

Reforming water resource management to facilitate trade and investment

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Abstract

Climate change, population growth and tougher environmental standards are long-term challenges facing the water sector in Europe. In this context it is important to have an adaptable water resource management regime that facilitates investment (in storages and interconnections) and leads to more efficient water use across all sectors.

The Water Framework Directive (WFD) encourages river basin planning and therefore facilitates an integrated approach to water resource management. Nevertheless the prospect of increasing, but uncertain, pressure from climate change will increase water scarcity in some areas. This will raise the importance of enabling water to move between users to those who value it most.

In the face of uncertainty market based approaches perform better than administrative approaches because of their inherent adaptability. This paper therefore explores how water trading and associated reforms to water rights could help Europe better meet the future challenge of climate change.

Keywords: Water rights, trading, water scarcity

JEL code: Q560

Impact of climate change on Europe's water resources

Climate change is likely to have a material impact on Europe's water resources. Modelling suggests that rainfall patterns will shift significantly both seasonally and regionally by the end of the 21st century.¹

In Southern and Eastern Europe, which are already dry, summer rainfall may continue to decline. This simultaneously reduces water availability and increases demand making droughts far more likely. While water can be stored to address this problem, the amount that can be carried over between seasons is limited by the size of existing water storages and reservoirs.

Climate change scenarios also suggest that winters will become wetter in Northern Europe. This will increase the risk of flooding as wastewater and drainage networks face increases in peak loads.

Any reduction in supply will have implications for other industries. Agriculture in Southern Europe will be particularly affected. But there will also be impacts on the transport and energy sectors. For example, a fall in river levels may impact on the loads that can be transported via barges. Also, river water used to cool power plants may no longer be available in adequate volumes.

Drinking water quality could also be negatively impacted due to frequent low water levels and a drop in the water table.

¹ European Environment Agency (2007), "Climate change and water adaptation issues", EEA Technical report No 2/2007, ISSN 1725-2237

The challenges for water resource management

We see three key challenges for water resource management that arise from climate change.

First, if there is a significant reduction in the amount of water available in groundwater and river basins this will have an impact on the environment. That is unless there is a mechanism for reducing abstractions. A key challenge for water resource management will be how to strike the right balance between the needs of the environment and users. The Water Framework Directive (WFD) set targets for member states associated with protecting the water eco-system but it does not mandate how best to implement any reductions in use that may be necessary in order to meet these targets.

Second, when water becomes scarce, and increasing supply is expensive, it will become more important to ensure available supplies are used and shared in the most efficient way. Achieving this involves ensuring water is allocated to its highest value use. Otherwise if existing water users are not those who generate the most value from the available water, then society as a whole will not be getting the maximum benefit.

Third, as a consequence of climate change existing infrastructure may become unfit for purpose. As a result, adapting to climate change will require increased investment and innovation in water, drainage and wastewater related infrastructure in order to reduce demand or increase supply. To be effective in addressing these key challenges water resource management approaches will need to be:

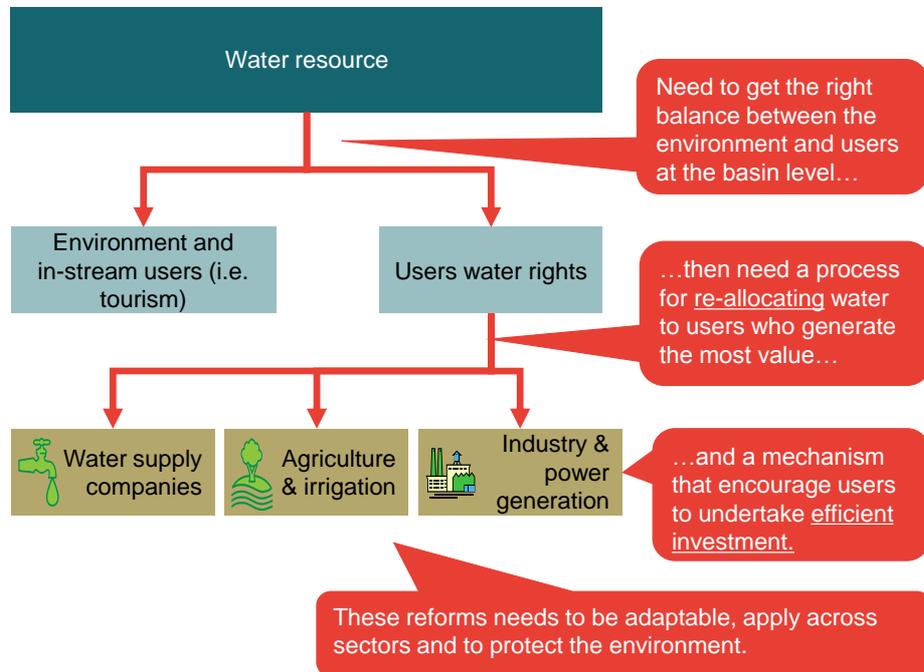
- **Adaptable.** The impacts of climate change are uncertain. This means the most efficient use of water and the most cost-effective investment will vary depending

