Abolishing the NHP's Water Diversions: a Turning Point for Water Management in Spain

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The ongoing debate in Spain about the National Hydrological Plan (NHP) has accelerated the crisis of the *structuralist* model, which has been the ruling model since the beginning of the twentieth century. The civic, scientific and technical movement in favour of the *New Water Culture* which has arisen over the last decade has, in practice, assumed a certain leadership in Mediterranean Europe as regards a similar debate which took place in the arid and semi-arid states of the western USA at the end of the 1960, and which matured in the 1970s and was concluded in the 1980s. In that case, the presidential veto of the *Hit List* blocked a final wave of major projects, which included massive water transfers over a distance of 2,000 kilometres, from the state of Washington to Los Angeles. The dominance of *hydraulic structuralism* based on the traditional supply-side strategies, and massive public subsidies, together with the development model prevailing on the Spanish Mediterranean coast and the scarcity of reasonable spatial planning plans, meant that the limits of sustainability of the Mediterranean river and aquifer ecosystems were exceeded. Instead of accepting this diagnosis of the sustainability problem, the previous government based the NHP on the so-called *structural deficit* of some basins, in contrast with the claimed *excess* in others, which resulted in the promotion of water transfers as a solution to this so-called *hydrological imbalance.*

Such concepts and diagnoses, similar to those which formed the basis of the strategies abandoned in the USA in the 1980s, continue, nonetheless, to be current in most of Mediterranean Europe and in the arid and semi-arid developing countries. Today in the EU, the North American experience which made it possible to develop the supply-side strategies into new strategies of *demand management and of conservation of* ecosystems, may be useful in guiding the implementation of the Water Framework Directive (WFD) in the Mediterranean area.

The change in direction regarding water management advocated by the new Spanish Government entails a turning point similar to that which the veto of the *Hit List* entailed in the USA (Arrojo et al-1997). This change in direction, at the moment, has focused on getting rid of the planned water transfers and on prioritising the modern desalination technologies. Such changes, in themselves, do not alter the diagnosis of the *structural deficit,* established in the NHP, nor do they change the consistency of the Plan's *supply-side* strategies; however, their value should not be underestimated. Doubtless, the pressure of cultural and political inertia in relation to water explains the new government's indecision at a time when it is being called upon to adopt a more consistent position, to acknowledge the *unsustainability* to the demands imposed by the development model currently in force and to definitively prioritise *demand management* strategies to re-establish a situation based on economic rationality and sustainability, consistent with the WFD. In fact, the current debate continues to focus on the application of the new desalination techniques, which the government is proposing as an alternative to the water transfer strategies. In spite of this, the debate is significant in terms of the expected progress of implementation of the WFD, which we must achieve over the next few years.

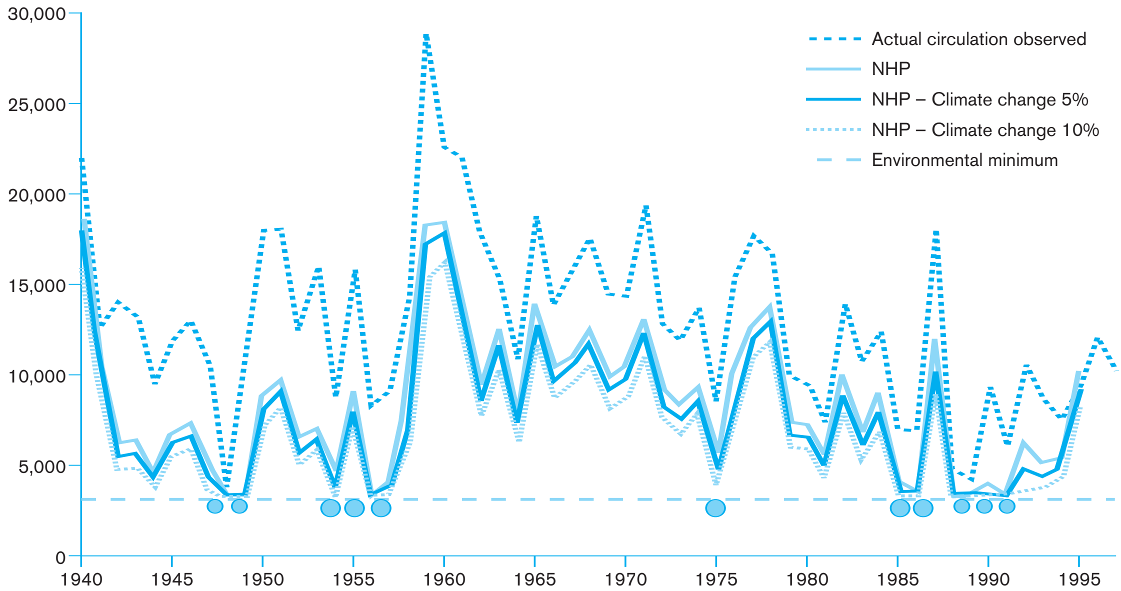
The Key Distinctions between Water Transfers and Desalination

