inter-basin trading	Between users in Tajo and Segura basins, and between users in the Guadalquivir and the Andalusian Mediterra-nean basins	Dry periods	Sellers: irrigation districts. Buyers: irrigation districts and the adminis-tration for domestic and environ-mental uses	Temporary	Bilateral agreements. Water administra-tion has played an active role as intermediary	Only if environmental and/or return flows from area-of-origin uses are affected. No effects have been documen-ted. Potential environmental benefits in the area of destination	Water agency (MAGRAMA*) must permit the change in the place of use of the water. Restricted by the existence of transportation infrastructures	Gives permit to the transfer. Owns main transportation infrastructures. Establishes fees for transportation	Some experiences with large exchanged volumes (*Estremera -SCRATS, Canal de las Aves-MCT*, Guadalquivir irrigation districts-*Aguas del Almanzora*)	Large potential. Strong opposition from regional governments in some areas-of-origin of water

Public Exchange Centres/ Water Banks	Intra-basin	Drought and normal availability periods	All. Potential sellers: agricultural users. Buyers would be other agricultural users and the administration for domestic and environmental uses	Temporary in the Segura; permanent in other basins	Via a central public agent	Only if environmental and/or return flows from upstream uses are affected	Restricted by the existence of transportation infrastructures. Prices set by water agency	Buyer and intermediary between sellers and buyers	Experiences in different Spanish basins (Júcar, Segura, Guadiana…)	Strongly supported by public budgets
Option Contracts	Intra-basin and inter-basin	Drought periods	All. Potential sellers: agricultural users. Buyers would be other agricultural users and the administra-tion for domestic and environmental uses	Temporary	Bilateral agreements	Only if environmental and/or return flows from area-of-origin uses are affected. Potential environmental benefits in the area of destination.	Water agency must permit the change in the place of use of the water. Restricted by the existence of transportation infrastructures	Gives permit to the transfer of water. Owner of transportation infrastructures. Establishes fees for transportation	One recent experience between users in the Tajo and the Segura basin	

Source: Own elaboration.

* MAGRAMA: Ministerio de Agricultura, Alimentación y Medio Ambiente.

One subtlety of the Guadiana scheme is the fact that, while farmers entering the program must surrender their private rights, those that gain access to them will be granted 30-year *concession* rights (which is a more attenuated property than the others). So the Guadiana basin will have more users with *concessions* than with private rights (Garrido & Calatrava, 2009).

The Guadiana public offerings were planned to continue in 2008 and the following years but the effects of the global economic crisis brought the Special Plan for the Upper Guadiana to a sudden stop.

Case 2 Operations of the Júcar basin exchange centre

Its objective was to increase the water table levels to ensure that the Júcar River did not dry out during the dry spell of 2005–2008, as had occurred during the previous drought in the 1990s. The purchases were for just the 2006/07 and 2007/08 irrigation seasons. The aim was to reduce extractions by 100 hm^3 in the Upper Júcar aquifer to enhance flows for the lower part of the basin. Farmers were given the option to lease-out their rights for one year in return for a compensation that varied between 0.13 to 0.19 €/m^3, depending on the distance of the seller's location to the associated wetlands or to the river alluvial plain. The 2006/07 program had a budget of 12 M€ and purchased 27.3 hm^3 for 5.5 M€. The second program in 2007/08 had a similar budget and required three rounds of acquisition offers (December 2007, February 2008 and March 2008) to acquire 50.6 hm^3 for 12.7 M€ (CHJ, 2010). This exchange centre did not meet its purchase objectives, as there were not enough bidders to cover the entire budget and target volume.