on the impact on water resources. Therefore, to be any policy response in this area, needs to be adaptable and flexible.

- **Cross-sectoral.** A cross-sectoral approach is also essential. In any region the most efficient means of reducing water use, or increasing supply, may be through operational change or investment in agriculture, electricity production or in the public water supply sector. Therefore, any policy response needs to apply to all relevant sectors.
- **Focussed on the environment.** The role of water resource management includes protecting the environment and other in-stream users. The environment needs to be provided with sufficient water, of sufficient quality, to sustain the resources' ecosystem within the year and in the longer term in the face of climate and demand pressures. In addition any impacts from water abstraction and use need to be managed.

Figure 1 below illustrates these challenges for water resource management.

Figure 1. Challenges for water resource management in the face of climate change



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How can water trading help?

Water trading can help address two of the three key challenges described above. It can help facilitate the efficient allocation of water and incentives efficient investment.

Facilitating the efficient allocation of water

As highlighted above any increase in water scarcity raises the importance of enabling water to move, between users, to those who value it most. In the absence of such a mechanism economic activity will be constrained and the cost of securing supplies will rise.

The WFD does not touch on the issue of water rights. Neither does it consider process for moving water and water rights between users. The water resource management

framework in many European countries was not designed, or intended to be used, as a way of allocating available water resources². However with increased water scarcity allocation mechanisms becomes more important.

The efficient reallocation of water rights could be achieved through the development of water markets and trading. This involves users buying or selling water and/or water rights from each other. If one party's willingness to pay for water is higher than another party's, the latter will benefit from selling water (or water rights) to the former (see text box below).

Trade is an effective mechanism for re-allocating water to those who value it most.

- **It ensures water resources are put to their best use.** Trading and markets helps reveals a price for water and water rights. If supply is fixed, inefficient or low value users will be encouraged to release water which will enable high value (and potentially more efficient) users to gain access to it.
- **It helps with adaptation to changing circumstances.** For example, trade can reallocate water in response to both long term reductions in available supply and short term droughts. This means if users' water rights are reduced, in order to protect the environment, trade will provide users with a mechanism for managing this risk. It can also take account of any changes in users' valuations that result from changes in technology or the value of their outputs. For example, an increase in the price of an agricultural commodity would increase the value attached to the water used to produce it. These users will then be less likely to sell and more likely to buy water in the market and as a result more water will move to these users. Compare this to an administrative approach where the

² See for example the UK Environment Agency report "*Alternative ways to allocate water, Final report*"

responsible agency takes back rights and re-issues (or auction) these. To adapt to changes in users' valuations the administrative approach would need to be regularly repeated.

- **It leads to the efficient use of, and investment in water and supply related infrastructure** by revealing the true value of water and protecting existing users' rights. The importance of this is further considered in the following section.

Water markets which involve all water rights holders are currently being considered in the UK and experience from other countries suggests that water and water rights trading can work.

What do water markets look like?

Users' water valuations will differ based on how they use the water and their location. As a result water markets are likely to be geographically limited, unless there is an interconnected water grid.