The membrane technologies applied to reverse osmosis and nanofiltration have matured rapidly over the last two decades, reducing energy and economic costs. We will examine the contrasts between the two alternatives by analysing the following elements: quality of resources, guaranteed availability of resources, flexibility and adaptability of the strategies and the energy, economic and financial balances.

The Quality of Resources

In the NHP, the quality of the water that can be diverted is relegated to a second place. The fact that the water of the Lower Ebro now has an average salinity of 1 200 µS/cm (apart from other pollution problems), is never perceived as a problem. The European Commission's insistence on this matter even led the government to acknowledge officially (although not publicly) that if the new irrigation planned for the Ebro Basin was completed, the salinity would increase and would exceed 1 500 µS/cm (FNCA-2002). It should be noted that the EU sets a maximum recommended salinity for drinking water of 1000 µS/cm, which would require salinity reduction processes for urban uses, but these were never taken into consideration. With regard to water desalinated by reverse osmosis, its conductivity may be around 400 µS/cm. In this way, as well as improving the quality of water

GRAPHIC 17 **Expected water flows in Tortosa on the basis of the volumes between 1940 and 1995**



Source: (MIMAM-2000) Analysis of the hydraulic systems in the NHP – p. 155.

supply, extremely significant indirect advantages are obtained (lower cost of making water drinkable, better reuse, saving on detergents, longer useful life for domestic electrical appliances, meters and equipment, etc.

Guaranteed Availability of Resources

In graphic 17, an original from the NHP, the profile of expected water flows in Tortosa is shown, based on the last 50 years, with a recession of 10% for climate change. As can be seen, even assuming only the 3,000 hm^3 fixed by the NHP as minimum environmental water flows for the delta, in eleven of the 55 years there would be no water flows available for transfer, which implies a significant technical inefficiency factor which would increase the cost per cubic metre of water actually available and divertible (Arrojo-2003). On the other hand, with regard to marine desalination, there is an almost 100% guarantee of availability.

The Flexibility and Ability of the Strategies to Develop

The uncertainties derive not only from climate change. Future domestic demands are extremely uncertain. The development of tourism, birth rates, migration flows, irrigation demands, the development of the agricultural markets in the context of liberalisation, among others, make expectations particularly uncertain in the Mediterranean region.

Given these prospects, it is vital that the options should be flexible and adaptable. The structuralist strategies suffer from serious inflexibility problems. In the planned water diversions, 50% of capacity was destined for urban demand that will be growing over the coming decades. Therefore, during these initial decades infrastructure should have been amortised using demand at much lower levels than the amounts given in the water diversion, increasing unit costs by approximately 26%. This rigidity would have been, most likely, exacerbated by the traditional tendency to over-inflate the size of the project.

