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# Études & documents
*Studies and documents*

# *Financing Water Resources Management in France (January 2012 update)*

ECONOMICS AND ASSESSMENT

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Ministère de l'Écologie, du Développement durable, des Transports et du Logement

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*This document is the update of the "Studies and Documents" No. 33, published in April 2011, which presented the report of a case study of the "financing water resources management in France" and which was conducted from December 2009 to May 2010 at the request of the Organization for Economic Cooperation and Development (OECD). Through numerous interviews with water operators, this updated version of January 2012 has refined its data, particularly expenses related to water in France, as well as national benefits of water resources management.*

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Director of publication: Dominique Dron

Authors: Olivier Bommelaer, Jérémy Devaux

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## Abstract

This update of January 2012 of a case study on « financing integrated water resources management in France » (produced in 2010 for OECD works) explores benefits of a policy targeting the good and sustainable ecological status of all water bodies. The infrastructure of domestic water supply has already been completed in France. Urban and industrial pollutions are more and more under control, and the new priority is to restore the ecological sustainability of water bodies. In big cities, water bills related to water supply and sanitation utilities are generally cheaper than European average, although they cover most of utilities costs and include basins consumption and pollution taxes. Water agencies have demonstrated the efficiency of financial solidarity at the watershed scale for treating point source pollutions and investing on water infrastructure. Navigation infrastructure is maintained through various taxes (gates taxes, hydraulic tax,...). Flood damages of private properties are financed through an insurance mechanism with a state guarantee, that feeds a public fund for flood prevention: the Barnier's fund. The scale of this fund has been consequently increased since 2008. Despite these achievements, the study shows that:

- This old system based on the "water pays for water" principle has been convenient for charging well identified pollutors such as industries and cities; but it has failed to charge other categories of pollutors specially in the case of diffuse pollutions. Complete cost-recovery of all water externalities on the water supply bills has reached the limits of social acceptability.

- The present system has put the emphasis on water quality and should move now to promoting and implementing a sustainable quantitative management of the water resource.

These new priorities have been identified in the water commitments of the "Grenelle" policy roadmap and should be reflected in the 9th and 10th Water agencies financial programs (2009-2021).

# Introduction

This case study on « financing integrated water resources management in France » has been produced following a template that had been defined by the secretariat of OECD to make sure that the focus would not be restricted to water supply and sanitation only – what the French would call the “smaller water cycle”- but enlarged to all water issues –the “larger water cycle”-.

Therefore the study is a first attempt to gather figures from various budgetary sources and cover many different fields, from managing the quantity of the resource in response to the water needs of all economical uses up to restoring the quality of all water ecosystems, without neglecting the financing of flood prevention and management. It identifies some limits of the existing financial systems in France, particularly concerning cost-recovery of farming pollutions.

# 1. Country context, policies and institutions

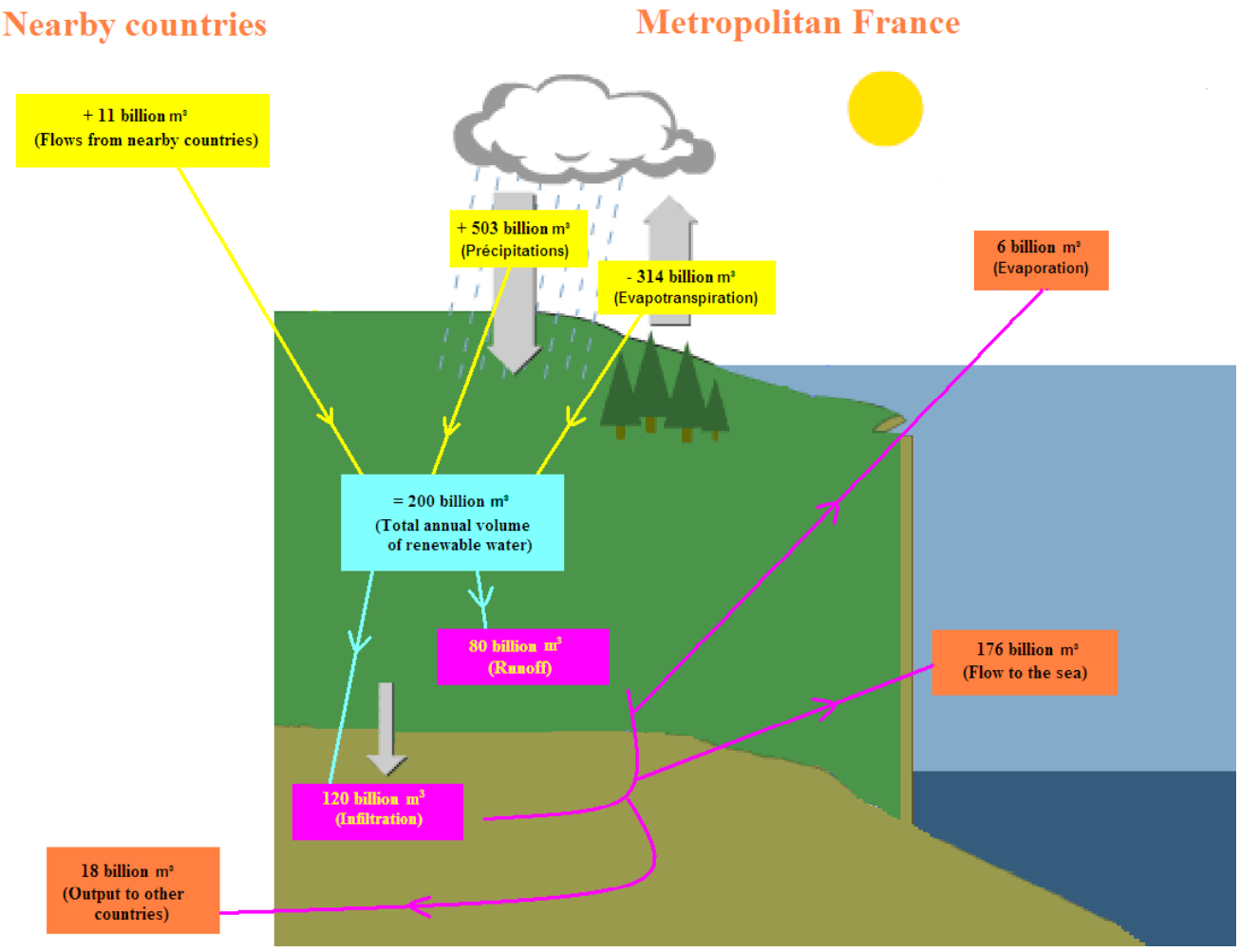
## 1.1. Brief overview of the French situation

### 1.1.1. Water in France

The total annual volume of renewable water reaches about 200 billion m³ in Metropolitan France. It corresponds to the rain input (503 billion m³) added to the flows coming from nearby countries (11 billion m³) and less the true evapotranspiration (314 billion m³): about 60% of rain water goes back into the atmosphere in the form of steam [1][1].

Out of the available 200 billion m³, 120 billion infiltrate into the soil and recharge groundwater (the stock of which is evaluated at 2,000 billion $m^3$) while 80 billion run towards rivers and stagnant water, whose volume is estimated at 108 billion $m^3$. France records an output of 18 billion $m^3$ towards its neighbouring countries (mainly the Rhone, the Rhine and the Meuse), which leaves a theoretical resource of 182 billion $m^3$, of which 176 billion $m^3$ flow out towards the sea and 6 billion $m^3$ evaporate.

**Figure 1 - Annual flow of the water cycle in France in 2001**




Source: CGDD/SEEIDD/ERNR2, according to Annual report 2010 of the State Council - The hydrosystem and its right [1]

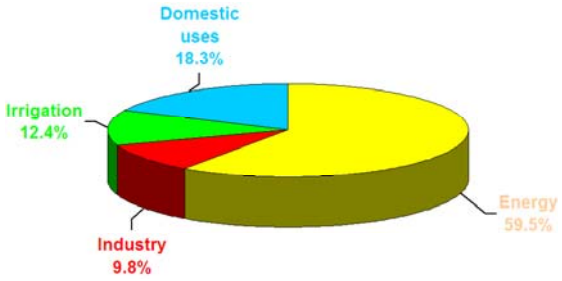
*Abstractions and consumptions of the main sectors of the economy and society*

- Abstractions

In 2007, the abstractions were estimated at 31.6 billion $m^3$. These abstractions are divided as follows: 18.81 billion $m^3$ (59.5%) for energy, 5.775 billion $m^3$ (18.3%) for domestic use, 3.923 billion $m^3$ (12.4% ) for irrigation and 3.108 billion $m^3$ (9.8%) for the industry.

[1] Throughout this case study, the numbers in brackets will refer to a reference identified in the bibliography of this report.

**Figure 2 - Abstractions of water resources in France in 2007 (in percentages)**




Source: Water agencies, SOeS, 2010

The abstractions have significantly declined in recent years since they were estimated at 34 billion $m^3$ in 2001. The following table and figure show the evolution of samples since 1994.

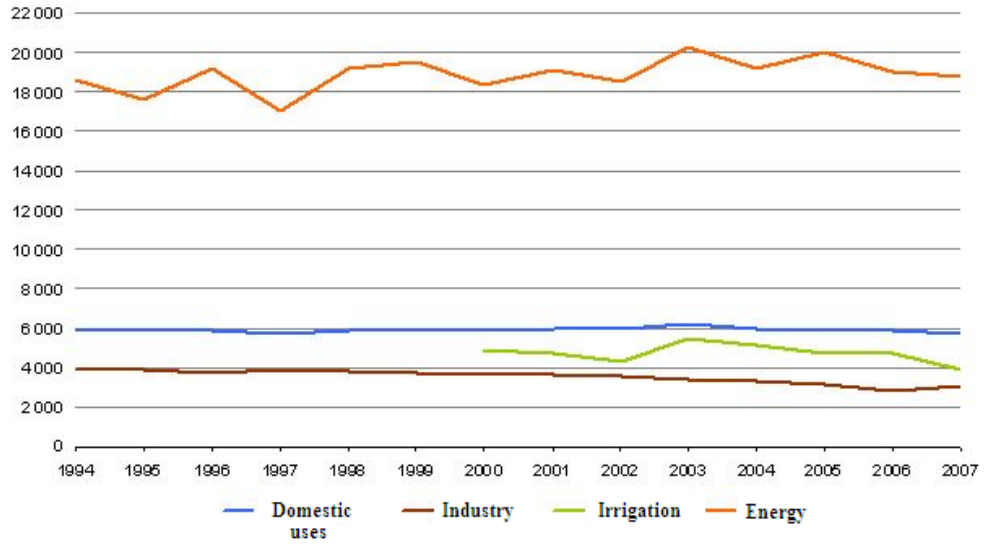
**Table 1 - Abstractions of water resources in France over the period 1994 – 2007 (in million $m^3$ and in percentages)**

| Year | Energy | | Domestic uses | | Irrigation | | Industry | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | 18,598 | - | 5,931 | - | - | - | 3,897 | - | - | - |
| 1995 | 17,613 | - | 5,985 | - | - | - | 3,879 | - | - | - |
| 1996 | 19,188 | - | 5,908 | - | - | - | 3,780 | - | - | - |
| 1997 | 17,068 | - | 5,702 | - | - | - | 3,889 | - | - | - |
| 1998 | 19,199 | - | 5,854 | - | - | - | 3,845 | - | - | - |
| 1999 | 19,498 | - | 5,865 | - | - | - | 3,717 | - | - | - |
| 2000 | 18,339 | 56.1% | 5,872 | 17.9% | 4,872 | 14.9% | 3,633 | 11.1% | 32,715 | 100% |
| 2001 | 19,142 | 57.1% | 5,966 | 17.8% | 4,768 | 14.2% | 3,650 | 10.9% | 33,526 | 100% |
| 2002 | 18,531 | 57.3% | 5,966 | 18.4% | 4,291 | 13.3% | 3,575 | 11.0% | 32,363 | 100% |
| 2003 | 20,278 | 57.3% | 6,200 | 17.5% | 5,517 | 15.6% | 3,402 | 9.6% | 35,397 | 100% |
| 2004 | 19,262 | 57.1% | 6,018 | 17.9% | 5,148 | 15.3% | 3,286 | 9.7% | 33,714 | 100% |
| 2005 | 20,059 | 59.2% | 5,915 | 17.5% | 4,695 | 13.9% | 3,202 | 9.4% | 33,871 | 100% |
| 2006 | 19,072 | 58.6% | 5,862 | 18.0% | 4,757 | 14.6% | 2,861 | 8.8% | 32,552 | 100% |
| 2007 | 18,810 | 59.5% | 5,775 | 18.3% | 3,923 | 12.4% | 3,108 | 9.8% | 31,615 | 100% |

Note : Volumes are estimated from reports of users with Water agencies for all uses except irrigation. For irrigation, the volume "flat" of the Water agencies were reassessed between 2000 and 2004 from the 2000 agricultural census and the portion of known volumes of meter readings. Before 2000, data are insufficient for this evaluation. Beyond 2004, the "flat" part reducing, recovery is no longer justified, even if the volumes reported are probably underestimates.

Source: Water agencies, SoeS, 2010

**Figure 3 - Evolution of abstractions by use (in million $m^3$)**




Source: Water agencies, SoeS, 2010

About 82% of the volumes of water were collected from surface waters (rivers, canals, lakes, reservoirs ...). But according to the uses and geographic areas, this distribution is highly variable. For domestic use, the use of groundwater is more common with nearly 63% of the volume are drawn from the ground. Generally better quality of this type of resource explains this choice. For cooling power generation plants, almost all of the volumes is taken from rivers (99.9%). For crop irrigation, nearly 80% of the abstractions that come from surface water. This difference is less pronounced in the industrial sector for which 59% of the volume are drawn from surface water.

**Table 2 - Origin of water collected by use in 2007 (in million $m^3$ and percentages)**

| | Energy | | Domestic uses | | Irrigation | | Industry | | All uses | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Surface waters** | 18,785 | 99.9% | 2,161 | 37% | 3,136 | 80% | 1,823 | 59% | 25,905 | 82% |
| **Groundwater** | 25 | 0.1% | 3,614 | 63% | 787 | 20% | 1,285 | 41% | 5,710 | 18% |
| **Total** | 18,810 | 100% | 5,775 | 100% | 3,923 | 100% | 3,108 | 100% | 31,615 | 100% |

Note: Metropolitan France, the volumes are estimated from reports of users with Water agencies for all uses including irrigation. For this purpose, the quantity is probably underestimated.

Source: Water agencies, SoeS, 2010

- Consumptions

With regard to consumption (water not returned to the environment after use), the proportions allocated to each category of use are different. If energy is the source of nearly 60% of abstractions, the net consumption is very low (about 7% of the volume that the sector takes). In contrast, crop irrigation takes only 12% of the total, but did return a very small part. The impact of withdrawals for irrigation is especially important that they take place mainly in surface water during low flow periods, that is to say when the level of being water is the lowest. Of the total volume of water consumed, the corresponding proportions for each use are as follows (2001 data):

**Table 3 - Consumption in an ordinary period by use (in million $m^3$ and percentages)**

| | Irrigation | | Domestic uses | | Energy | | Industry | | All uses | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Consumption** | 2,880 | 48% | 1,440 | 24% | 1,320 | 22% | 360 | 6% | 6,000 | 100% |

Source: Annual report 2010 of the State Council - The hydrosystem and its right [1]

**Table 4 - Summer consumption (summer peak) by use (in million $m^3$ and percentages)**

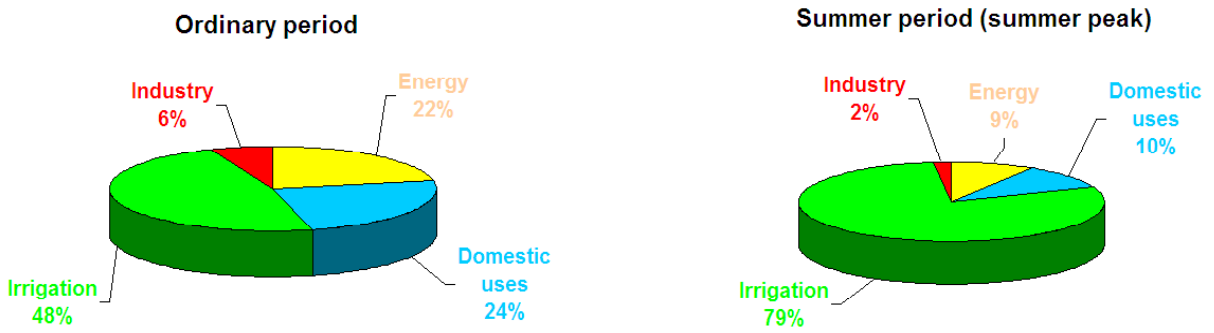
| | Irrigation | | Domestic uses | | Energy | | Industry | | All uses | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Consumption** | 4,740 | 79% | 600 | 10% | 540 | 9% | 120 | 2% | 6,000 | 100% |

Source: Annual report 2010 of the State Council - The hydrosystem and its right [1]

*N.B. 1: Abstractions and consumptions are to be compared to the figures given in the preceding paragraph which characterise the water cycle in Metropolitan France.*

*N.B. 2: These data have a limited reliability because some water uses are not well known and comprehended, especially those related to agriculture.*

**Figure 4 - Water consumption in France**




Source: Annual report 2010 of the State Council - The hydrosystem and its right [1]

*Stored water volumes*

Water management of reservoirs is of prime importance in the quantitative management of water resources. It allows regulating river flows and facing the periods of drought. In France, 10 billion $m^3$ are impounded, including 7.5 billion $m^3$ (75%) retained in dam reservoirs [2].