Case 3 Operations of the Segura basin exchange centre

The Segura basin, in the southeast of Spain, is the most water-scarce basin in the country. There is a wide gap between water supply and demand, mainly because of increasing consumption, caused by the huge increase of irrigation schemes developed over the last few decades. The Segura exchange centre issued two public offers targeted to rice farmers in the upper part of the basin who were willing to temporarily lease their surface water. Two public offers were established in 2007 and 2008 with a budget of 700,000 € each, and a maximum price of 0.18 €/m^3. In 2007, 2.93 hm^3 were purchased at an average price of 0.168 €/m^3 and with a total budgetary cost of 495,000 € (Calatrava & Gómez-Ramos, 2009). 41 lease contracts were signed with small farmers accounting for 371.5 ha. The result of the 2008 offer was similar to the 2007 one. Purchased volumes were intended for maintaining environmental flows in the Segura and Mundo River in the Albacete province (Castilla-La Mancha) but only once the domestic demands were satisfied. In practice, all the purchased volumes were for maintaining environmental flows.

Case 4 Formal lease contracts under the 1999 Reformed Water Law provisions

There are only a few documented experiences of formal lease contracts since the 1999 Reformed Water Act. Contrary to what was initially expected, many users have been reluctant to formally exchange their water or concessions. Maybe the most important experience in terms of volume was in the Tagus River in 2002, between the *Mancomunidad de*

Canales del Sorbe (Guadalajara), a large urban retailer (buyer), and the irrigation district of *Canal de Henares* (seller). 20 hm^3 were transferred, at a fixed price of 38,000 €/year, plus a variable quantity of 0.04 €/m^3 for the first 4 hm^3, and 0.02 €/m^3 for the rest of the total volume. In the Segura basin, 35 formal lease contracts were authorized between 2000 and 2005, for a total volume of 10.1 hm^3, less than 1% of total annual water consumption in the basin (Calatrava & Gómez-Ramos, 2009). In the Guadalquivir, some exchanges represented just one right-holder permuting his own rights from the lower basin (with more salinity concentration) with his rights in the upper basin.

Case 5 Inter-basin exchanges under Royal Decree 15/2005

According to the 1999 Reformed Water Law, exchanges involving different river basins (jurisdictions) require the explicit approval of the Ministry of Environment. In 2005–2008, Spain suffered a drought that prompted the Spanish Government to permit inter-basin water exchanges (Royal Decree 15/2005). There are two important inter-basin aqueducts that would enable exchanges across basins (the Tagus-Segura Transfer and the Negratín-Almanzora Transfer, the latter between the Upper Guadalquivir basin and the Almanzora basin, in Almería). There are others operating in the country, but no exchange request has yet been filled.

Across-basin exchanges were contracted in 2006 (six in number, totalling 75.5 hm^3), 2007 (17, representing 102 hm^3), and 2008 (two, with 68 hm^3). Farmers in the area-of-origin (Tagus and Upper Guadalquivir basins) leased out their water rights to farmers and urban users in the recipient basins of Segura (*Sindicato Central de Regantes del Acueducto Tajo-Segura* and *Mancomunidad de los Canales del Taibilla*) and the Andalusian Mediterranean basins (*Aguas del Almanzora*, which mainly services irrigators). In the Tagus basin, the sellers were the over-supplied irrigation districts of *Canal de Estremera* and *Canal de las Aves*. Farmers received a payment of 2,400 €/ha for fallowing their irrigated land, which in those years was more than the value of the crops (maize) they would have grown under normal conditions.

The amounts bought by users in the Segura basin from the Tagus basin only in 2006 largely surpassed those of all the exchanges approved among users in the Segura basin between 1999 and 2005. The *Mancomunidad de Canales del Taibilla*, the major urban water supplier in the Segura basin, signed an agreement in 2006 with farmers in the Upper Tajo basin (*Canal de las Aves* irrigation district) to buy up to 40 hm^3 at a price of 0.28 €/m^3. In 2007, 36.9 hm^3 were bought at a price of 0.23 €/m^3. The price in 2006 was greater because when the agreement was reached the selling farmers had already incurred in some cultivation costs (Calatrava & Gómez-Ramos, 2009).