Desalination allows a significant margin for flexibility in production. An appropriate design can be drawn up which avoids bottlenecks – seawater pumping capacity, backup lines, membrane racks – so that at crucial times there can be a switch to an emergency system. Conversely, the adaptability of desalination makes it possible to gear supply better to actual demand, in terms of time and space, avoiding over-supply and facilitating the allocation of costs to the real user in each area.

The Energy Cost

On the basis of the data available in the annexes to the *Economic Analysis of the NHP* volume, table 21 shows the energy balance of pumping and turbines in the various sections of the water diversion (Valero et al-2001).

As we can see, the energy required to bring one cubic metre to Almería (leaving out of consideration the recoverable energy in descending sections) amounts to over 4 kwh/m^3, the equivalent of pumping volumes from a depth of some 1,200 m.

Today, desalination through reverse osmosis, applying the latest techniques for recovering the residual energy from the brine, requires less than 3.5 kwh/m^3. Current developments in *isobaric chambers* and the use of membranes which function at a lower pressure already herald energy requirements of less than 2.5 kwh/m^3.

Economic and Financial Balance

The *Economic Analysis* document (MIMAM-2000) annexed to the NHP claimed to prove that overall, the planned water diversions of the Ebro were profitable. This document suffered from serious errors, the most significant of which were:

TABLE 21 **Energetic Balance of the Ebro diversion**

SECTION	ORIGIN	DESTINATION	Gross head m	Height rate Kwh/m	Accumulated Kwh/m³
5	**Tous**	**Embalse**	144.0	0.577	2.114
		de Azorín	148.0	0.596	2.710
			148.0	**0.589**	**3.300**
5a	**Azorín**	**Antiplano**	175.0	0.693	3.992
6	Azorín	Emb. Mayés	-166.0	-0.383	2.916
6a	Mayés reservoir	Canal PMI	-164.0	-0.389	2.527
7	**Mayés reservoir**	**El Saltador**	116.0	0.462	3.378
		tunnel	41.0	0.173	3.551
8	**El Saltador tunnel**	**Aguadulce**	130.0	0.516	4.067
TOTAL	**LOWER EBRO**	**ALMERÍA**		**Average**	**2.893**
				Average	**3.172**
TOTAL	**LOWER EBRO**	**BARCELONA**		**Average**	**1.802**

a) energy costs were underestimated, as the government itself ended up by acknowledging, when it doubled its calculations three years later;
b) the costs of reducing the salinity of water for urban use were left out (0.2 €/m^3);
c) expected leaks in transport and storage were not taken into account (15%);
d) 22% of investment corresponded to plant which should be amortised over 15 years and not 50 years;
e) there was a failure to adopt a realistic timetable, with intercalated interest (Sahuquillo-2001) and amortisation based on the trends in actual demand and the predicted availability of water flows (FNCA-2002).

Correcting these errors causes the average cost estimates in the *Economic Analysis* document to be doubled.

With regard to the costs of desalination, the previous government fostered confusion by disseminating costs which were not up to date. Today, the large desalination plants are entering into contracts on international markets for less than €0.4/m^3. For this, they must take on costs in a range of €0.40-0.44/m^3, with a medium-term horizon which might approach the threshold of €0.35/m^3. These costs mean that desalination wins hands down against water diversion projects of over 400-500 kilometres.

In mid-2003, the previous government published the so-called *Study on utilisation of system and tariffs,* presenting the financial plan for the water diversions in which:

- 30% of financing would come from European non-refundable funds;
- 30% would come from state public funds without interest, to be paid back in 50 years; and
- 40% would be loans on the capital market at 4% interest.

It should be pointed out that the loan of 30% from state public capital was without interest and there was no plan to compensate even for inflation, with a single payment in 50 years. With regard to the 40% of private loans, the rate of 4% included inflation of 2%, leaving net interest of 2%. Obviously, terms such as these were only viable with a state guarantee, which would conceal another subsidy proportional to the risk of failure, which as we will see was very high.