### 1.1.2. The 7 basic principles of water management in France

- **Decentralised management at the level of river basins:** the French water policy is defined and co-ordinated at the national level, and transposes the European Community water policy. But its implementation is organised in a decentralised way, at the level of the 7 large metropolitan river basins for integrated resource management - the "large water cycle" is spoken about - and at the municipal or inter-municipal level for drinking water supply and sanitation utilities - "small water cycle". The basin is the basic unit of water management which follows the geographical territory of the resource and not the administrative boundaries.

- **An integrated approach:** which aims at taking into account all the water uses, the needs of the aquatic ecosystems, the prevention of pollution and the control of natural and accidental hazards.

- **Organisation of dialogue and co-ordination of actions:** respectively by the Basin committee (compared to a "Water Parliament") and the Basin Co-ordinator Prefect for the large water cycle, and by the mayor or the municipal elected official, president of the inter-municipal syndicate, for the small water cycle.

- **Pricing according to the measured volume of water abstraction and consumption:** users are equipped of a meter or a device for measuring the taken quantities.

- **Mobilisation of specific financial resources pooled at the level of the basin:** France applies, on the one hand, the "polluter pays" and "user pays" principles and, on the other, that of "water pays for water". The abstractions and pollution are subjected to water taxes (charges) paid with the water bill to the Water agency of each large river basin. Each Water agency uses these amounts for studies and actions to improve water resources and aquatic environments.

- **A multiyear planning and programming:** Water management planning defines the objectives and priorities for action on a river basin scale, through the Master Plans for Water Development and Management (SDAGE), and on a sub-basin scale, through the Water Development and Management Schemes (SAGE). The Water agencies integrate the objectives of these master plans into 6-year financial plans approved by their Basin committees and boards of directors then voted by the Parliament and included into the laws of finance. The Agencies are currently preparing their $10^{th}$ Action Plan (2013-2018).

- **A clear distribution of responsibilities between public authorities and private operators for the management of municipal drinking water supply and sanitation utilities:** Drinking water supply and sanitation are public services decentralised at the level of municipalities which are responsible for the choice of the management method (direct or delegated - subcontracted). When the municipality subcontracts the management of the public utility to an external operator[2], the obligations of each partner are clearly defined in a contract and governed by law.

### 1.1.3. Challenges of water management in France

All in all, French water management must face several fundamental challenges:

- Allowing everyone to have access to drinking water and to the treatment of waste water,

- Preserving water resources and aquatic environments, and taking care of their health,

- Preventing permanent and accidental pollution,

- Preventing and managing floods and droughts, controlling erosion,

[2] In France, there is no privatisation of the service, neither regarding work control nor the responsibility for its organisation, nor regarding compliance with health and environmental regulations

- Ensuring food and fish production, while limiting the impacts of agriculture on the environments and resources, including coastal and marine environments,

- Allowing the sustainable development of socio-economic activities which all depend on the availability and quality of the resource: health, services, industry, energy production, transport, navigation, tourism, sports and recreational activities.

The actions developed during the last decades made it possible to face these challenges. In particular, with the water law of 1992, France started a sound management of the water resource, taking into account the water requirements of the ecosystems and not only the water needs related to human activities.

As regards water quality, domestic and industrial pollution was considerably reduced and today the main challenges are agricultural pollution and new forms of chemical pollution (heavy metals, drug residues). In this respect, full implementation of the European Directives is an important stake. Thus, France launched a proactive action plan for compliance to the standards of the waste water treatment plants to fill the last gaps in the implementation of the Urban Waste Water Directive of 1991. As regards the Water Framework Directive (WFD) of 10/23/2000, it is a structuring framework with the objective of good ecological status of water to be achieved in 2015, which requires, in particular, improvements in the hydromorphology of rivers. Regarding the residues of medical drugs, a National Plan on Drug Residues (PNRM) in water is being drafted by a national steering committee set up in November 2009 by the Ministers for health and ecology.

As regards quantitative aspects, France is facing more and more frequent droughts. But historically, quantitative management of water resources has never being the main problem of France; the country has never encountered serious problems of access to water except during some episodical droughts (1976, 1989, 1990, 1991 and 2003). In an average year, the French water resources are thus essentially abundant and sufficient. However, some groundwater tables are overexploited. France developed national and local regulations and strategies for better facing water shortages and floods.

The main challenge of the coming years will be to adapt to climate change: adaptation of water resources management and planning, but also adaptation of water uses especially in agriculture where significant water savings will have to be made in irrigation.

### 1.2. Institutional organisation of the water sector and presentation of some main stakeholders

#### 1.2.1. At national level

*The State Government*

Regarding water policy, the State plays the role of regulator: it has the task of water policing; it takes care that the drinking water standards related to the supplied water and the effluent standards of the waste water treatment plants are complied with; it takes care of compliance to the rules of awards of contracts by local authorities to private companies; it takes care of transparency to the users. The State guarantees common cause between users, equalisation between river basins, access to water for everyone.

Water policy is laid down by the Ministry of Ecology (MEEDDM) which proposes and implements the national legislation adopted by the Parliament. But the French right also transposes the Community water policy, which includes a bigger and bigger set of directives and standards.

In addition, this water policy is highly decentralised and is drawn up in a participative way, either at the level of the river basins, created by the law of 1964, or at the municipal level[3]. It is prepared and implemented there in a concerted way by all the water stakeholders: the State government, local authorities and various categories of users, including associations for environmental protection and associations of consumers.

*The ONEMA*

The Ministry of Ecology relies on the National Agency for Water and Aquatic Environments (ONEMA), national organisation responsible for the knowledge and monitoring of the status of water and aquatic environments. This

[3] The mayor and his/her town council are elected every 6 years by universal suffrage. Water is a stake of local democracy clearly identified by the voter, who knows the elected official who is directly in charge. The mayor is legally responsible for compliance with water quality and for the financial management of the service, either subcontracted or directly managed.

institution was created by the Law on Water and Aquatic Environments of 2006 (also called LEMA). It has taken the assignments of the former Higher Council for Fisheries (CSP), in particular. The ONEMA is organised on three levels: a Directorate-General at the national level, interregional Delegations, Departmental Services.

The ONEMA has four main assignments:

- Development of knowledge on water systems: the ONEMA orientates the research programmes,
- Information on water resources, aquatic environments and their uses: the ONEMA manages the national Water Information System (WIS),
- Control of water uses: the State entrusts part of its water policing responsibilities to ONEMA whose departmental teams control the compliance with regulations and note infringements,
- Local action: the ONEMA organises the diagnosis of the status of water and aquatic environments, participates in the planning of local water policies (SDAGE, SAGE, monitoring programmes), provides technical support to water management activities in the territories, for example for the restoration of aquatic environments.

*The National Water Committee*

The National Water Committee (CNE/NWC) is the place where can participate the water stakeholders at the national level. Chaired by a Member of Parliament nominated by the Prime Minister, it gathers representatives of the users, associations, local authorities and governmental administrations as well as qualified people and the presidents of Basin committees. It is consulted on the orientations of the national water policy. It gives advice on the draft legal texts (bills, decrees), on the planned reforms and draft governmental action plans.

Created in 1964, the NWC had its responsibilities widened by the LEMA with the creation of a Consultative Committee to propose advice on the price of water and the quality of water supply and sanitation public services and with the establishment of a committee concerned with the Water Information System (WIS). The number of its members was increased to adapt it to the evolution of the stakes and to its new assignments: new ministries became members and the representation of some categories of users was increased.

### 1.2.2. At the level of large river basins

*1st level of decentralisation*

In France, water management is decentralised at two main levels. The first level of decentralised management is on a large river basin scale, where river basin authorities are in charge of financing (Water agencies) and dialogue (Basin committees), with a multiyear planning and programming in the basins (SDAGE, action plans of the Water agencies) and with co-ordination by a Basin Co-ordinator Prefect.

*The Basin committees*

In each of the seven large metropolitan river basins, the Basin committee, chaired by a local elected official, is made up of representatives from local authorities (40%), users and associations (40%) and the State government (20%). The system of Basin committees aims at ensuring stakeholders' co-ordination and representativeness. All the users are represented: associations for nature conservancy and of consumers, industrialists, large regional developers, farmers, fishermen and fish farmers, tourism, nautical activities, electricity producers, water suppliers, etc.

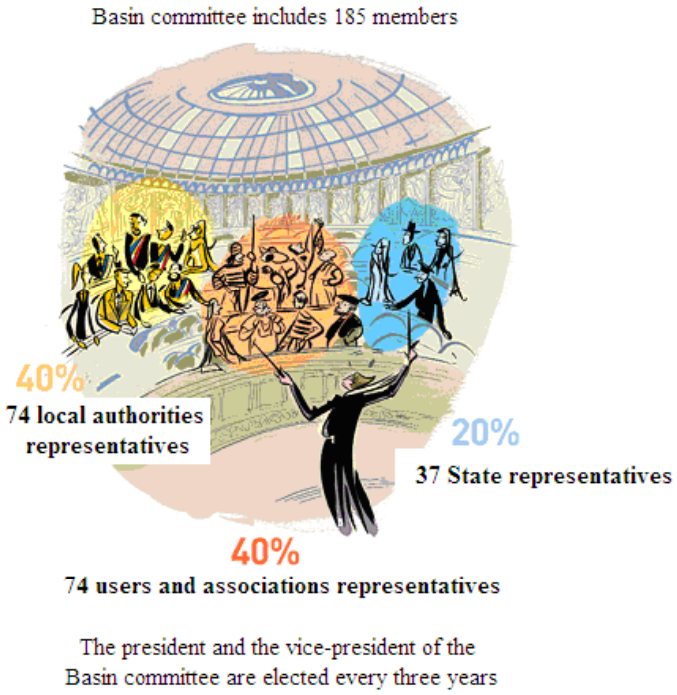
The Basin committee orientates the water policy priorities in the basin. It prepares the Master Plan for Water Development and Management (SDAGE) which is then approved by the State government.

The SDAGE is a planning document which gives the overall orientations of water management in the basin and the objectives to be achieved. The SDAGE is also a legal framework for public policies: any administrative decision concerning water management (local regulations, programmes for financial assistance, town planning documents) must be compatible or made compatible with the SDAGE, i.e., pursuant to jurisprudence, not to go against its provisions or its objectives.

The first SDAGEs were carried out pursuant to the water law of 1992 and go back to 1996. Each SDAGE was revised in 2009 to become the "Management Plan" required by the European Water Framework Directive of 2000.

The Basin committee follows up the SDAGE implementation. It approves the rates for the taxes levied by the Water agency and votes the multiyear action plan of the Water agency (priorities, conditions for financial assistance) which contributes in the financing of the SDAGE implementation. In accordance with the Water Framework Directive, the SDAGE is from now on accompanied by a Programme of Measures (PoM) which distributes the means (regulatory, financial) and the actions (water policing, works, communication, awareness campaigns, education, pilot projects, contracts, experience sharing) allowing achieving the objectives of good water status in 2015. The Programme of Measures is jointly drawn up by the State and the Basin committee and approved by the State after advice from the Basin committee.

**Figure 5 - Composition of the Seine-Normandy Basin committee**




Source: http://www.eau-seine-normandie.fr/ [3]

*The Water agencies and Water offices*

The Water Law of 1964 created 6 "Financial Basin Agencies" -now called Water agencies- one in each metropolitan river basin (outside overseas departments and except for the Rhone-Mediterranean and Corsica Water Agency which has two Basin committees). The Water agencies are public bodies in charge of financing water policy under the supervision of the Ministry in charge of Ecology. In the Overseas Departments (DOM), this task is carried out by the Water offices, created more recently by the Overseas Orientation Law of 13 December 2000 and which are local public bodies.

The Water agencies and Water offices are financially autonomous and have their own financial resources coming from the taxes levied on the water uses. Their field for action covers the quantitative and qualitative management of surface water and groundwater.

The Water agency is managed by a Board of Directors composed of representatives from local authorities, the various categories of users, the State, and of the Agency staff. The Chairman of the Board of Directors and the Director of the Agency are appointed by the Government. The six Water agencies have a permanent staff of about 2,000 people on the whole to carry out their assignments.

The Water agency has three levers for action:

- Environmental taxation: water taxes levied on water abstractions and the emission of pollutants, which are incentives.

- Financial assistances: they are subsidies and loans for action and investments which aim at implementing the water policy orientated by the SDAGE and included in the programme of measures of the basin and in the five-year action plan of the agency.

- Facilitating water governance in the basin, through the production and dissemination of information (measurement and data networks, studies, experts' appraisals, prospective, research,…), taking charge of the operation of the basin's participative bodies (basin committee, topical and geographical commissions, local commissions), preparation of the planning documents, contractualisation, organisation of the public consultations and debates, education and training, communication and international co-operation.

The Water agencies contribute in the investments and follow-up of the installations, with financial incentives to the local contracting authorities and by helping them in the SAGE steps and river contracts. They sign framework agreements with the regions, departments, communities of agglomerations, for the implementation of multiyear work programmes. They manage or finance the measurements and data networks and the controls of quality and compliance with the objectives. They produce studies and research aiming at evaluating that the objectives are achieved in the basin and complete every year the table of indicators of the SDAGE. Their action aims to clarify and strengthen collaboration and dialogue between all the local interested parties. They have also a role of public information and awareness: they manage a documentation service available to the public, disseminate information documents and provide financial support for actions of information in the basins (financing of river facilitators for example). They organise the public consultations planned by the WFD.

*The Local Public Basin Authorities (Etablissements Publics Territoriaux de Bassin - EPTB)*

The Local Public Basin Authorities (EPTB) are in line with the logic of the Water Law of 1964, which had conceived a coherent structure relying on three main types of water stakeholders: Basin committees, Water agencies and public bodies being able to become contracting authorities for projects on a river basin or sub-basin scale. Thus, to facilitate flood prevention and sound water resource management on this scale, as well as conservation and management of wetlands, the interested local authorities and their groupings can become associates within a EPTB.

The Law of 2003 on technological and natural risks led to the recognition of the EPTBs (little recognised before this date) as legitimate stakeholders in river management and flood prevention. For this reason, they are approved by the State and have the necessary competences conferred by the legislator. The law of 2005 relating to the development of rural areas specified the role of the EPTBs in terms of "conservation and management of wetlands".

The EPTBs can formally take three forms:

- Inter-departmental institution,

- Open mixed syndicate,

- Restricted mixed syndicate.

### 1.2.3. At the level of tributaries, sub-basins or aquifers

*The Local Water Commissions*

At the level of tributaries, sub-basins or aquifers, a Local Water Commission (LCW), made up by one half of representatives of local authorities, by one quarter of users' representatives and by one quarter of State representatives, can be created to prepare a Water Development and Management Scheme (SAGE), local adaptation of the SDAGE. The SAGE is a planning document which has an administrative and legal status which prevails against individual ones. It lays down the objectives to be achieved (water uses, quantitative and qualitative protection of water resources and aquatic ecosystems, conservation of wetlands, etc.). It plans various types of actions adapted to local stakes: peoples' information and education, river maintenance and development, drinking water supply, control of rain water, defence against floods, pollution control, surface and groundwater protection, restoration of ecosystems and wetlands, etc.