Markets can involve the trade of treated or untreated water on either a temporary or permanent basis.

- **Temporary water trade or short term leases of water rights** — A short term market in water provides users with operational flexibility as it enables them to respond to changing seasonal conditions. In the short run, some users may be able to change their water use by changing their output which enables other users to take advantage of this. For example, during the 2007/08 droughts in Australia, horticulturalists bought significant volumes of water from dairy producers, who were more able to reduce their water consumption in the short term.³
- **Trading of water rights or long term leases** — In the long term, users are able to adapt their operations and change their demand for water. For example, an agricultural producer could invest to improve their water use efficiency in order to free up water rights for sale. A water rights market also enables users to secure longer run access to water. In this way the market facilitates a decision to enter or expand operation or exit. This works in much the same way as carbon credits being traded in the EU emissions trading scheme.

Facilitating efficient investment

A water market can lead to the efficient use of, and investment in water and supply related infrastructure for two key reasons.

First, users will be incentivised to invest or innovate where it is efficient by either saving, producing or transporting water up to the point where there are buyers are willing to pay for the additional costs of this investment.

³ “The impacts of water trading in the Southern Murray Darling basin – an economic social and environmental assessment” – Australian government, national water commission, 2010

For example, an agricultural producer could reduce inefficiencies in their irrigation system (by installing a dripper system or improving their watering schedule) in order to generate surplus water or rights that could then be sold on the market.

Similarly, a public water supply business could build an interconnection between two geographically distinct networks in order to take advantage of any spread in water valuations across the regions. This would result in water being sourced from where it is most cheaply supplied. By revealing the value of water across regions, efficient interconnections will be encouraged. More generally a water market will encourage efficient investment and discourage inefficient investment whether this involves reducing demand or increasing supply.

Second, by protecting existing users' rights when compared to an administrative approach investment in long life assets will be encouraged. Users who are certain that their rights will not be subject to *ex post* appropriation will be more likely to invest in long life assets that rely on the water right holding in question.

For example an agricultural producer may consider replacing a channel irrigation system with a pumped and piped network in order to reduce its water consumption and sell this water on the market. However, if instead water rights are subject to a regular administrative process whereby the responsible agency takes back rights and re-issues (or auctions) these to higher value users this investment would be discouraged.

International experience with trade

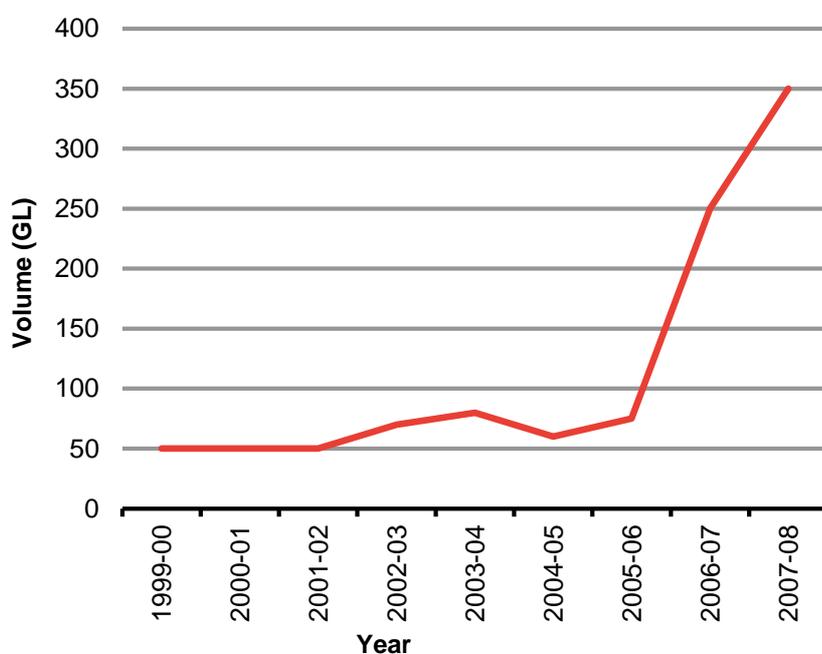
Some water trading already occurs in Europe including in Spain and the UK. More significant trading occurs in Australia, Chile and the Western United States. Taken together the experiences of these countries shows that over time, market participants

have used both water and water rights trading to adapt to changes in the environment and the industry. Their experiences also show that the scope for water trading will vary based on the following key factors.