The contract between the *Canal de Estremera* Irrigation District and the *Sindicato Central de Regantes del Acueducto Tajo-Segura* (SCRATS) has been active during 4 years. SCRATS paid 6 M€/year for 31 hm^3/year. The price was 0.19 €/m^3 in 2006 and increased up to 0.22 €/m^3 in 2008 (Calatrava & Gómez-Ramos, 2009).

In 2007 and 2008, when almost no water could be transferred to the Almanzora Valley through the Tagus-Segura aqueduct due to the prolonged drought, farmers in the Almanzora looked for alternative resources (25 hm^3/year) and established two type of agreements: i) They acquired 1,400 ha of irrigated land in the Marshes of Guadalquivir; and ii) established formal lease contracts with different irrigation districts in the Middle Guadalquivir (*Bembézar* and *Guadalmellato* irrigation districts) and the

Genil catchment (Corominas, 2011). This author calculates the profit obtained by the sellers in the Guadalquivir entering the latter-mentioned lease contracts as the difference between the income losses due to lower use of water and the received compensation. This profit was 220 €/ha (Guadalquivir) and 280 €/ha (Genil). Corominas (2011) stated that for prices of 0.15 €/m^3, both buyers and sellers could obtain gains from the exchanges in the Guadalquivir River basin (in practice, the price was 0.18 €/m^3).

The exchanging system in the former case involves three geographical sites in the arrangement: water rights linked to land in the lower Guadalquivir basin (i), were transferred to the Andalusian Mediterranean basins (ii), using the Aqueduct Negratín-Almanzora (iii), whose abstraction point is in the Upper Guadalquivir. However, there was only one agent, i.e. the company *Aguas del Almanzora*, which acted as buyer and seller at the same time. To reduce the environmental and third-party impacts a volumetric tax of 50% was enacted, which implied that the contractor was given permission to transfer only 50% of the water rights attached to the land purchased.

Aguas del Almanzora also established five-year water lease agreements with farmers in the Middle Almanzora Valley (*Pago de la Vega del Serón* irrigation district) with concessions from the Negratín reservoir (Guadalquivir basin) at prices in the range of 0.15–0.18 €/m^3.

A common element in both across-basins exchanges is the fact that the MARM (Spanish Ministry of Environment) decided to exempt the exchanging parties from paying the fees applicable to all regular aqueduct beneficiaries, on the grounds that there was an extreme drought situation in which these exchanges took place. In the case of the inter-basin Tagus-Segura Aqueduct the fees ranged from 0.15 €/m^3 for irrigators to 0.21 €/m^3 for water agencies supplying municipalities in the recipient region.

3 CONCLUSIONS

More than twenty different experts and stakeholders were consulted in the course of two meetings during 2011. All consulted experts were knowledgeable of the market experiences reviewed earlier in depth, directly or indirectly. A wide consensus exists among them about water markets (WMs) being considered an interesting tool to help water allocation in Spain. They agreed on considering WMs as having a great potential in solving critical situations related to water scarcity and drought. However, most consulted stakeholders found several weaknesses or problems in the current Spanish WMs system. The lack of transparency has been identified as one of the main challenges of water management in Spain (see Chapter 17). There is hardly any public information about who uses the water and for what, or what are the potential benefits and externalities. The lack of information is exacerbated in a context of liberalized water reforms. In the absence of robust water governance and effective surveillance, it is very unlikely that WMs will be efficient and socially accepted.

Other important issues that were identified as critical were:

- The need for more flexibility in the priorities criterions used to allocate water as established in the Law or in the Water planning documents.
- The need for national legislation to clarify the conditions under which those exchanges that involve more than one region could be made. The existing legislation should