Contractual steps are also taken to plan and finance the planned actions: should they concern a river, an aquifer or a bay, these steps are called "river contracts", "aquifer contracts" or "bay contracts".

To implement the actions planned by the SAGE, the Local Water Commission can rely on an EPTB or on any other group of communities.

*"Water Police"*

Facilities, infrastructures, work or activities, which can have an impact on health, safety, water resources and aquatic ecosystems, are regulated by a specific "Water Police". This term covers two aspects: a special administrative frame and a control compliance with regulations.

The administrative frame requires either a mere declaration or an administrative authorisation, according to the characteristics of the project and the limits laid down by ministerial decrees. To take territorial specificities into account, in terms of pressure on the water resource and in terms of vulnerability of this resource, the administrative authority (the Prefect) can also enact rules applicable to some territories. It is for example the case in areas vulnerable to pollution by nitrates, in areas feeding water intakes, but also in areas subjected to a quantitative deficit or in polluted areas, etc.

The decisions are made locally by the Prefect, representative of the Governmental Administration (State) in the Department. When an authorisation is needed, the decision to grant it or not is made after an investigation for assessing the potential impacts of the project and consulting the population concerned. The authorisation is granted for a defined duration, it is not final. It can be withdrawn or modified with a stricter purpose, without allowance, should there be a risk for public health (drinking water), safety (floods) or aquatic environments. For example, concerning an authorisation for abstraction, the prefect's decree must:

- Define one or several abstraction quantities according to the source and the hydrological context,
- Take into account the abstraction quantity as compared to the other uses,
- Comply with the provisions of the SDAGE and SAGE,
- Impose the measurement of abstracted flows,
- Lay down provisions for the building and maintenance of water intakes,
- Lay down provisions to avoid contact between the different aquifers during drillings.

Often, several administrative services of the State are concerned (agriculture, town planning, health, industry, environment, etc.). Co-ordination of these services is carried out within the Inter-Ministerial Mission for Water **(**Mission Inter-Services de l'Eau - MISE). This unique water body allows jointly examining documents, making decisions faster in a co-ordinated way, taking into account all the aspects of the project and all the stakes (health standards, town planning rules, vulnerability of the ecosystems, etc.).

Co-ordination is also organised between the Department and the river basin district. The Prefect of the region, where the Basin committee has its home office, coordinates the State policy as regards the water police and water resources management. This Prefect is called Basin Co-ordinator Prefect. This co-ordination allows consistency of State actions between the Regions and Departments concerned and the homogeneous implementation of the SDAGE and Programme of Measures in the river basin.

The Basin Co-ordinator Prefect has the resources needed for crisis management in particular. He can take measures for limiting or provisionally stopping water uses to deal with accidents, floods, droughts or water shortages. The decisions of restriction are made after dialogue with the users.
The agents in charge of the water police (decentralised services and ONEMA) control compliance with regulations. They make an official report when there is infringement. Sanctions are defined. They are usually administrative sanctions (obligation of completing work for compliance with the standards or closing down of the facility for example). In some cases, penal sanctions are necessary. The official report is then transmitted to the court and the judge can inflict a penalty, either financial or a sentence of imprisonment in the most serious cases.

*2nd level of decentralisation*

The second level of decentralisation of water resources management concerns the small water cycle (drinking water supply and sanitation). Thus, the municipalities take care of the management of these services, either alone or in a grouping. Thus, for 36,763 municipalities, there are approximately 35,000 water utilities: 15,000 for drinking water supply, 16,500 for community sanitation and 3,500 for on-site sanitation.

For drinking water supply, inter-municipality is predominant: 3/4 of the municipalities are regrouped within inter-municipal bodies. For sanitation, only 44% of the municipalities are regrouped. For 20 years, the development of inter-municipalities has had a significant impact on the management of water utilities: the pooling of human resources and technical means allowed the municipalities improving efficiency of the services and following up subcontracting agreements.

The local authorities can either directly manage the water utility themselves (public authority or direct management) or hand over management to a specialised operator, which can be public or private (delegated / subcontracted management). Whatever the management mode chosen, the municipality is the owner of the facilities and remains answerable to the users. There are three main management modes:

- **Direct management or by a "public authority":** The municipality has complete responsibility for investments, the operation of the water utilities and for relations with the users. The staff members of the public authority are municipal employees with civil servant status. Management by a public authority concerns large towns whose technical services are highly structured or small rural communities.

- **Delegated / subcontracted management:** The municipality delegates the management of all or part of the water utility to a public or private industrial company within a contract whose duration is limited to 20 years (18 years on the average). The methods used for the price evolution are laid down in this contract. The water price is precisely fixed every year by the municipality after negotiation with the operator and debate in a deliberating assembly. "Affermage" (leasing) and concession are the two types of contracts that are usually used. "Affermage" is the most frequently used.

In leasing, the municipality directly makes and finances investments and only entrusts the operation of installations to the operator. The operator is paid through the water bill by levying, on behalf of the owner municipality, the amounts corresponding to the expenditure of technical depreciation and financial amortisation.

In concession, the operator builds the facilities and operates them at its own expense, taking full reimbursement from the water price. The candidate operator must estimate which investments it is prepared to make.

In both cases, the risk of deficit (or benefit) is taken by the operator and, at the end of the contract, the operator will have to give back the network and installations, the operating software, the plan of the networks and the customers' file. In 2007, in France, drinking water supply was mainly implemented under delegated management (52% of the municipalities but 72% of the covered users). Sanitation is more and more often entrusted to private operators (55% of the users in 2007 as compared to only 35% in 1997). On the whole, there are 9,000 contracts for delegated management of service.

When a municipality decides to call upon the competence of an operator, it will be within a multiyear contract after a call for competition. This contract specifies the contractual obligations and distributes the risks between the contractors, who will have usually to work as partners for 10 to 20 years. The average duration of the contracts is 11 years. The contract is awarded within a strict regulatory framework guaranteeing a call for competition with an obligatory transparency. On the average, there are about 500 to 700 calls for competition made for contracts each year in France.

- **Mixed management:** There are intermediate situations between direct and delegated management. Subcontracting often only concerns a facility (waste water treatment plant, sewage pumping stations, etc.) or part of the facility, or part of the service only (invoicing, customers' management, etc.). For instance, the municipality can operate drinking water production plants by itself and only delegate supply. Another example, the commercial aspect (invoicing and recovery) is more and more often entrusted to a different specialised operator within a procedure of award of a public contract. Therefore, the same invoice for drinking water and sanitation frequently involves several operators, whereas it is emitted by only one of them. This reflects the flexibility and complexity of the French system.

### 1.3. Big steps of the legislation related to water resources management

*Summary of the main water laws on which France is relying*

The French water organisation relies above all on the Law of 16 December 1964 which organised water management at river basin level, with a multi-stakeholder governance by Basin committees, a polluter-pays and user-pays financial mechanism and a 6-year planning of financial actions. The French territory was then divided into seven large river basins (Artois-Picardy, Seine-Normandy, Loire-Brittany, Adour-Garonne, Rhone-Mediterranean, Corsica and Rhine-Meuse). In each one of them, basin authorities were created: the Basin committee (advisory body made up of representatives from the State, local authorities and users) and the Water agency (executive organisation). However, although there are seven river Basin committees, there are only six Water agencies, Rhone-Mediterranean basin and Corsica basin are grouped in the same agency. To the 7 large river basins were added the Overseas Basins: Guadeloupe, Guyana, Martinique, Mayotte, Réunion.

**Figure 6 - Maps of the seven large French metropolitan river basins**


The Laws on decentralisation of 1982 and 1983 then had a crucial importance in water resources management in France as they organised the decentralisation of the State responsibilities towards the local authorities (towns, departments, regions). The administrative and financial supervision made by the Prefect was then suppressed and the Prefect's executive power was transferred towards the elected officials.

The law of 29 June 1984, called "Law on Fishing", organised fishing in freshwater and fish-farming management. It thus allowed making progress in taking aquatic environments into account, through the obligation of "reserved flow" in particular. This principle gives an ecological minimal flow, which has to be complied with by the dam managers, in order to guarantee the good functioning of the aquatic ecosystems located downstream of the dams.

The law of 3 January 1992, called "Water Law", laid down the principles of true integrated water management by:

- Giving a patrimonial nature to water, "common heritage of the Nation",
- Guaranteeing balanced management between the various water uses,
- Ensuring overall management of water in all its forms (surface, ground, coastal water),
- Creating the conservation of aquatic ecosystems and wetlands,
- Enhancing water as an economic resource,
- Making drinking water supply a priority.

The Water Law of 1992 also developed planning instruments on a basin scale: the Master Plans for Water Development and Management (SDAGEs) for large river basins and the Water Development and Management Schemes (SAGEs) for sub-basins.

Finally, the law of 1992 also transposed the objectives of the Directive of 1991 on Urban Waste Water (UWW) imposing to all the cities of more than 2,000 inhabitants to have a collecting system to guarantee a secondary treatment of waste water.
The Law of 21 April 2004, which is the Law on the transposition of the Water Framework Directive (WFD) of 23 October 2000, establishing a framework for Community action in the field of water policy, laid down objectives of good water status before 2015. As regards drinking water supply and sanitation utilities, it introduces a principle of recovering from the users the cost of the services related to water use, including the costs for the environment and the resources themselves.

Finally, the Law on Water and Aquatic Environments (LEMA) of 30 December 2006 renovated the whole framework defined by the laws of 1964 and 1992 and provided tools for achieving the objective of good status required by the Water Framework Directive. The LEMA again places water in its overall context by emphasizing its environmental aspects and by creating the ONEMA especially in charge of restoring and safeguarding aquatic environments. It improves the conditions for access to drinking water and gives more transparency to the operation of public water and sanitation utilities. The LEMA proposes several measures to alleviate the chronic imbalances between the available resources and the water demand. Its objective is a "sound and sustainable management of the water resource" which takes into account adaptations to climate change and flood prevention.

*The "Grenelle for the Environment"*

The "Grenelle for the Environment" is an important national debate organised in France in 2007, which gathered all the interested parties (State, local authorities, employees' organisations, employers' organisations, associations) in order to make long-term decisions on the environment and sustainable development. Rather than being a new governmental programme, the "Grenelle for the Environment" is a new social and participative step which calls upon all innovations to try to meet the challenges of sustainable development. This huge work, to be carried out until 2020, already allowed the President of the Republic to approve about 300 commitments. It is innovating both by its scale (about a 400-billion investment over the period) and by its governance method as it involves from the start all the economic stakeholders and the French society in the identification of priorities, then in the formulation and implementation of the planned actions.

The commitments of the "Grenelle for the Environment" were integrated into the law of 3 August 2009 for implementation of the "Grenelle for the Environment"; the draft law on the national commitment regarding the environment is being adopted in the spring of 2010; and into the laws of finances for 2008, 2009 and 2010. As regards water management, these commitments very ambitiously aim at achieving two thirds of good ecological status of surface water bodies in 2015 by controlling pollution of all origins, toxic and diffuse pollution in particular, restoring the ecological continuity of rivers, protecting threatened water intakes and outstanding wetlands, and by fighting against wastage of the water resource…

The "Grenelle for the Environment" also made it possible to lay down ambitious objectives for agriculture to reduce its contribution to diffuse pollution (reduction by 50% of the use of plant protection products, contribution to green and blue belts, generalisation of the plant cover of lands, development of biological agriculture…).

The **sectoral components** of the Grenelle especially include the following commitments having impact on water:

- **Water**
  - To achieve 66% of good ecological status of the water bodies in 2015.
  - To complete the installation of protection areas for all drinking water intakes and to define action plans before 2012 aiming at ensuring the protection of 500 of the most threatened intakes.
  - To acquire 20,000 hectares of wetlands to protect them from artificial environment and to guarantee their ecological services, in particular regarding flood prevention and water treatment: commitment from the Water agencies to finance up to 50%.

- To detect leaks in the drinking water supply networks and to plan their repair. The obligation of inventory of assets is extended to all the drinking water supply utilities. To incite to improving the yield of the drinking water supply networks to reduce leaks and to save a scarce resource, by privileging water proofing of the networks in the new connections when granting assistance to investment.

- To restore the fresh water ecosystem and to reduce the obstacles to the migration of fish: plan and charter for restoration of the ecological continuity of rivers in relation with the "green and blue belt".

- To adapt abstractions to the resources by respecting the ecology of the water systems.

- To increase the monitoring of the environments to provide better information.

- To recover and re-use rain water while complying with the health constraints.

- To prohibit the use of phosphates in all the detergents from 2012 onwards.

o **Sanitation**

- To reach a compliance rate of 98% of the wastewater treatment plants before 2012 and 100% before 2015. This objective concerns 146 wastewater treatment plants classified as not complying in 2007.

o **Water and Air (second national health and environment plan: PNSE2)**

- To reduce the discharge of the most worrying substances (within the meaning of REACH) especially benzene, mercury, trichloroethylene, perchlorethylene, some chromium compounds and endocrine disruptors, residues of drugs,…

o **Agriculture**

- Support to biological or reasoned agriculture, whose surface areas should triple before 2012, by privileging its establishment in drinking water intake areas and on the river banks, to reduce the soil/water migrations of pesticides and other diffuse pollution.

o **Waste**

- To reduce by 15% before 2012 the land filling (burying) of waste for better protecting soils and groundwater.

- To improve the management of some specific waste (bottom ashes, treated wood, dredging/clearing sediments, macro floating waste).

o **Research**

- To increase research budgets while privileging technological innovations, on water and sanitation in particular ….

*New Community obligations*

The Marine Strategy Framework Directive (MSFD) and the Floods Directive came into effect at the end of 2009. The MSFD will extend to all the marine environments and resources the WFD's approach and obligations of good ecological status up to 200 miles from the coastlines. The Floods Directive strengthens the obligations of the Member States of assessing and preventing flood risk.

## 2. Benefits of water resources management

The management of water resources can provide a significant number of benefits. This section will detail several of them in succession, bringing them together in three large families: the benefits due to better quality management of water resources, the direct socio-economic impacts, and the benefits due to sustainable governance and better quantity management of water resources. No evaluation made on these 3 topics is completed and thus could not be regarded as an exhaustive quantity measurement of the benefits concerned.

Before going into detail, the following tables can give an overview of every topic. Table 5 shows the amounts of financial impacts dealt with in this section. Foremost among these, we can find the economic sectors of hydropower and mineral waters which respectively generate turnovers of 2.8 and 3.5 billion euros per year.

In terms of benefits, we distinguish future benefits, i.e. which are not seen on the market today, from current benefits.

**Table 5 - Financial impacts related to the management of water resources (in million of euros per year)**

| **Turnovers of activities related to water resources** | **Amounts** |
|---|---|
| Turnover of hydropower | 2,800 M€ |
| Turnover of sales of fish | 1,098 M€ |
| Turnover of sales of shells | 626 M€ |
| Turnover of fish-farming | 161 M€ |
| Turnover of natural mineral waters | 3,500 M€ |
| Turnover of spas and hydrotherapy | 330 M€ |
| Turnover of activities related to spa and hydrotherapy | 690 M€ |
| Turnover of recreational fishing | 365 M€ |
| **Total** | **9,570 M€** |

| **Yearly benefits related to water resources** | **Amounts** |
|---|---|
| *Current benefits* | |
| Benefits of avoided floods damages (assessment to be confirmed) | from 300 to 700 M€ |
| Benefits of tourist activities (assessment to be confirmed) | 1,000 M€ |
| *Future benefits* | |
| Avoided costs related to agricultural pollution | from 1,113 to 2,395 M€ |
| Non commercial benefits (groundwater) of WFD's good status | from 350 to 650 M€ |
| Non commercial benefits (surface water) of WFD's good status | 500 M€ |
| **Total** | **from 3,263 to 5,245 M€** |

| **Exceptional benefit related to water resources (not annual)** | **Amounts** |
|---|---|
| Benefits of avoided damages of a hundred-year flood on the city of Paris | 8,600 M€ |
| **Total** | **8,600 M€** |

Sources:

Evaluating the environmental benefits on water bodies [6]

Non-merchant benefits of achieving good water status: evaluation on the French scale [7]

Figures and Statistics n°43 – the French energy bill in 2008 [9]

Economic aspects of the French spa sector [11]

Health and well-being tourism [12]

Website of Seine Great Lakes [13]

Impact of local policies on the spa sector in France [27]

Note on the approach to cost-benefit analysis of the draft Bassée and issues of funding [32]

Studies & Documents n°52 – Assessing water pollution costs of farming in France [38]

Website of Natural mineral water [37]

Table 6 details the causes and effects of all benefits due to water resources, including those for which there may not be given (for now) any monetary value because of lack of studies on the subject.