- **The extent of water scarcity.** An explicit cap on water availability increases the importance of trade as a means to access water. In Australia, trade accelerated from the time water abstraction was capped.
- **Heterogeneity of users.** Variations in users' water valuations will drive trade. In particular trading appears to be more prominent where there are significant agriculture users. Agricultural users' water valuations appear to be more heterogeneous as they vary based on the commodity being produced, the efficiency of the user, the area and climatic conditions where they are located.
- **Extent of interconnection.** Interconnections increase the size of markets. Water trading in Australia is dominated by trade in the Murray Darling Basin. The size and extent of interconnection in this basin has created the potential for some very large water markets. This increases the potential for trade. However, it is important to note that there is a two way relationship between markets and interconnection. Significant differences in water valuations across areas will drive investment in interconnections.
- **Government commitment to water markets and streamlined approval and transfer processes.** Countries with well-developed water markets tend to have gone through a process of legislative reform to facilitate trade. For example, Australia and Chile both acted to improve the completeness of their water rights and registries. Also both the US and Australia have streamlined approvals for standard well-known trade types.

International experience also shows that trade levels tend to increase over time. Following the capping of licences, a lengthy drought, and reforms to the water rights regime, water rights trading in Australia’s major basin grew by around 600% from 1999/00 to 2007/08 (see **Figure 2** below). Now the market has a value of over 1.68 billion Australian dollars, and in 2007-08 approximately 20% of total water use in Australia’s major basin was traded.⁴

Figure 2. Growth in the trade of water rights in Australia’s Southern Murray Darling Basin from 1999/00 to 2007/08



Source: volumes approximated from figure 13 (Chapter 4) in the National Water Commission, (2010) “Impacts of water trading in the Southern Murray Darling Basin”.

A report by Frontier Economics Australia, has indicated that Australian water trading arrangements have improved water use efficiency; allowed agricultural producers to improve their management of the risks associated with highly variable supply;

⁴ National Water Commission (2008), “Australian Water Markets Report 2008-2009”.

facilitated the restructuring of the irrigation industry; and enabled new developments to augment supply.⁵ Most importantly, these arrangements reduced the economic impact of the recent drought, the worst in Australia's history.

The theory and international experience suggest that water resource management reforms that seek to improve water trading arrangements are likely to be beneficial.

Addressing the identified barriers to trade

In the UK some trading and leasing of water rights already takes place, although it is relatively limited. This has led regulators to investigate whether there are any administrative barriers which could be constraining markets⁶. Of the barriers identified we consider the following to be of more general relevance.

- **Lack of a visible market.** It can be difficult for users to identify potential trading partners. Also they may be unable to estimate the value in trading as there are no visible price signals.
- **High and uncertain transaction costs and approval processes.** The approval process, unless clearly described, can be costly to participants as it may require expert assistance and take a significant period of time (quoted timeframes in the UK range from 6 to 18 months). Furthermore, the outcomes of the process could be uncertain because of legislative arrangement designed to protect the environment. For example the UK Environment Agency can reduce rights at the

⁵ Frontier Economics et al (2007), "The economic and social impact of water trading" Report for the Rural Industries Research and Development Corporation, National Water Commission and Murray-Darling Basin Commission.

⁶ Ofwat & Environment Agency, (2008) *Exploring views on the potential for more active water rights trading*. Although not described in the list below there are also disincentives within the regulatory regime, which arises from the regulatory treatment of sales revenues and purchase costs. These decreases the gains from trade regulated companies get to keep.

point of trade. This may discourage sellers from coming forward and make many potential participants unwilling to commit resources to it.

- **General uncertainty about future water rights.** Uncertainty about future water availability and the government policies relating to water rights encourages a conservative approach and users are more likely to hold on to their water rights.