clarify aspects such as the spatial and temporal restrictions to trading or the criteria for the approval or rejection of water exchanges by the Water Authorities. Also, the integration of water trading in the process of hydrological planning would be desirable.
- Water prices were too high because sellers had in most cases a dominant position. So there should be more transparency in price-setting.
- Public Exchange Centres (Water Banks) have been mainly used in Spain to solve environmental problems related to the overexploitation of water bodies in different basins. They should have a more active role in pursuing other formats of market exchanges.
- There are only a few documented experiences of formal lease contracts between right holders. Trading has been concentrated in the southeastern part of Spain with limited numbers of participants. In general, the participation of individual right holders has been limited while the participation of governmental bodies or public water agencies as buyers has been the rule rather than the exception. Moreover, in general terms, there were not enough bidders to cover the entire budget when a public water exchange centre was established.
- During the 2005–2008 drought period, the Spanish Government permitted inter-basin market exchanges using the pre-existing water infrastructures. The role of the central government was instrumental in facilitating exchanges across basins, but new regulations are needed to review and process them in a more transparent and expedient way.

One example of water market reform came in 2010 with Andalucía's new Water Law, after this region assumed almost all competencies in terms of water management in its territory in 2007. Although constrained by the National Water Law, the Andalusian Water Law established some changes related to the water management with the WFD criteria. One of the main differences with the National Water Law is the change in the priority system. Now, irrigation is on the same level as other users such as industries (for example, thermo-solar plants), so exchanges between these two uses are allowed. When allocating water, economic and environmental efficiency, third party effects and other aspects will be taken into account. As many stakeholders believe that the priorities system should be more flexible, the change in the Andalusian Water Law could serve as a precedent.

REFERENCES

Ariño, G. & Sastre, M. (2009). Water sector regulation and liberalization. In: Garrido, A. & Llamas, M.R. (eds.), *Water Policy in Spain*. CRC Press, Taylor & Francis, Leiden: 95–106.

Calatrava, J. & Gómez-Ramos, A. (2009). El papel de los mercados de agua como instrumento de asignación de recursos hídricos en el regadío español [The role of water markets as an allocative instrument of water resources in Spanish irrigation sector]. In: Gómez-Limón, J.A.; Calatrava, J.; Garrido, A.; Sáez, F.J. & Xabadia, A. (eds.), *La economía del agua de riego en España* [The economics of irrigation water in Spain]. Fundación Cajamar, Almería, Spain: 295–319.

CHJ (Confederación Hidrográfica del Júcar) (2010). *Memoria 2004/2009* [Report 2004/2009]. Confederación Hidrográfica del Júcar [Jucar River Basin Authority].

Corominas, J. (2011). *Aplicación a los regadíos del Guadalquivir del intercambio de derechos del agua en situaciones de dotación restringida*. [Lecture]. Botín Foundation Seminar on Water Markets in Spain. June 2011, Madrid, Spain.

Easter, K.W.; Rosegrant, M.W. & Dinar, A. (1998). *Markets for Water: Potential and Performance*. Kluwer Academic Publishers.

EC (European Commission) (2011). Third Follow up Report to the Communication on water scarcity and droughts in the European Union. COM (2004) 414 final. Available from: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0133:FIN:EN:PDF [Accessed 28th May 2011].

Embid Irujo, A. (2010). The foundations and principles of modern water law. In: Garrido A. & Llamas, M.R. (eds.), *Water Policy in Spain*. CRC Press, Taylor & Francis, Leiden: 109–116.

Garrido, A. & Calatrava, J. (2009). Trends in water pricing and markets. In: Garrido, A. & Llamas, M.R. (eds.), *Water Policy in Spain*. CRC Press, Taylor & Francis, Leiden: 129–142.

Llamas, M.R.; Fornés, J.M.; Hernández-Mora, N. & Martínez Cortina, L. (2001). Aguas subterráneas: retos y oportunidades [Groundwater: challenges and opportunities]. Botín Foundation and Mundi-Prensa. Madrid, Spain.

WWF (2005). *Los mercados de aguas y la conservación del medio ambiente: Oportunidades y retos para su implantación en España* [Water markets and environmental conservation: Implementation opportunities and challenges in Spain]. WWF. Available from: http://assets.wwfspain.panda.org/downloads/posicion_wwf_sobre_mercados_de_aguas.pdf [Accessed 14th May 2011].