**Table 6 - All benefits due to water resources and their financial impact (in millions of euros)**

| Type of benefit | Improvement action(s) carried out | Effect(s) | Financial impact(s) |
|---|---|---|---|
| **Benefits due to better management of water quality** | | | |
| **Public health** | - Development of urban sanitation systems<br>- Drinking water supply | - Reducing mortality<br>- Eradication of epidemics (cholera, malaria, ...) | No existing monetary value |
| **Water quality and biodiversity** | - Commissioning of major facilities for urban wastewater treatment<br>- Compliance with the UWW directive | - Decreased concentration of certain pollutants (BOD5, NH4, Phosphorus)<br>- Increased number of fish species | No existing monetary value |
| **Good ecological status required by the WFD**<br><br>*Note: only the non-merchant benefits were assessed in an exhaustive way; for the merchant benefits only the benefits of the prevention of agricultural pollution were taken into account.* | - Measures for achieving good ecological status of all water bodies by 2015 | - Treatment costs avoided for agricultural pollution, avoided costs of moving water intakes,…)<br>- Non-merchant benefits of users and non-users of ground and surface water bodies | Future impacts<br>- Direct costs avoided for agricultural pollution: from 1,113 to 2,395 M€<br>- Non-merchant benefits: 1,000 M€ (from 350 to 650 M€ groundwater + 500 M€ surface water) |
| **Bathing water** | - Implementation of the Directive on the quality of bathing waters and shellfish waters | - Improving the bacteriological quality of water | No existing monetary value |
| **Direct socio-economic impacts of water resources** | | | |
| **Tourism** | - Implementation of the Directive on the quality of bathing waters and shellfish waters | - Tourist flows preserved in the bathing resorts through the application of the directives | - Preservation benefit (assessment to be confirmed): 1,000 M€ |
| **Hydropower** | | - Use of water resources by the electricity companies | - Turnover of hydropower production: 2,800 M€ |
| **Fishing, aquaculture and fish-farming** | - Implementation of the Directive on the quality of bathing waters and shellfish waters | - Possibility of selling products from the sea and rivers | - Turnover of fish sales: 1,098 M€<br>- Turnover of shellfish sales: 626 M€<br>- Turnover of fish-farming: 161 M€ |
| **Natural mineral waters** | | - Use of water resources by the mineral water industry | - Turnover of mineral waters: 3,500 M€ |
| **Spas and hydrotherapy** | | - Use of water resources for spas and hydrotherapy and related activities | - Turnover of spas and hydrotherapy: 330 M€<br>- Turnover of related activities: 690 M€ |
| **Recreational activities related to water uses: the example of fishing** | - Recovery and development of banks by cities | - Possibility of developing recreational activities such as fishing | - Turnover of recreational fishing: 365 M€ |
| **Other market uses** | | - Use of water resources for other uses (ski slopes, ...) | No existing monetary value |
| **Benefits of governance and better management of water quantity** | | | |
| **Better risk control** | - Construction of dams,… | - Limiting damage in case of flood | - Avoided damages (assessment to be confirmed): from 300 to 700 M€ |
| | - Construction of lake-reservoirs to prevent the consequences of a 100-year flood in Paris | - Limiting damage in case of flood | - Avoided damages: 8,600 M€ (exceptional benefit related to a 100-year flood) |
| **Multi-stakeholder governance of the basin** | - Decisions made in the public interest by the Basin committees | - Taking into account all situations | No existing monetary value |
| **Development of waterways transport** | - Development of waterways | - Savings in terms of $CO_2$ as compared to the use of freight transport by road | No existing monetary value |

### 2.1. Benefits due to better management of water resource quality

#### 2.1.1. Benefits for public health

Access to drinking water and sanitation had, in France as elsewhere, a very strong demographic impact, starting from the middle of the 19th century. Pasteur said that his contemporaries "drank 90% of their diseases". The arrival of drinking water in the cities in the middle of the 19th century is regarded as the main factor for reduction of infant mortality (from 0 to 1 year old) which passed from approximately 200 deaths to about 100 deaths for thousand children between the beginning and the end of the 19th century. The examples of Paris and Marseilles agglomerations are relevant to show the benefits of access to drinking water and sanitation.

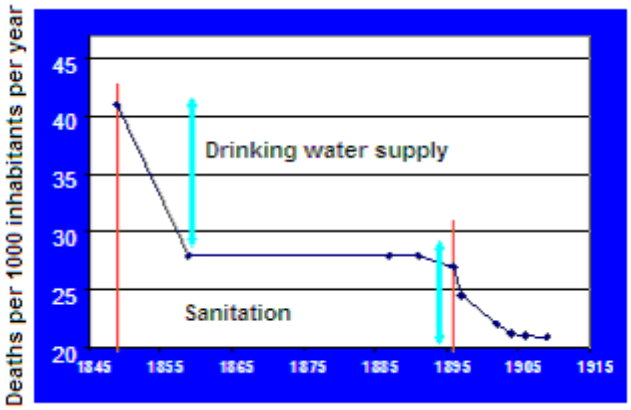
*The Paris agglomeration*

Equipped with a defective sanitation system at the beginning of the 19th century, the Paris agglomeration developed epidemics, one of which was most fatal in 1832, 18,400 people died from cholera. This epidemic will be only the first of a long series which continued in 1849, 1854, 1865 and 1892. In order to fight against these lethal waves originating from pollution of soils and wells by the waste water discharged into the streets, more than 1,500 km of underground galleries devoted to drainage were built within the great development project of the city of Paris in the middle of the 19th century. This health project will continue during the 20th century with, in 1927, the adoption of a sanitation programme which planned the building of a waste water treatment plant in Achères. As a direct consequence, this better management of waste water discharges made possible the definitive disappearance of the epidemic waves caused by water-borne diseases.

*The Marseilles agglomeration*

The following figure shows the successive demographic effect of drinking water conveyance then of sewerage on the population of Marseilles.

**Figure 7 - Health effects in Marseilles of the development of drinking water supply and sanitation**




Source: Bruno Le Bansais, Seine-Normandy Water agency, 2006

The treatment of waste waters of the Marseilles agglomeration before their discharge into the sea and the treatment of sludge only appeared in the 1990s. Between the censuses of 1999 and 2006, overall mortality dropped by 1.7% per year, i.e. twice more quickly than its average evolution during the 20th century (less than 0.9% per year).

*Malaria in Corsica*

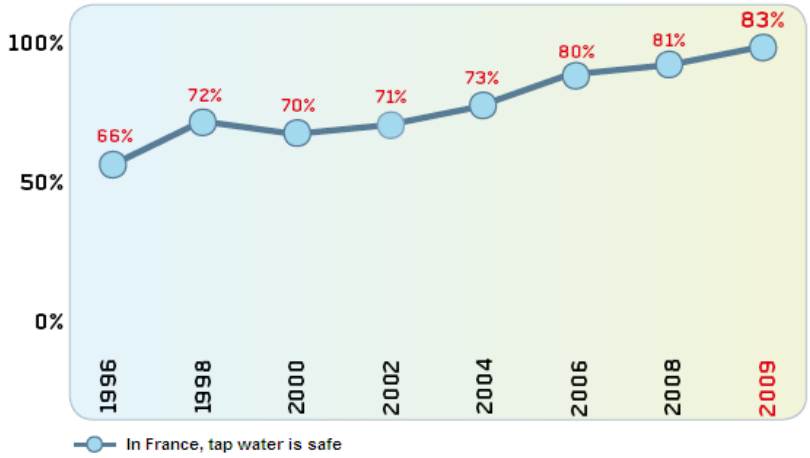
The eradication of malaria in Corsica in 1948-49 highlighted that this disease related to the lack of sanitation was the cause of 52% of the deaths of children of less than 5 years old until 1948: this infant mortality indeed decreased from 97/1000 in 1948 to 47/1000 in 1950.

*Confidence of the public, direct consequences of better management of water quality*

The current French situation of water coverage, characterised by rates close to 100% for this small water cycle, allowed establishing a solid bond between water and French citizens. Indeed, they have high confidence in the quality of the tap water as the recent public opinion polls proved it. According to the C.I.EAU/TNS/SOFRES 2009 barometer, 85% of the questioned people answered that they trust tap water and 86% estimate that the French health authorities take maximum precautions so

that the standards of tap water quality protect the consumers' health. Finally, water is considered to be safe by 83% of the questioned people, this rate being in constant increase these past years as shown in the following figure [4].

**Figure 8 - Evolution of the opinion on water safety**




Source: Water information centre. C.I.EAU/TNS/SOFRES 2009 Barometer [4]

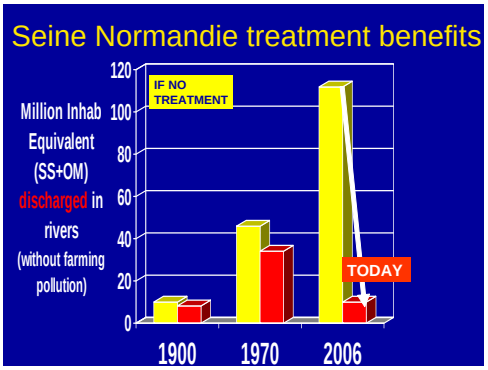
### 2.1.2. Benefits of better water quality and biodiversity

*Example of the Seine and Seine-Normandy basin*

Besides public health benefits, better qualitative water resources management allowed, as shown by a study carried out by the Seine-Normandy Water agency (AESN), the health condition of the Seine to improve in an impressive way over the last 40 years [5].

**Figure 9 - Benefits of waste water treatment for the Seine-Normandy basin**

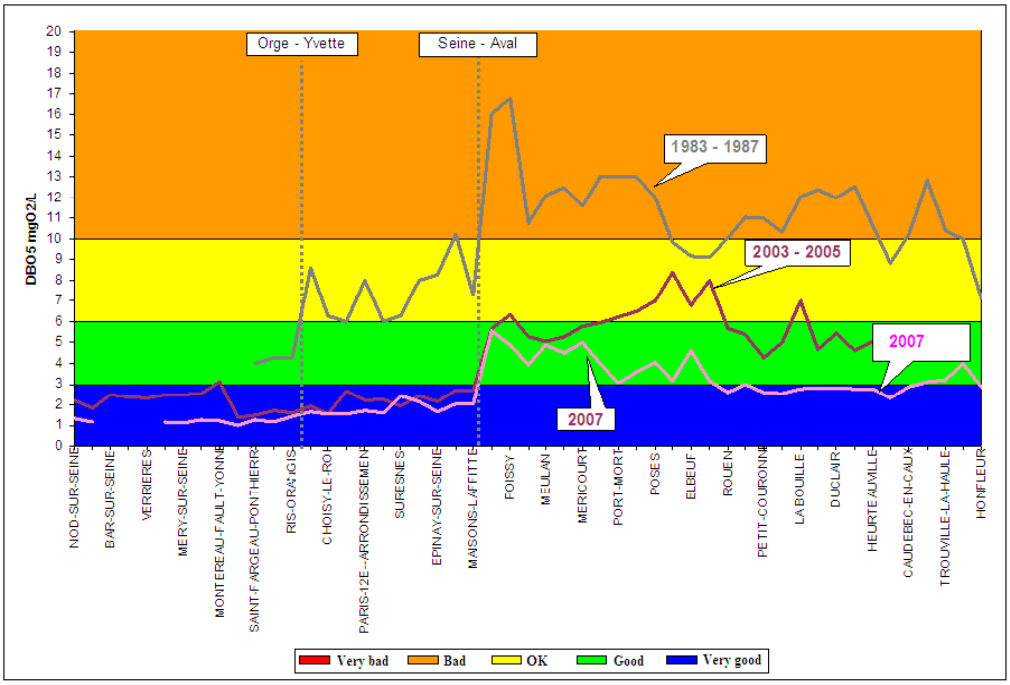
| BENEFITS OF SANITATION WITHIN THE SEINE-NORMANDIE WATERSHED | | |
|---|---|---|
| | 1964 | 2006 |
| Bathing areas in conformity | 43 % | 95 % |
| Ammonium concentration of Seine | 10 | 1 |
| Cadmium conc. of sea shellfish | 5 | 1 |
| Child mortality | 25‰ | 3.5 ‰ |
| Hépatitis A (18-25 males prevailence) | 55 % | 5% |
| Number of foreign visitors/tourists | 8 M | 40 M |




Source: Olivier Bommelaer, Seine-Normandy Water agency, 2006

The great recent evolutions of the Paris sewerage system, including, among other things, the building of large installations for the treatment of urban waste water (Valenton, Colombes, Achères) and compliance with the urban waste water EU directive of 1991 of several basin treatment plants, generated a decrease in the concentrations of Biological Oxygen Demand (BOD-5), ammonium ($NH_4$) and phosphorus in the Seine. For BOD-5, pollution related to organic matter can be regarded as controlled today, as clearly shown in the following figure.

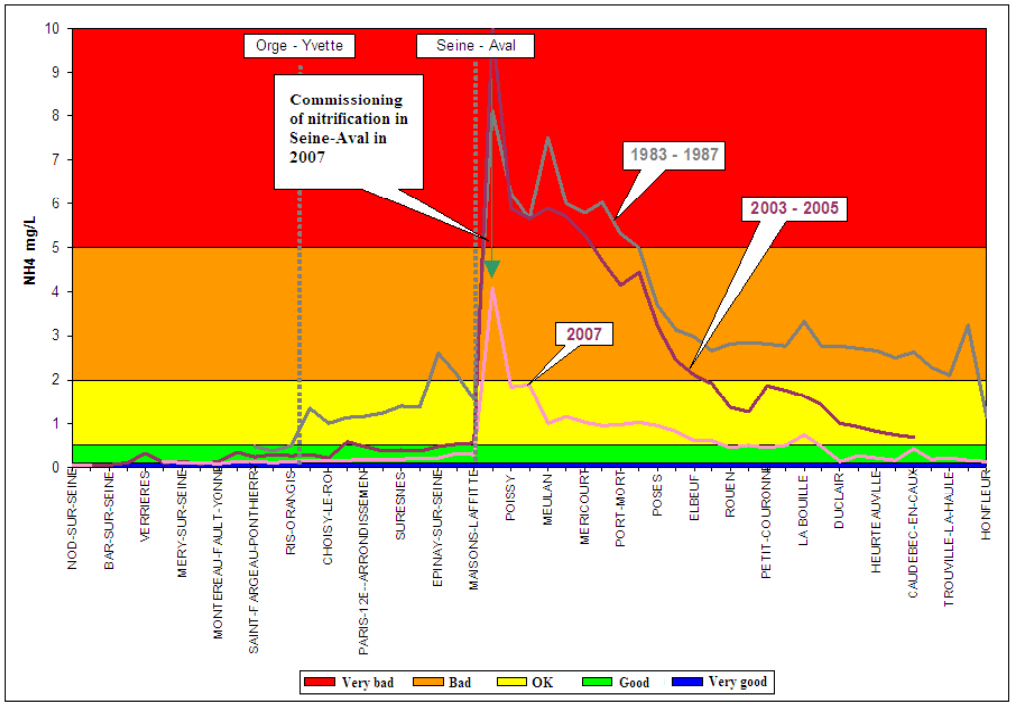
**Figure 10 - Longitudinal profile of BOD-5 concentration in the Seine**




Source: "25 years of sanitation policy in Paris agglomeration: Impact on the quality of the Seine". Seine-Normandy Basin Committee [5]

For ammonium, a toxic pollutant for aquatic fauna, findings are also satisfactory with significant improvement as shown in the following figure.