Water resource management reforms focussed on addressing these barriers to trade could facilitate the development of the water market. This would allow trade to develop where it is efficient.

Increasing the visibility of the market

To estimate the benefit from trade, potential participants need to understand:

- if, and where, there may be water rights available for trade;
- the nature of, and condition associated with the rights; and
- the likely selling/buying price.

The visibility of the water market could be increased by governments developing a platform for publishing buy and sell offers. This would help users to identify potential trading partners and therefore facilitate the development of a market.

In addition publishing traded prices would assist users to identify the benefit they may get from entering into a trade. While markets are small this may require traded prices to be identified at a regional level so that individual buyers and sellers cannot be explicitly identified.

Reducing transaction costs and simplifying the approval process

A trading approval process is necessary to manage the potential impacts of water trading on the environment and other water users. For example, moving an abstraction point upstream as a result of trade could reduce the in-stream flow between the new and old abstraction points.

Transaction costs can be reduced through a streamlined approval process. Doing this without impacting on the effectiveness of the process requires the development of explicit trading rules. When compared to a case-by-case approval process explicit, upfront rules for different types of trade would create a more streamlined system. International experience suggests this can be helpful particularly as trading volumes increase.

Explicit, *ex ante* trading rules would help users understand the likelihood of approval, the terms that would apply and to assess the likely benefits of trade in advance.

So what might a system of trading rules look like?

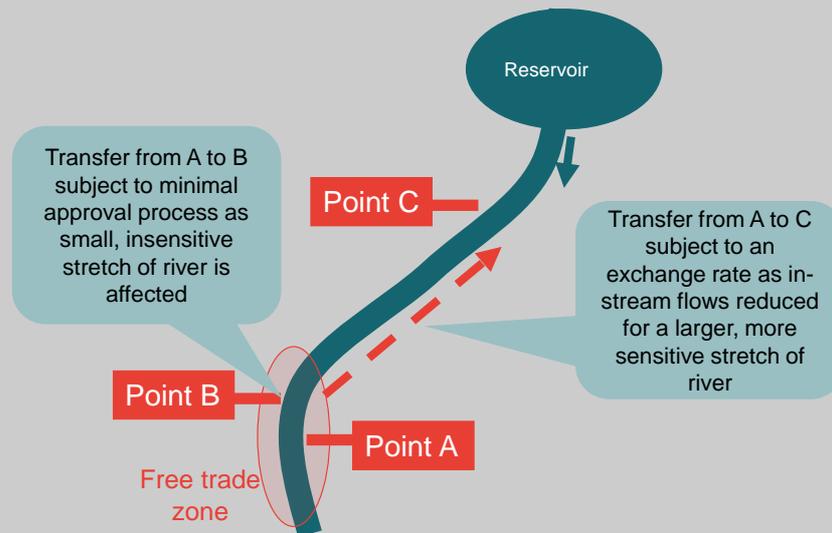
Simple trades with no change of use or abstraction point, or within agreed trading zones, could be pre-approved and subject only to a registration process. More complex trades would be governed by rules which set out terms by which licences would be adjusted in order to take account of any impact on the environment and other water users. These could include the following.

- Generic exchange rates (or a fixed methodology for estimating exchange rates). These could be applied to the traded volume to account for any increase or decrease in the water returned to the environment as a result of a change in use. Or when a trade significantly changes river flow regimes
- Trading zones, within which trade is unconstrained, and outside of which restrictions apply. For example, upstream trades outside of the pre-specified zone could be subject to an exchange rate adjustment which takes account of any

negative impact on in-stream flows (see **Figure 3** below).

While there might still be trades that demanded a case-by-case investigation, there would be clear, predictable rules to govern the majority of trades, reduce risk and uncertainty and encourage people to enter the market.

Figure 3. Example of how exchange rates and trading zone could be applied



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Creating well defined water rights

Government policies for addressing unsustainable abstraction levels or protecting the environment are often implemented in a way that means that water rights holders face significant policy uncertainty about the extent to which their rights may be subject to future reviews.