These terms and other *creative accounting* devices resulted in a government amortisation cost of only €0.0405 /m^3, which implied a real subsidy of 60%. In spite of this, when adding the energy costs, the average cost came to €0.25/m^3. When basic errors, such as those pointed out above, are corrected, *the average costs to be paid by users would have amounted to approximately €0.43/m^3, while the costs in the more remote sections (Murcia-Almería), would have exceeded €0.5/m^3* (Arrojo et al. 2004).

In view of such high costs, the financial analysis by the previous government opted to obscure its own tariff calculations and ended up by deciding that the tariffs would only be negotiated with the users *once the investments had been made and the operational phase had started*.

On the basis of these data, and in view of the ability to pay and willingness to pay estimated by the government itself in the areas benefiting from the water diversion (€0.12/m^3 and €0.8/m^3, in the Júcar basin, €0.24/m^3 and €0.15/m^3 in Castellón, and €0.36/m^3 and €0.20/m^3 in Murcia-Almería) it is clear that this financial plan was destined for failure from the outset.

Viability and Priority of the Demand Management Strategies

In spite of the interest of the debate, focusing the issue on choosing between the water diversion option and desalination is a mistake, since desalination is not in most cases the cheapest alternative to water diversions. In so far as the majority of net benefits generated by the actual use of water in various productive activities (particularly in irrigation) are lower than desalination costs, it is clear that the *expediency value* of water in the various Mediterranean basins is, at the present time, lower than the cost of desalination. The regional valuation, basin to basin, of these *expediency values* (using the net benefits generated as the reference), has been set out in FNCA-2202-b. The curves obtained, integrated into the corresponding sections at the divertible volumes in each basin, result in the average values per basin set out in table 22 and a weighted average for the value of divertible flows of €0.14/m^3.

Seville provided a practical example of this during the drought at the beginning of the 1990s. After dramatic instances of hundreds of thousands of families having their water cut off, the problem was resolved by offering €0.04/m^3 to the farmers of the surrounding region, if they ceded their irrigation rights during the drought period.

In short, if we adopt a strictly economic rationale, before deciding on desalination of marine water, much cheaper options should be used, through appropriate demand management strategies (Arrojo-2003) (Albiac et al-2002).

TABLE 22 **Average expediency value of water in the Mediterranean basins**

	Júcar	Segura-Almería	Barcelona	Total
Hm^3	315	546	189	1,050
Average expediency value	0.04 €/m^3	0.19 €/m^3	0.18 €/m^3	0.14 €/m^3

Source: Arrojo-2003.

In order to do this, it would be necessary, on the one hand, to make the current system of allocating surface water more flexible and, on the other, to put an end to *mismanagement* of groundwater. The transfer of resources from less-profitable uses to more profitable ones, with appropriate economic compensation, would offer significant possibilities, particularly regarding management of drought periods.

The experience of the *Water Banks* in California (Arrojo et al-1997) offers interesting lessons in this respect, which should be studied and made use of in our country. The curves of the *expediency value* of water are reference points for the prices which such possible *Water Banks* could activate at basin level in periods of drought, under the control of the relevant hydrographic confederations.

The experience of the *Income Compensation Programme* for irrigators in the Mancha, where compensation is given for withdrawing land from irrigation or producing products which consume less water, offers us an example of *demand management* in action, even though clearly many improvements could be made, together with the emblematic cases of over-utilisation of aquifers in the wetlands of the National Park of las Tablas de Daimiel.

However, such *demand management* approaches will not be viable unless, first of all, an end is put to the ruling situation of *mismanagement*, which makes the systematic opening of new illegal wells possible, since this destroys the tension of scarcity which acts to make any kind of market (whether more or less regulated) efficient. Because of this situation of *mismanagement*, even the free markets in private groundwater are inefficient at present, in so far as this mismanagement punctures and destroys the tension in these *markets*.

By adopting these priorities, focusing on *demand management* strategies, would enable the new technologies of desalination, salt level reduction, regeneration and reuse to take their optimal places both now and in the future.