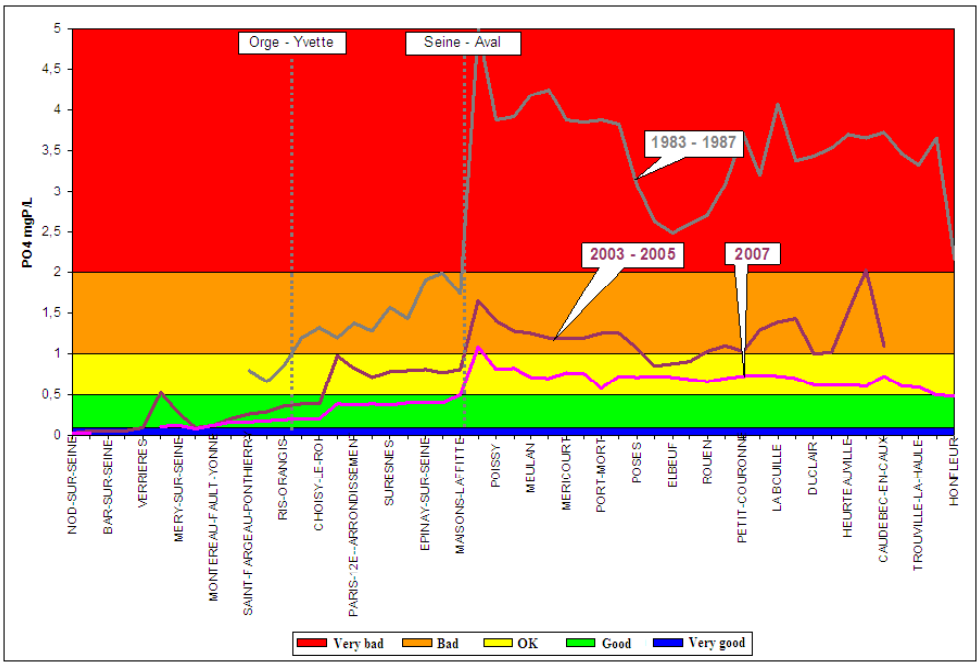
**Figure 11 - Longitudinal profile of $NH_4$ concentration in the Seine**




Source: "25 years of sanitation policy in Paris agglomeration: Impact on the quality of the Seine". Seine-Normandy Basin Committee [5]

Phosphorus has also very clearly decreased between the periods of observation, this finding mainly resulting from the generalisation of treatment of this element, required by the urban waste water EU directive, and from its removal in the detergents for domestic use.

**Figure 12 - Longitudinal profile of orthophosphate concentration in the Seine**

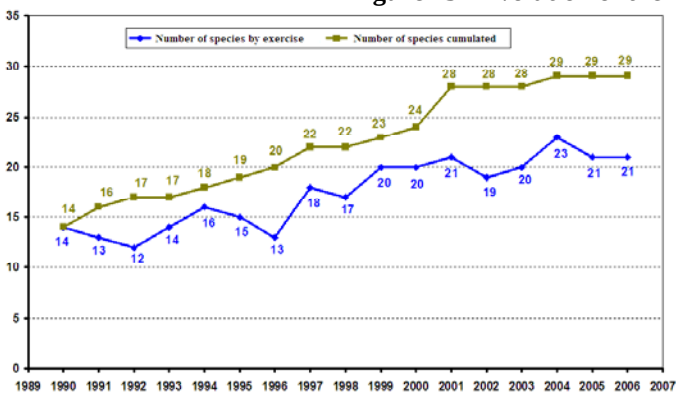



Source: "25 years of sanitation policy in Paris agglomeration: Impact on the quality of the Seine". Seine-Normandy Basin Committee [5]

In addition, pollution of the Seine by heavy metals has significantly regressed. The studies carried out within the PIREN - Seine (Interdisciplinary Research Programme on the Environment in the Seine carried out by the National Scientific Research Centre (CNRS)) show the very clear trend towards the decrease in metal contents in sediments. In the same way, they highlight a total fall in the discharges per capita. This results from the pollution removal by industry and craft industry, from the regulatory pressure which increased with the passing of years and from the source control of the uses of these metals.

Finally, the evolution of water quality in the Seine had positive consequences on fish quality, as it passed from an extremely poor diversity of species in the Sixties and Seventies, with only three species listed in the Seine, to a fairer diversity with 32 species currently listed. The first salmons, which disappeared from the Seine about a century ago, reappeared in Rouen (120 km upstream of the estuary) at the beginning of the 2000s, then in the rivers of the Yvelines Department downstream of Paris agglomeration. The first big catches were noted in the capital during autumn 2008, a year when 260 salmons were observed by video count in the fishway of the Poses dam, located upstream of Rouen[4]. In 2009 the French National Federation of Fishermen (FNPF) estimated that approximately a thousand of salmons crossed Paris. In addition to salmon, 3 other emblematic biological indicators of good quality of the environment are back in the Seine: sea trout, allis shad and sea lamprey [5].

**Figure 13 - Evolution of the number of counted species**



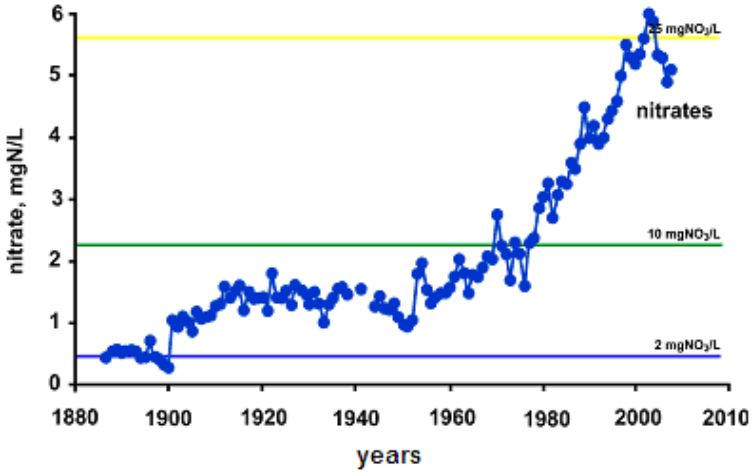

Source: "25 years of sanitation policy in Paris agglomeration: Impact on the quality of the Seine". Seine-Normandy Basin Committee [5] (from ONEMA data for the Interdepartmental Union for Sanitation in the Greater Paris (SIAAP))

Miraculous fishing: a metre-long salmon fished in the Seine in Paris in October 2008 (Source: Agence France-Presse)

[4] Source: National Agronomic Research Institute (INRA)

In spite of all these positive points, some problems remain and are thus a major challenge for the coming years. This is, for instance, the case of nitrates, which, although affecting only very little the ecological quality of inland surface water, is an eutrophication factor for marine environments. Therefore, the Seine contributes to the nutrients input leading to the eutrophication of the estuary in the North Sea. The nitrates are mainly of two origins: nitrate fertilisers used in intensive agriculture since the end of the Fifties and the discharges of urban waste water treatment plants. The distribution between these two sources is approximately 2/3 for agriculture and 1/3 for the towns. The agricultural inputs have been in constant increase since the end of the Fifties with a beginning of stabilisation in the past years [5].

**Figure 14 - Evolution of nitrate concentrations in the Seine from the System Quality Assessment of watercourses (SEQ-Eau)**




Source: "25 years of sanitation policy in Paris agglomeration: Impact on the quality of the Seine". Seine-Normandy Basin Committee [5] (from PIREN Seine, SAGEP)

To reliably comply with the WFD objectives, some efforts are thus still to be made with regard to nitrite and nitrate concentration in particular. Regular and controlled operation of the new installations for pollution removal from water should contribute in this.

### 2.1.3. Benefits from achieving the WFD good ecological status of water bodies

In 2005, the Economic Studies and Environmental Assessment Directorate of the Ministry of Ecology carried out a cost-benefits analysis of the passage of all water bodies to the good status required by the WFD by 2015[6, 7]. This study, updated in 2009, in 2010, and in 2011 with the release of a publication [38] valued the benefits of such a market share (especially lower treatment costs for drinking water) and non-merchant benefits (including both the values of use and non-use of ground and surface waters). Merchant benefits hereunder quoted mainly relate to reducing or suppressing actual costs of diffuse pollution from agriculture and animal breeding. Therefore, the value of each benefit corresponds to the present cost value, based on the hypothesis that the good ecological status is reached.

*Merchant (or commercial) benefits*

- **Additional expenditures of households due to agricultural diffuse pollution**

  - Costs of substituting bottled water to tap water due to nitrates

Small children are a risky population group vis-à-vis the nitrates. Indeed, nitrates can cause methemoglobinemia (or so-called disease of "blue baby"). The against-medical indication of tap water is routine in France for small children. Expenditure on consumption of bottled water replacing the consumption of tap water thus appear as an additional expenditure of households because of nitrates. Thus, within children under 2 years and excluding infants fed by their mother (25% of the total number of children for the first 4 months), nearly 1.5 million children are concerned. With an average consumption of 0.75 liters of bottled water per day (274 liters per year), we obtain a total purchase of 410 million liters of bottled water per year at an average price of 0.538 euro per liter[5] . Thus, household spending induced by nitrates is about **220 million euros a year**.

[5] In 2004, the industry of natural mineral waters generated a turnover of 3.5 billion euros to 6.5 billion liters of products. This corresponds to a price of 0.538 euro per liter [37].

➢ Costs of substituting bottled water to tap water due to pesticides

According to a report of the Directorate General of Health (2008), 5.1 million people are served by water excessing at least once a year pesticide standards. Based on an average consumption of 258 liters per person and per year (CREDOC IFEN survey conducted in 2000) and an average cost of purchase of 0.538 euro per liter, costs of substituing bottled water to tap water due to pesticides reach to **710 million euros a year**. Pending results of specific studies, we will not include this figure in the costs. However, it appears interesting to keep it in the evaluation of the upper bound of the potential benefits of achieving good status.

➢ Costs of collecting and processing bottled water packaging

We consider an average weight of 30 grams of packaging (plastic bottles) per liter of bottled water, and a cost of collection and treatment (including recycling) of about 250 euros per tonne. The average cost does not account for transportation costs of waste in rural households from their homes to the recycling centers.

Under these conditions, the waste containers of bottled water consumed by fear of agricultural pollution are between 38,310 and 56,010 tonnes annually generating an expenditure of between **10 and 14 million euros**. This expense is passed on to the household budget through the Tax Collection of household waste (TEOM) or the Fee for Garbage Collection (REOM) and eco-contribution.

➢ Costs of domestic filtering of tap water due to agricultural pollution

If some consumers buy bottled water, others are equipped with a device for filtering tap water. The CIEAU / TNS Sofres, 2009 Barometer, "French people and water" [4], estimated at 23% the number of French people using water treatment devices, i.e. water softeners (anti-liming) and devices considered to filter pollutants (water filter jugs and fixed equipment with activated carbon). If 13% of respondents indicated that they were already equipped with water filter jugs, the survey did not provide any figure on fixed filtration.

- The jugs are sold from 30 to 60 euros each[6]. We estimate their lifespan at about 4 years. They operate with cartridges to be replaced every month, at an average unit cost of 5 or 60 euros per year per household for about 3.4 million households. We estimate that 70% of the households use water filter jugs because of agricultural pollution, and that they actually replace their cartridges only 8 times per year (instead of 12 times). This corresponds to 2.38 million households, and leads to an annual national expenditure for domestic filtration by jug related to agricultural pollution between 113 and 131 million euros.

- Regarding domestic fixed filtration, pending a sounder value, we estimate that at least 2% of the households are equipped for fear of agricultural pollution, i.e. 520,000 households. We take an average purchase price of 40 to 120 euros for each unit, amortized over approximately 8 years, with the cartridges to be replaced twice a year at a cost of 24 euros per unit. We believe that these households will properly replace their filters for a total annual expenditure of about 58 euros per household. This leads to an annual value of approximately 30 million euros.

On the above basis, the cost of filtering the tap water of households caused by diffuse pollution from agriculture is estimated to range between **143 and 161 million euros.**

o **Additional expenditures of water and sanitation services related to agricultural diffuse pollution and affecting the water bill of domestic consumers**

➢ Expenses of reducing farming pollutions incurred by the Water agencies

On 2007 and 2008, Water agencies have committed 144 million euros for the fight against agricultural pollution when they have collected about 11 million of pollution charge for farmers: budget analysis of Water agencies thus shows a net annual **60 to 70 million euros** in expenses due to agricultural pollution and mainly financed by the domestic fee, that is to say by the bill drinking water from domestic consumers. In addition, this encryption should be considered as a low range of costs the fight against agricultural pollution. Indeed, to allow farmers to adapt their equipment and practices to control pollution generated by their activity and thus curb the alarming deterioration of water quality, a program (called PMPOA) had been created over the period 1994-2000, followed by a second (called PMPOA 2) over the period 2002-2007. It is estimated that over 700 million aid that was granted by the state, local governments and water agencies under the PMPOA 2 (Source Agreste). However, this

[6] Major suppliers are Brita and Terraillon. In 2009, the CEO of Terraillon believed that the French market for water filter jugs was "booming" and estimated it at 90 million euros.

figure being only one order of magnitude and not being picked up by other sources, it was decided not to include it in the present exercise.

- Costs incurred by the eutrophication of raw waters at the intakes

A study conducted in 2005 by the Loire-Brittany Water Agency at the basin level estimated at 39.3 million euros the total costs occured (in 2003 euros) by the mechanical cleaning of the eutrified waters at the intakes and the overconsumption of power due to the choking of the rising main pipes by eutrophic waters (additional cost of pumping energy caused by algae and plants bulky pipes pumping raw water eutrophic). 24% of annual withdrawals of drinking water of the basin were affected. On this basis, the national expenses of water supply concerned by these mechanical consequences of eutrophication can be estimated between **60 and 100 million euros per year.**

- Costs incurred by the displacement of the intakes used

To avoid investing in expensive treatments of diffuse pollution mainly from agriculture, drinking water supply utilities had to give up many contaminated intakes and relocate the corresponding pumps, which resulted in investment costs and constant operating cost overruns, new intakes being systematically located further away from metropolitan areas than the old ones (higher costs for the mobilisation and conveyance of raw water to drinking water treatment plants and distribution networks). As a first approximation, we can estimate that the resulting permanent additional cost is from 0.04 to 0.10 euro per $m^3$, and involves no less than 10% of the mobilised drinking water. Based on the figure of 6 billion $m^3$ of annual withdrawals for drinking water (2005), this additional annual cost is estimated at between **24 and 60 million euros,** without taking into account the health externalities of this practice.

- Costs of interconnections by drinking water producers

To continue using the old contaminated intakes without investing in additional treatments when the costs of displacing the production facilities would prove to be prohibitive, the producers of drinking water in urban areas, having more water resources available from different geographical origins, initiated the mixing of contaminated waters with "clean" waters. This practice, which is somewhat worrying the local authorities concerned, raises real ethical issues[7] and tends to spread in recent years. We will estimate at this stage that it affects about 15% of treated water and leads to a permanent operating cost between 0.02 and 0.04 euro per $m^3$. The corresponding additional annual cost would range between **18 and 36 million euros.**

- Cost overruns incurred by drinking water treatment related to nitrates

To supply drinking water from raw water, complying with quality standards on the concentration of nitrates, the community bears various costs: it can carry out some work (discontinued intakes, dilution or palliatives for poor quality, etc.) or implement additional treatments.

According to a report from the Directorate General for Health [30], nitrate contents above 50 mg per liter denote the degraded status of the resource and the need for taking measures. According to the representatives of private operators members of the Commission of Water Supply of the Scientific and Technical Association for Water and Environment (ASTEE), the reduction of nitrate made target of a still live 25 mg per liter. Still according to the members of this Commission, the volume of water treated annually against nitrates would be around 5% of the collected volumes (300 million $m^3$). Based on studies of the Ile de France Region of 2010 and the Loire-Brittany Water Agency, the SEEIDD would consider a hand closer to 10% (600 million $m^3$). With an additional cost of curative nitrates between 0.4 and 0.6 euro per $m^3$, and considering that the only measure is the introduction of additional water treatment, we thus provide a SEEIDD estimate of the costs supported by the community to supply drinking water with a standard nitrate concentration. These are ranging between **120 and 360 million euros.**

- Cost overruns incurred by drinking water treatment related to pesticides

To supply drinking water from raw water, complying with quality standards on the concentration of pesticides, the community must develop additional treatments.

According to the Commission of Water Supply of ASTEE, 45% of the volume of water withdrawn annually for drinking water are treated against pesticides (2.7 billion $m^3$). By amortizing the investment over a period of 15 years and adding operating costs, the value of the additional costs of treatment due to pesticides for private operators is ranging between 0.06 and 0.11

[7] Populations and districts previously "naturally" supplied with water of excellent quality are therefore supplied, without notice or public debate, with water deliberately loaded at the limit of the drinking water standards in force. Just remember that the French standard on the nitrate content of drinking water is 5 times more permissive than the U.S. standard.

euro per $m^3$ (these values apply both to groundwater than surface water). For what is beyond the scope of private operators (management by a public authority), the value of the additional costs of treatment due to pesticides is about 0.2 euro per $m^3$ (value Drouet 2008 made on 28 plants in the basin Seine-Normandy basin). Knowing that the private operators run 75% of the facilities, we can evaluate the costs borne by the community to deliver drinking water meeting the standards of pesticide concentration. These are ranging between **120 and 358 million euros.**

- Cost overruns for wastewater treatment related to agricultural nitrates

The EU Directive 91/271 on Urban Wastewater Treatment (UWW) requires tertiary treatment of discharges into sensitive areas of cities over 15,000 population equivalent. This treatment concerns the discharges from several major cities including total nitrogen and phosphorus. We have no data on costs related to phosphorus. We therefore confined ourselves to a first approximation of the agricultural share of nitrogen treatment required by the UWW Directive in metropolitan wastewater discharges. Indeed, the investments underway in Paris is an eloquent showcase[8].