Secure, well defined property rights are essential to support the development of an efficient water markets. Furthermore, well-defined water rights (and the means to trade these rights) facilitate investment by increasing certainty. Investment in alternative supply sources is encouraged when suppliers can easily compare and value the price of their product. Analysis of arrangements in Australia has highlighted that reforms to water abstraction rights had provided certainty and security of access;

factors that are crucial in ensuring there are no barriers to investment in new and alternative sources of urban water supply⁷.

In Australia, Chile and the western US water rights more closely resemble private property rights. While they are not necessarily absolute in terms of quantity they are typically granted in perpetuity (although defined processes for reviewing rights typically exist). **Table 1** outlines the key characteristics of water rights, that are necessary to provide certainty for water users, which are commonly highlighted in economic literature.

⁷ Frontier Economics (2008), “Review of urban water entitlements in Australia: a report prepared for the Joint Steering Committee for Water Sensitive Cities (JSCWSC)” & “Urban water markets: a final report for the Joint Steering Committee for Water Sensitive Cities (JSCWSC)”, December 2008.

Table 1. Key characteristics of water rights

Clearly-specified	Owners and potential holders of water rights understand exactly what benefits and obligations the right brings.
Secure	The right is not subject to modifications or revocation at the discretion of others without due compensation.
Exclusive	The direct benefits and the costs associated with the use of the rights accrue to the holder.
Enforceable and enforced	It must be possible to determine when a right has been infringed and to have legal mechanisms for preventing or redressing this.
Transferability and divisibility	The right can be traded in whole or in part to others and is defined in a consistent manner. These are often listed as key characteristics for water rights in order to facilitate the development of water markets.

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In specifying rights for water, the challenge is applying these principles to a resource where the availability can vary from year to year. First, the total volume of water available in any unit of time will vary as a result of seasonal, annual and inter-annual rainfall variations, as well as climate change. Second, the relative water needs of the environment may vary over time due to changes in environmental standards.

In this context **clearly-specified** water rights are those that provide holders with certainty around the risks they face or that define the level of reliability attached to the rights.

For a water right to be **secure** it must not be subject to modifications or revocation at the discretion of others without due compensation. This means that users need to understand *ex ante*, the specific circumstances when the water available under their right can be altered in response to a change in water availability or environmental

standards; and the circumstances where compensation will be provided. Setting these terms out in advance removes the risk of rights being arbitrarily infringed. This enables rights holders to clarify their supply risk and given them the certainty on which they can invest and improve their efficiency of water use over time.

In any market, participants look for clarity over exactly what it is that they are trading. Time-limiting licences, or enabling their reallocation at the discretion of a government agency, is likely to discourage market participation.

Conclusions

With the potential for climate change to impact on rainfall patterns across Europe it will become more important to have adaptable water resource management regimes that:

- facilitate the efficient use of water and efficient investment in water related infrastructure; and
- lead to a more efficient allocation of water across sectors.

In the face of uncertainty market based approaches perform better than administrative approaches because of their inherent adaptability. Water markets which involve all water rights holders buying or selling water and/or rights from each other are currently being considered in the UK. And experience from Australia and the Western US suggests that water and rights trading can work.

Water trading can lead to a more efficient allocation of water rights. If one party's willingness to pay for water is higher than another party's, the latter will benefit from selling water (or water rights) to the former. A water market also leads to the efficient use of, and investment in water and supply related infrastructure.

- Users will be incentivised to invest or innovate where it is efficient by either saving, producing or transporting water up to the point where there are buyers are willing to pay for the additional costs of this investment.
- By protecting existing users' rights when compared to an administrative approach, investment in long life assets will be encouraged.

Given the benefits of trade water resource management reforms that seek to improve existing water trading arrangements could be beneficial. These reforms should focus on addressing common administrative barriers to trade in order to facilitate the development of the water market where it is efficient. This would involve:

- increasing the visibility of the market by developing trading platforms and publishing trading data;
- reducing transaction costs and simplifying the approval process through the development of explicit trading rules; and
- creating well defined water rights where holders understand *ex ante* the level of supply reliability attached to the rights and the specific circumstances when the water available under their right can be altered in response to any drought.