The UWW Directive fixed at 10 mg per liter the concentration limit of total nitrogen in treated discharges in sensitive areas, which is more restrictive than the EU standard for drinking water regarding nitrates[9]. In practice, a large city like Paris should reduce by more than 91% the daily input of 121.2 tons of nitrogen in its treatment plants [31], of which we can estimate that at least 12 tons come from agricultural nitrates in the supplied drinking water and about 10 tons from collected rainwater[10]. This suggests that at least 10% of the costs of tertiary treatment of nitrogen are attributable to agriculture. At the national level, we can estimate at about 2.5 billion $m^3$ the domestic waste water to be treated (including storm water drainage arriving at the treatment plants). The corresponding expenditure of local authorities attributable to the tertiary treatment of agricultural nitrogen can then be estimated, on the basis of treatment costs of the Commission of Water Supply of the Scientific and Technical Association for Water and Environment (ranging from 0.4 to 0.6 euro per $m^3$, at 250 million $m^3$ per year). Annual expenditure of sanitation utilities for wastewater treatment due to excess of nitrates from agricultural sources can thus be estimated to be in a range from **100 to 150 million euros.**

- Market losses due to eutrophication

Eutrophication is associated with an excess of nutrients (phosphorus and nitrogen), brightness and temperature. If the eutrophication of inland waters is mainly due to phosphorus, marine eutrophication depends, in turn, essentially on the nitrogen quantity released. An inter-agency review of 1991 estimates the losses due to eutrophication in the following manner:

- Estimates of tourist losses on water bodies: 60 to 140 million francs in 1988 (i.e. from 13.5 to 31.6 million euros 2009).
- Estimates of tourist losses due to decrease in fishing and angling: 16 to 21 million francs in 1988 (i.e. from 3.6 to 4.7 million euros 2009).
- Estimates of losses due to marine eutrophication: 240 to 310 million francs in 1988 (i.e. from 54.2 to 70 million euros 2009).

That is to say a total oscillating between 316 and 471 million francs in 1988, corresponding to a benefit oscillating between **71 and 106 million euros 2009**. This estimation will have to be updated on the basis of more recent data.

- Costs of cleaning green algae along the coast

On February 3, 2010, the Minister of Agriculture Bruno Le Maire and the Secretary of State for Ecology Chantal Jouanno jointly presented a project to fight against the spread of algae on the coast of Brittany. This control plan is scheduled for a period of five years, ranging from 2010 to 2014. It will fund the collection of algae, storage, processing and research for better understanding of the phenomenon. For 2010, **40 million euros** are allocated to finance the collection and composting of algae.

Summary of merchant benefits

Overall, the merchant benefits associated with achieving the good ecological status of water bodies would be in the range between **1,113 and 2,395 million per year**. Within these, the additional expenditure of households due to agricultural diffuse

[8] For his only treatment plant Achères, which rejects the Seine wastewater by more than 6 million population equivalent, SIAAP commissioned in 2007 a first stage of nitrification at a cost of 320 million euros and is midway through an additional investment of 1 125 million including the stage of denitrification.

[9] The limit value of 50 mg per liter of nitrate ($NO_3$) in drinking water corresponds to 11.4 mg per liter of total nitrogen.

[10] Partially impacted by agriculture.

pollution would be in the range between 373 to 1,105 million per year while the additional costs of water and sanitation services related to agricultural diffuse pollution would be between 740 and 1,290 million per year.

*Non-merchant benefits*

Regarding non-merchant benefits, the benefits linked to the values of use and non-use of groundwater have been estimated through contingent valuation surveys in a range of 350 million euros to 650 million euros per year. Always regarding non-merchant benefits, the benefits associated with the values of use and non-use of surface waters can be estimated at 500 million euros per year. We therefore accept a non-merchant benefit of achieving good status of all inland waters (groundwater and surface) between 850 and 1 150 million, with an average value of about 1 billion euros.

*Draft vision of merchant and non-merchant benefits of achieving good status*

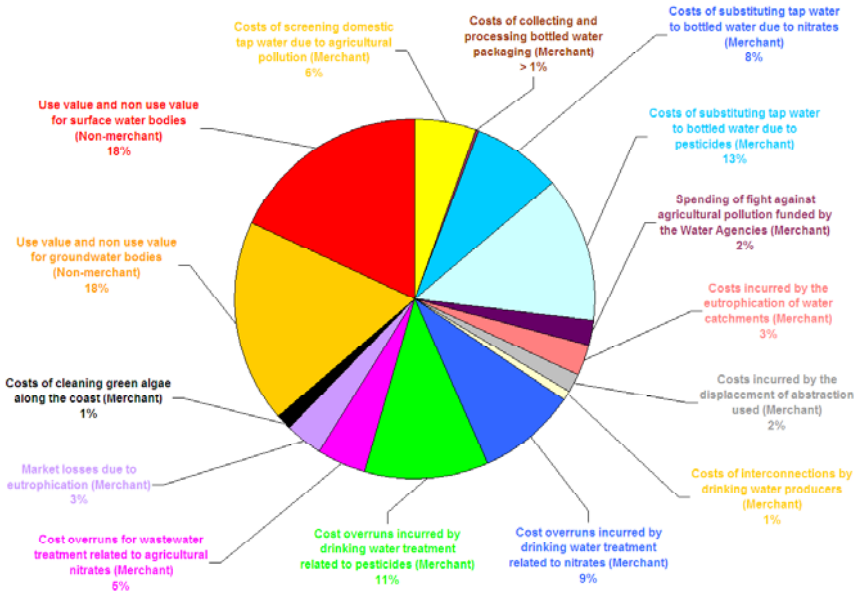
Table 7 and Figure 15 allow to have an overview of benefits of achieving the good status.

**Table 7 - Benefits (merchant and non-merchant) of achieving good status**

| | Min. | Max. |
|---|---|---|
| **Merchant benefits** | **1,113** | **2,395** |
| ➢ Costs of substituting tap water to bottled water due to nitrates | 220 | 220 |
| ➢ Costs of substituting tap water to bottled water due to pesticides[11] | - | 710 |
| ➢ Costs of collecting and processing bottled water packaging | 10 | 14 |
| ➢ Costs of screening domestic tap water due to agricultural pollution | 143 | 161 |
| ➢ Expenses of reducing farming pollutions incurred by the Water agencies | 60 | 70 |
| ➢ Costs incurred by the eutrophication of water catchments | 60 | 100 |
| ➢ Costs incurred by the displacement of abstraction used | 24 | 60 |
| ➢ Costs of interconnections by drinking water producers | 18 | 36 |
| ➢ Cost overruns incurred by drinking water treatment related to nitrates | 120 | 360 |
| ➢ Cost overruns incurred by drinking water treatment related to pesticides | 257 | 358 |
| ➢ Cost overruns for wastewater treatment related to agricultural nitrates | 100 | 150 |
| ➢ Market losses due to eutrophication | 71 | 106 |
| ➢ Costs of cleaning green algae along the coast | 30 | 50 |
| **Non-merchant benefits** | **850** | **1,150** |
| ➢ Use value and non use value for groundwater bodies | 350 | 650 |
| ➢ Use value and non use value for surface water bodies | 500 | 500 |
| **Total of the benefits of achieving good status** | **1,963** | **3,545** |

Source: CGDD/SEEIDD/ERNR2, 2010-2011

**Figure 15 - Proportions of merchant and non-merchant benefits**




Source: CGDD/SEEIDD/ERNR2, 2010-2011

[11] Pending an ad hoc study, this figure will only be retained for the upper bound of the potential benefits of good status.

The total benefits of achieving good water status would therefore be of around 2.75 billion euros a year with 64% (1.75 billion) would come from merchant benefits (for the only areas evaluated) and 36% (1 billion) of non-merchant benefits.

### 2.1.4. Benefits due to the improvement of bathing water on the whole territory

Among the benefits of the improvement of water quality due to water resources management, the example of bathing water proves to be extremely interesting since the health and tourist consequences of these recreational activities are huge. For example, the application of the EU directives on bathing and shellfish water quality at the end of the 1970s reduced by a factor of ten the cases of hepatitis A in France.

The report "Health status of bathing water in the sea and fresh water" of 2009 of the Ministry for Health and Sports [8] allowed drawing a positive assessment over the bathing season of 2008. During the latter, 33,775 samplings were made at 3,312 control points. The results of these controls reveal that 96.4% of the beaches comply with the standards of the European Directive 76/160/EEC of 8 December 1975 and with the provisions of the code of public health.

**Table 8 - Bacteriological quality of the classified points (bathing season 2008)**

| **Monitoring points complying with the EEC directive** | | | |
|---|---|---|---|
| Water quality | Sea water | Fresh water | Total |
| A : good quality water | 1,387 (70.5%) | 609 (45.3%) | 1,996 (60.3%) |
| B : average quality water | 526 (26.7%) | 669 (49.8%) | 1,195 (36.1%) |
| Total of complying points | 1,913 (97.2%) | 1,278 (95.1%) | 3,191 (96.4%) |

| **Monitoring points not complying with the EEC directive** | | | |
|---|---|---|---|
| Water quality | Sea water | Fresh water | Total |
| C : water that can be momentarily polluted | 53 (2.7%) | 55 (4.1%) | 108 (3.3%) |
| D : bad quality water | 0 (0.0%) | 10 (0.7%) | 10 (0.3%) |
| Total of non-complying points | 53 (2.7%) | 65 (4.8%) | 118 (3.6%) |

| | | | |
|---|---|---|---|
| Sub-total of classified points | 1,966 (99.9%) | 1,343 (99.9%) | 3,309 (99.9%) |
| Sub-total of the points whose frequency has to be increased | 2 (0.10%) | 1 (0.07%) | 3 (0.09%) |
| **Total of the controlled sites** | **1,968 (100%)** | **1,344 (100%)** | **3,312 (100%)** |

Source: Health status of bathing water in the sea and fresh water, Ministry for Health and Sports [8]

## 2.2. Direct socio-economic impacts of "water resources management"

Water management represents about 174,000 direct jobs, including more than 3,000 private researchers and 133,000 private jobs. Those regroup about 51,000 jobs in construction and public works, 46,000 jobs with the operators of drinking water supply and sanitation utilities, 27,000 with land managers[12], and 7,000 with product manufacturers. It represents an annual expenditure of approximately 27,000 million euros, i.e. 1.35% of the French GDP. As water is a transverse challenge which conditions both human life and health, biodiversity and the development of all the economic activities, its availability, its quality and its sustainable management have an impact on all these activities. We will only quote some economic sectors which particularly benefit from sustainable water resources management in France.

### 2.2.1. Tourism

The first economic sector benefiting from better water resources management has a direct link with the improvement of bathing water quality as mentioned in the preceding point. Indeed, the quality of water and aquatic environments is a determinant of certain tourist flows, for seaside tourism in particular, linked to some labels, including the blue flag. The latter is based, in particular, on the compliance with the bathing quality standards of the European directives, standards whose environmental requirements were increased in 2006. Compliance with these standards forced many coastal municipalities to increase the performances of their waste water treatment plants by a total investment then estimated at 1,500 million euros: an assessment made in 2004 by the Water agencies estimated the cost of inaction at about 1 billion euros corresponding to the annual economic losses of all the French seaside towns concerned, if they were not complying with the standards. The study estimated that the decrease in economic resources thus avoided, thanks to the improvement of water quality, would compensate the investment made for compliance in less than 2 years.

[12] Farmers in biological or "integrated" agriculture.

### 2.2.2. Hydropower

In 2008, hydropower produced 63 Terawatt hours (TWh) accounting for 12.4% of the national electricity production. This hydropower production was slightly higher than the national exports of electricity in 2008, i.e. 58.7 TWh, which earned 2,800 million euros and reduced of about the same amount the energy bill of France, which has been a net exporting country of electricity since 1981 [9].

### 2.2.3. Fishing, aquaculture and fish-farming

In 2007, the sales of sea fish, highly dependent on the quality of inland waters which are discharged into coastal water, represented 1,098 million euros for 413,000 tons sold. Entirely dependent on the quality of fresh and coastal waters, the sales of oyster shells, shellfish, cephalopods and those of fish farming reached 626 million euros for 271,000 tons sold and 161 million euros for 46,000 tons respectively. There were then 19,936 direct jobs in this market which generates consequent repercussions in the agri-food, catering and tourist sectors (source : Ministry of agriculture / Agrimer).

### 2.2.4. Natural mineral waters

- Economic weight

In 2004, the industry of natural mineral waters generated a sales turnover of **3.5 billion euros**, which accounts for 2.5% of the French total agri-food industry (140 billion euros). In Europe, the production of natural mineral water reaches about 25 billion litres. With more than 6.5 billion litres produced in 2004, France is the third natural mineral water producer of the European Union after Italy and Germany which have 7.8 and 7.5 billion litres of mineral water respectively produced per annum. The French average yearly consumption of mineral water was 142 litres per capita in 2006 [37].

- Employment

In France, the number of direct jobs generated by the bottled water industry is estimated at 10,000 people. The number of indirect jobs, without considering the spa industry, is very high and estimated at more than 30,000 people. Most of these jobs cannot be delocalised, because dependent on the springs. They participate in the dynamism of often-isolated areas where the exploitation of a spring is sometimes the only industrial activity.

The water-bottling industry did not break its bonds with hydrotherapy, and, in the majority of the 108 French thermal sites, the same spring feeds both types of activity. It is especially the case of Contrexéville, Evian, Thonon-les-Bains, Vichy and Vittel. Spas and hydrotherapy still generate 10,000 direct jobs according to the specialists, around 50,000 indirect jobs (lodging, catering, etc.), as much induced employment (trade, leisure, tourism, etc.) and remain highly dependent on the vitality of the natural mineral water trademarks.

### 2.2.5. Spas and hydrotherapy

In 2005, 108 thermal spas, mainly located in the Rhone-Alps, Auvergne, Aquitaine, Languedoc-Roussillon and Midi-Pyrénées regions, accommodated 547,070 curists having taken 9.052 million days of cure there. These cures annually represent a health expenditure of about **330 million euros** refunded by health insurance and mutual health organisations. The exploitation of a mineral water for therapeutic purposes is subordinated to obtaining an authorisation from the Minister for health after favourable opinion from the departmental council of the environment and health and technological risks and opinion from the National Academy of Medicine (art. R.1322-7 of the code of public health).

The thermal spas employ 13,800 people to whom are added 1,100 private doctors and about 500 paramedical personnel. In 2003, in addition to their lodging and daily expenses in the thermal spas, the curists spent **690 million euros,** mainly in hotels, local restaurants, recreational activities (casinos, visiting sites) and in the local trade and services [27]. This expenditure contributes in creating or keeping **110,000 jobs** [11]. The thermal investments for the water resource amounted in total to 42 million euros from 1989 to 2003, which hardly corresponds to 2.8 million euros per annum. The economic repercussions of hydrotherapy are all the more significant than they mostly benefit to small towns in rural mountain areas [11]: 71% of the thermal spas have less than 5,000 inhabitants. Due to such benefits, the main thermal areas decided to make mineral springs one of their priorities. Auvergne thus included a *"Hydrotherapy"* component in its contract within the State-Region plan 2000-2006 [12]. The spa contracts made it possible to have coherent policies aiming at controlling the water resource and at modernising the often ageing infrastructures.

### 2.2.6. Recreational activities related to water uses: the example of fishing

The water uses, related to recreational activities and culture, are numerous and of varied nature (bathing in a natural water body or in a swimming pool, fishing, nautical sports, watering and maintenance of parks and gardens…). They do not inevitably mean high consumption. But they diversify at an intensive pace. For example, many cities having decided to recover

their banks and arrange them, river urbanisation followed, from their access to their crossing, whereas until then these zones were rather devoted to industrial or transport activities.

In 2006, the ONEMA counted between 1.3 million and 1.4 million open water fishermen and anglers in France. The number of people who practise recreational and sport fishing at sea is estimated at nearly 3 million. Between 1.5 million and 1.8 million fishermen practise fishing in boats, between 1 million and 1.2 million are fishing from banks and from 1 million to 1.5 million are fishing by hand (source : BVA). These fishermen represent a consuming market, which, according to estimates, varies between 350 million euros and 380 million euros and generates a French production of fishing articles of 40 million euros (2004).This market, which has remained stable for a long time, encountered slow recession these past years. Recreational fishing has economic repercussions on the tourist, hotel and catering industry, on the traditional and specialised trade and on the retailing and distribution industry. Finally, the fishermen presence and activities are an effective relay in the protection and conservation of biotopes, as well as of the fauna and flora species concerned.

### 2.2.7. Other market uses

Other uses raise more questions such as the storage of chemically stabilised water bodies to manufacture artificial snow in winter: 325 winter resorts thus manufacture 78,000 million $m^3$ of snow each year on the average.

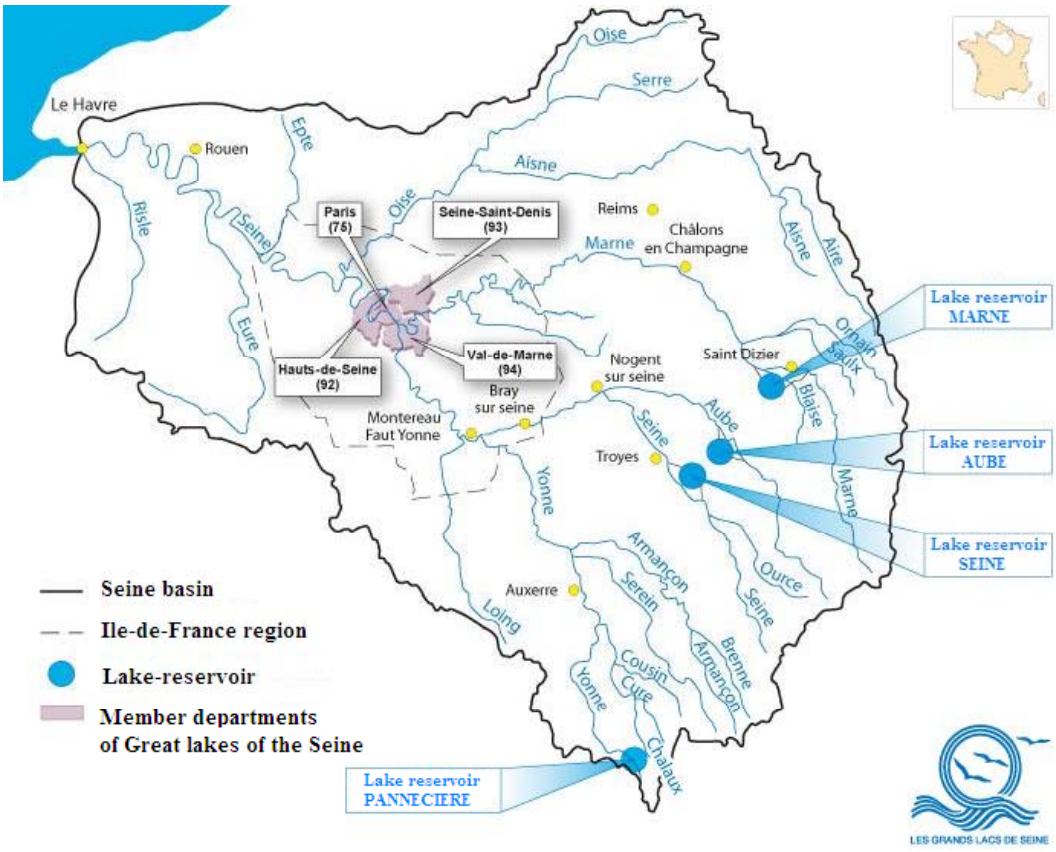
## 2.3. Benefits of governance and better quantitative management of water resources

### 2.3.1. Benefits due to better risk control

In France, flood hazards immediately recall, in the people collective memory, the floods undergone by the city of Paris and its suburbs in 1910. If human losses were incredibly low (only one victim), the property damages were considerable: no electricity for weeks, no gas for days, no drinking water, household refuse floating in the flooded streets, etc. It had been then necessary to wait nearly two months before all that water was evacuated and several more months before activities became normal again.

To prevent such a situation to occur again, four lake-reservoirs were built upstream of Paris, in the south-east of the Ile-de-France Region (see Figure 16), under the leadership of the EPTB: Seine Great Lakes. The four lakes provide a reservoir of over 800 million $m^3$ [13].

**Figure 16 - Map of the four lake-reservoirs built upstream of Paris**




Source: Seine Great Lakes, http://www.seinegrandslacs.fr/ [13]

Meanwhile, in the 1990s, Seine Great Lakes conducted a study (updated in 2010) to estimate damages due to flooding in the Paris region in order to understand how the building of these four lake-reservoirs lowers the amount of damage [32].

This study used a hydraulic flow model to estimate the direct and indirect damage surface due to overflow of streams but does not assess the damage of any kind (direct, indirect, or networks surface) due to the effects of rising groundwater or due to the spread of the flood in the underground networks. Indeed, this phenomenon is poorly understood and difficult to comprehend on a scale as large as the region. Damage estimates are both direct (losses from a physical impact of causing a raw material or physical destruction) and indirect (costs of rehabilitation, intervention or loss of use or time resulting from a flood ).

If a flood type 1910 occured today, a million people would be moved, nearly 55,000 ha would be flooded for several months, 439 municipalities would be affected, 170,000 companies would be possibly “impacted” and half of the economic activity would be immediately stopped. Indeed, today, approximately 85% of the flood plain of the Seine is urbanised in Paris and its close neighbourhood. Moreover, taking into account the weight of Paris area in the French economy, such a flood would have a national incidence.

Electricity would be the first affected network with 1.8 million Parisians deprived of electricity. By ripple effect, all the other networks supplied with electricity would be affected, namely drinking water supply, public transportation, banking houses, food stores, etc. The multiplication of the underground installations of emergency power generators, car parks, and sensitive installations (computers, records,…), which occurred these past fifty years, can hardly reassure on the consequences of such a flood.

The Seine Great Lakes study amounts to 5.9 billion euros the total cost of damage if a flood type 1910 would happen today. Without the presence of four lake-reservoirs, the damage would go up to about 14.5 billion euros. Risk management can therefore drive to, in this case, a reduction of almost 60% (8.6 billion) economic impacts of such a catastrophe. These estimates should, moreover, be regarded as a low range to the extent that the following types of damage could not be assessed comprehensively:

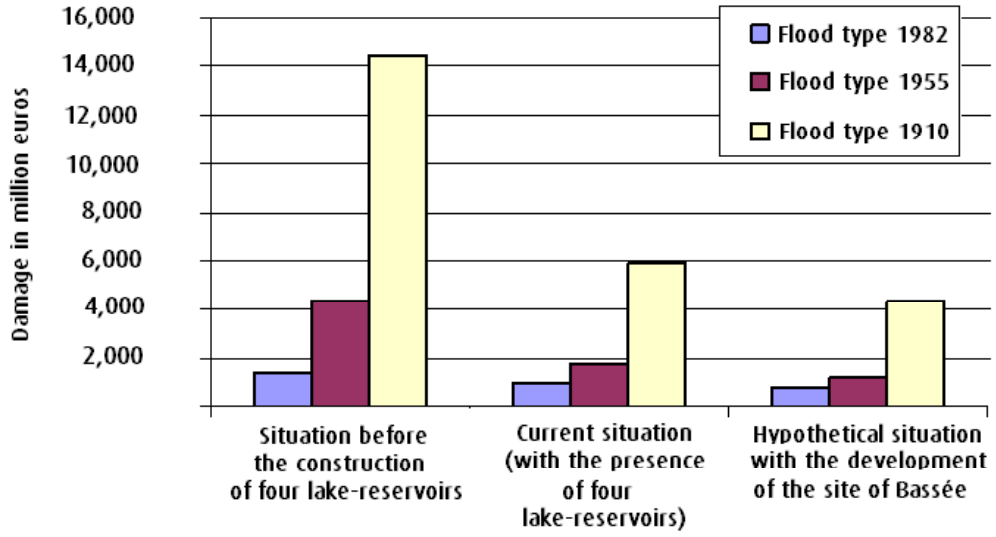
- Direct damage to roads,
- Damage related to direct or indirect networks (incomplete estimate),
- Damage related to local development: lower land and housing,
- Said intangible damage related to flooding (effect on health, psychological effect, damage to cultural heritage, the environment, loss of tourist attraction in the affected areas, etc.).

Despite the significant action of the four lake-reservoirs, the Ile-de-France is still vulnerable to major floods. The protection is due to a partial control of only 17% of the watershed upstream of Paris, and insufficient command of the Yonne Pannecière whose dam controls only 2% of the basin. However, other works, which are not managed by the EPTB Seine Great Lakes, are also used to regulate the flow of the Yonne. Thus, the artificial lake of Settons, located in the regional park of Morvan in Nievre can store 19.5 million $m^3$ in the months between November and June in order to avoid flooding of the Yonne, and thus the Seine.

To improve this situation it is expected a development on the site of the Bassée in Seine-et-Marne with the construction of a pool of "non-flood." This development would consist of storage units (or pots) filled by pumping during heavy floods. The project includes 58 km of embankment which defines low-rise 2 300 hectares of over-stocking areas downstream of Bray-sur-Seine near the confluence of Seine and Yonne. The capacity to reduce the crest of the Yonne is estimated at 55 million $m^3$ [13].

Also as part of the study of Seine Great Lakes previously mentioned, the impact of the development of the Bassée on the damage of a flood like the 1910 was evaluated. Damage, compared to the current situation would be further reduced to about 1.6 billion euros, and from 5.9 to 4.3 billion euros. The following figure is used to display the amount of damage, depending on the situation of proposed development, both from a hundred-year flood of 1910 that type of minor flooding like the 1955 and 1982.

**Figure 17 - Damage of a flood type 1910 on the Paris region according to the layout of the Bassée (in millions of euros)**




Source: Egis Eau for Seine Great Lakes, December 2010 [32]

### 2.3.2. Benefits due to the multi-stakeholder governance of the basin

These benefits are very high taking into account, in particular, the citizens' sensitivity to any increase in the water price and the multiplicity of the interested parties who often express antagonistic expectations in the preparation of the SDAGE and action plans of the Water agencies. Thus:

- The Seine-Normandy Basin Committee represents about 10,000 municipal contracting authorities elected by universal suffrage, primarily in rural areas and whose expectations and needs considerably vary according to the geographical location of their municipality (upstream or downstream of Paris agglomeration, oyster producers, dependent on seaside tourism conditioned by bathing water quality,…), their levels of income, their specific quantitative and qualitative water problems, etc. This committee however voted in 1998 the acquisition and sustainable management of a vast wetland whose benefits were primarily advantageous for the Parisians, in terms of flood prevention. It also prioritised the treatment of the drained storm water of Paris agglomeration whose very significant impacts on the quality of the downstream resources (including marine resource) had been highlighted by the PIREN-Seine international research programme supported by the Seine-Normandy Water Agency (AESN). On the Sélune River, a river of the Seine-Normandy basin, the Local Water Commission voted the levelling down of two hydropower dams which could not be arranged to restore fish continuity.

- The Rhine-Meuse Basin Committee allowed finding a solution to the issue of the fishways in the Rhine where a balance between hydropower and ecological continuity could be found in a however difficult context of transboundary discussions. Or still, to the issue of chlorides in the Moselle, eminently complex conciliation between local, economic, ecological and transboundary stakes, for which it is probably the Basin committee arrangement which only allowed emerging from this legal dispute.

Generally, the vast majorities which approved the SDAGE in autumn 2009 show that compromises are possible on many provisions, without eluding some elements of the debate. Moreover, the action of the Basin committees, "intermediate" levels of water policy, is today strongly relayed by that of the Local Water Commissions, responsible for developing the SAGEs and in charge of making truly "local" compromises emerge.

### 2.3.3. Benefits due to the development of waterways transport

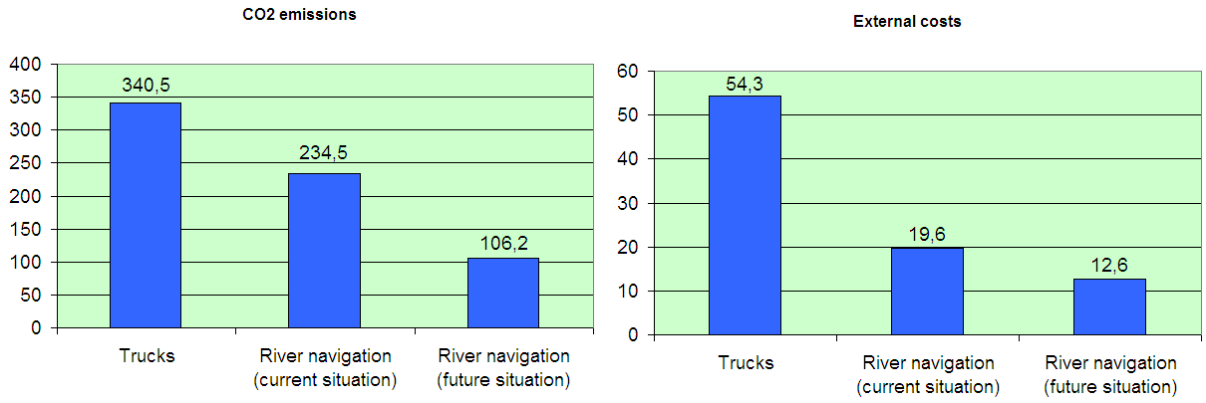
Waterways transport is an interesting alternative to road transport with high $CO_2$ emission. In order to show its ecological and economic effectiveness, the "Voies Navigables de France" (VNF), the national authority in charge of the management of part of the network of inland waterways, designed an "eco-calculator", making it possible to compare the carriage of goods on waterways to the carriage of goods by road. This calculator (called EVE) also takes into account $CO_2$ emissions, fuel consumption as well as externalities such as noise, traffic blocks, air pollution or the risks of accident and pollution [14].

The VNF economic newsletter of the 2nd semester of 2009 [15] gives an example of environmental benefits of waterways on a trip from Le Havre to the Nogent-sur-Seine. This estimate makes a comparison between the transportation of a TEU container by heavy-duty truck, by waterways transport in its current configuration and by waterways including the installations planned

between Bray and Nogent. The use of waterways in their current configuration allows reducing by 28% the $CO_2$ emissions between Nogent-sur-Seine and Le Havre. Modernisation work would lead to an even more significant benefit as it would involve a reduction of 55% of the emissions as compared to the current situation. The comparison of the externalities is still representative of the benefits generated by waterways transport.

Investing in the development of waterways with upgrading of dikes, rehabilitation of quays and banks, restoration of channels and infrastructures, as done in France, thus allows offering a true alternative to road transport and generating huge environmental benefits.

**Figure 18 - Comparisons for the transportation of a TEU container (in euro per TEU) on a trip Le Havre - Nogent**




Source: The VNF economic newsletter of the 2nd semester of 2009 [15]

# 3. Investing in water resources management

## 3.1. Information on water resources management

To mitigate the problem of the dispersion of information between the many public and private data producers, a partnership arrangement was reinforced by the LEMA of 2006, following the National Water Data Network (RNDE) resulting from the Water Law of 1992: the Water Information System (WIS) organises the collection, storage, enhancement and dissemination of data on water, aquatic environments and uses of all the French metropolitan and overseas departments. The WIS takes into account the needs expressed by the various data users which are the services of the state, contracting authorities, managers, experts, citizens, etc. These data are of a quantitative, physicochemical, biological, morphological, economic and regulatory nature. The Water and Biodiversity Directorate of the Ministry of Ecology lays down the strategic orientations of the WIS. The ONEMA coordinates the WIS and supervises the governance system. It is responsible for and finances methodologies, enhancement, dissemination and reporting to the European Commission. The International Office for Water is in charge of the technical management of the WIS.

## 3.2. Evaluation of the costs of water resources management

### 3.2.1. Overview of the expenses related to water

*Overall vision of the expenditure related to water*

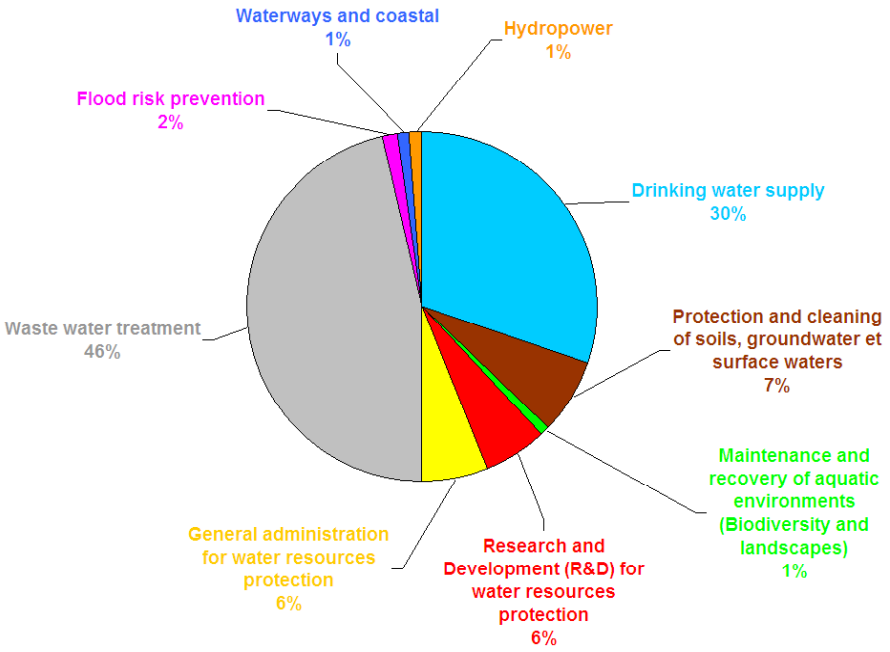
In 2007, the total expenditure related to water amounted to nearly 28,3 billion euros, about 76.5% of which (21.6 billion euros) concerned drinking water supply and sanitation.

**Figure 19 - Expenditure related to water in 2007 (in million euros and percentages)**

| Types of expenditure related to water | Amounts |
|---|---|
| **Water supply and sanitation** | **21,609** |
| ➢ Drinking water supply | 8,533 |
| ➢ Waste water treatment | 13,076 |
| **Environments and natural resource management** | **2,190** |
| ➢ Protection and cleaning of soils, groundwater et surface waters | 1,949 |
| ➢ Maintenance and recovery of aquatic environments (Biodiversity and landscapes) | 241 |
| **Knowledge, administration, research** | **3,396** |
| ➢ Research and Development (R&D) for water resources protection | 1,662 |
| ➢ General administration for water resources protection | 1,734 |
| **Heritage and damage to the great water cycle** | **1,051** |
| ➢ Flood risk prevention[13] | 432 |
| ➢ Waterways and coastal | 332 |
| o Voies Navigables de France (VNF) | 297 |
| o Coastal Conservancy | 45 |
| ➢ Hydropower[14] | 285 |
| o Electricity of France (EDF) | 225 |
| o National company of the Rhone | 60 |
| **Total expenditure related to water** | **28,254** |

[13] Value for year 2009.

[14] Value for year 2008.




Sources:

Environmental economics in 2009 - Report of the Commission of audits and environmental economics – 2011 Edition [16]

SEEIDD estimates from Environmental economics in 2009 - Report of the Commission of audits and environmental economics – 2011 Edition [16]

SEEIDD estimates from Environmental economics in 2008 - Report of the Commission of audits and environmental economics – 2010 Edition [28]

Environmental economics in 2007 - Report of the Commission of audits and environmental economics – 2009 Edition [29]

Studies and documents to be published in the first half of 2012 on Funding flood risk prevention

Interviews with the Great Lakes of the Seine

Management report 2008 of the Voies Navigables de France [19]

Interviews with Voies Navigables de France

Annual activity report 2007 of the Coastal Conservancy [33]

Report on Sustainable Development 2008 of EDF Group [2]

Press release – Discovery day on hydraulics on 27 June 2009 [17]

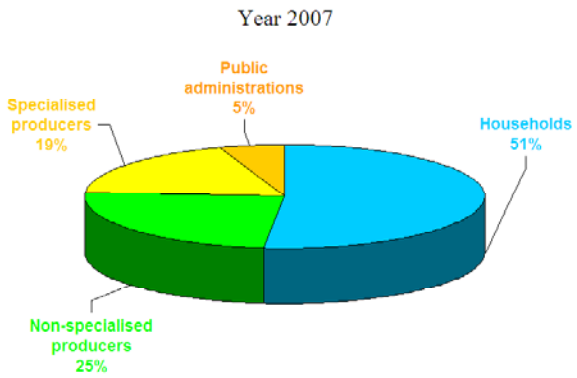
Yearly 2008 report of the National Company of the Rhone [18]

### 3.2.2. Expenditure related to water supply and sanitation

*Drinking water supply*

**Figure 20 - Expenditure related to drinking water supply (in million euros for the years 2000, 2005, 2006, 2007 and in percentages for the year 2007)**

| | 2000 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Households | 3,635 | 4,252 | 4,315 | 4,405 |
| Non-specialised producers | 1,666 | 2,024 | 2,093 | 2,097 |
| Specialized producers | 1,046 | 1,958 | 1,569 | 1,591 |
| ➢ *Municipalities and EPCI* | *937* | *1,772* | *1,312* | *1,303* |
| ➢ *Specialised enterprises* | *109* | *186* | *257* | *288* |
| Public administration | 368 | 408 | 423 | 441 |
| ➢ *Water agencies* | *202* | *191* | *189* | *199* |
| ➢ *General and Regional councils* | *166* | *217* | *234* | *242* |
| **Total** | **6,714** | **8,641** | **8,400** | **8,533** |

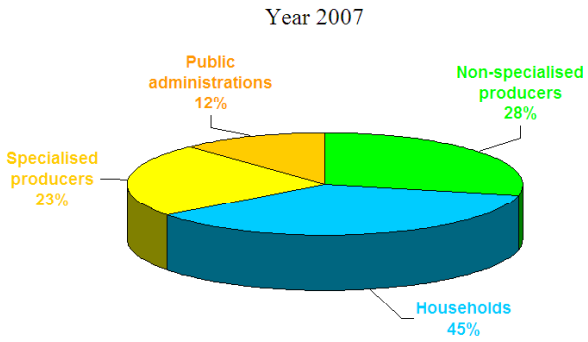



Source: Environmental economics in 2009 - Report of the Commission of audits and environmental economics – 2011 Edition [16]

*Waste water treatment*

**Figure 21 - Expenditure related to waste water treatment (in million euros for the years 2000, 2005, 2006, 2007 and in percentages for the year 2007)**

| | 2000 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Non-specialised producers | 3,142 | 3,649 | 3,691 | 3,691 |
| Households | 3,923 | 4,469 | 4,687 | 4,770 |
| Specialised producers | 1,688 | 2,520 | 2,781 | 3,065 |
| ➢ *Municipalities and EPCI*[15] | *1,472* | *2,216* | *2,240* | *2,420* |
| ➢ *Specialised enterprises* | *216* | *304* | *542* | *646* |
| Public administrations | 1,182 | 1,418 | 1,485 | 1,550 |
| **Total** | **9,935** | **12,056** | **12,644** | **13,076** |

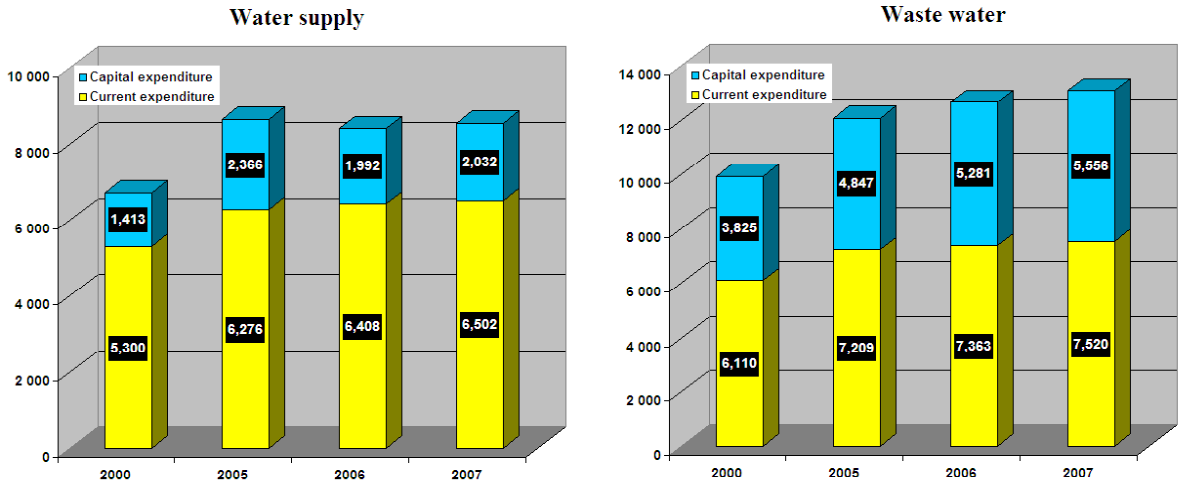



Source: Environmental economics in 2009 - Report of the Commission of audits and environmental economics – 2011 Edition [16]

*Detail for water supply and sanitation by type of expenditure*

The total expenditure related to drinking water supply and sanitation (operation and investment) increased by an average of about 4% per year between 2000 and 2007 (twice as much as the inflation rate). Compliance with the Community standards of the waste water treatment plants and sewerage systems explains the more significant rise of investment costs in infrastructures which increased twice faster and higher than the current expenditure, averaging about 6% as against 3%.

**Figure 22 - Expenditure related to sanitation and drinking water supply over the 2000-2007 period (in million current euros)**




Source: Environmental economics in 2007 - Report of the Commission of audits and environmental economics [16]

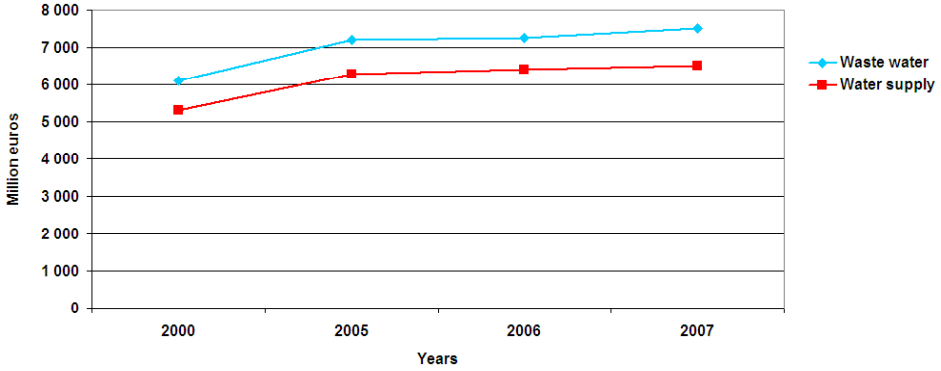
*Current expenditure of water supply and sanitation*

Current expenditure includes the various activities of management, co-ordination, planning, research and development, day-to-day administration and communication.

The current expenditure related to drinking water supply and sanitation significantly increased in the same proportions over the 2000-2007 period with respective rises of 23.1% (3.3% per annum) and 22.7% (3.2% per annum).

[15] EPCI : Public bodies for inter-municipality cooperation.

**Figure 23 - Current expenditure related to sanitation and drinking water supply over the 2000-2007 period (in million current euros)**



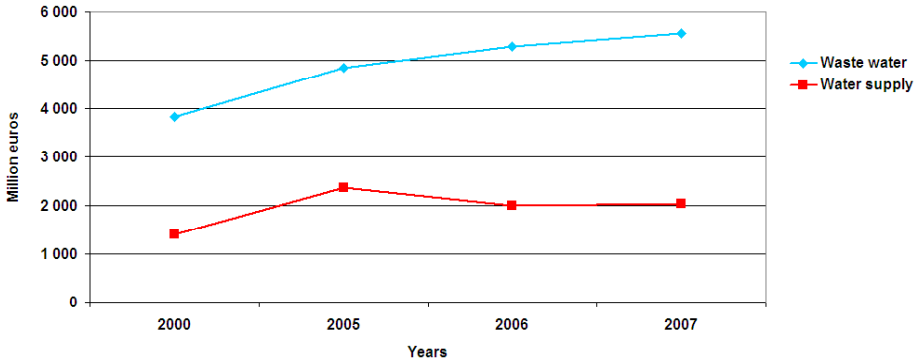

Source: Environmental economics in 2007 - Report of the Commission of audits and environmental economics [16]

These costs are dependent to a large part of household water consumption. However, in recent years, a downward trend of consumption has been noted at the same time on the whole territory by the water producers and at the level of the waste water treatment plants. Should this tendency continue on the long term, this will have consequences on the financing terms of spending.

*Capital expenditures of water supply and sanitation*

Capital expenditures for sanitation include expenditures for the construction of sewage systems and waste water treatment plants for collective, industrial and on-site systems. As concerns water abstraction and supply, the expenditure in infrastructures includes installations for water intake, conveyance and supply to the treatment plants, to storage installations and to the water supply networks.

**Figure 24 - Capital expenditure related to sanitation and drinking water supply over the 2000-2007 period (in million current euros)**




Source: Environmental economics in 2007 - Report of the Commission of audits and environmental economics [16]

From 2000 to 2007, the value of the investments made in sanitation remained definitely higher than those in drinking water supply. Developments take place instead in the same proportions with respective increases of 45.3% (6.5% per year) and 43.8% (6.3% per year). In 2007, sanitation monopolised more than 70% of the financial efforts in the capital.

In 2004, France had a waste water drainage system of 280,000 km of drains to which were added 93,000 km for storm water drainage. There are 17,300 waste water treatment plants with a total capacity of 89 million population-equivalents. As regards the drinking water supply network, it consists of 878,000 km of pipes (in 1950, there was only 8% of this linear). This equipment is, for the most part, the property of public authorities, which financed up to 64% of the investments in 2007 (50% for municipalities or inter-municipalities and 14% for departments and regions), the remainder being dealt with by the Water agencies to a total value of 13%, private companies to a total value of 14% and households for on-site sanitation (9%).

The value of the network was estimated at 85 billion euros in 2001, with a value of new installations estimated at 225 billion euros, including private on-site sanitation.

About 95% of the population's waste water is treated (including 85% by collective systems) and 99% of the French population is connected to a drinking water supply network. This coverage rate implies that there will be little development of new

networks, the main investment having been already made. It is thus the renewal and compliance to the standards of the infrastructures which will be of prime importance in the coming years.

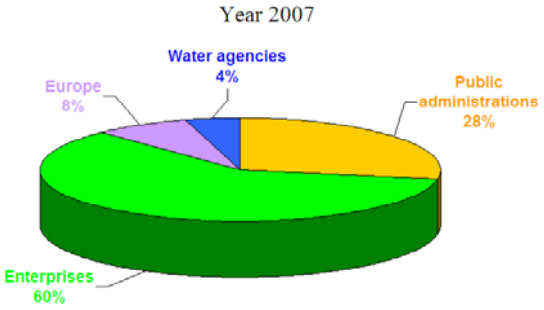
### 3.2.3. Expenditure related to environments and natural resource management

*Protection and cleaning of soils, groundwater and surface waters*

The scope of the protection of soil, groundwater and surface waters is defined by the Classification of Environmental Protection Activities (CEPA) in 2000 which classifies activities in environmental protection field. "*The protection and restoration of soil, groundwater and surface waters include the measures and activities aimed at prevention of polluting infiltrations, the decontamination of soil and water and soil protection against erosion and other physical damage and against salinization. Monitoring and control of pollution of soil and groundwater are included*" [16].

**Figure 25 - Expenditure related to the protection and cleaning of soils, groundwater and surface waters (in million euros for the years 2000, 2005, 2006, 2007 and in percentages for the year 2007)**

| | 2000 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Public administrations | 413 | 421 | 495 | 543 |
| ➢ *Central administration* | *312* | *256* | *283* | *266* |
| ➢ *Local administration* | *101* | *165* | *213* | *277* |
| Water agencies | 89 | 68 | 115 | 87 |
| Enterprises | 288 | 817 | 1,028 | 1,166 |
| Europe | 35 | 166 | 189 | 154 |
| **Total** | **824** | **1,472** | **1,827** | **1,949** |



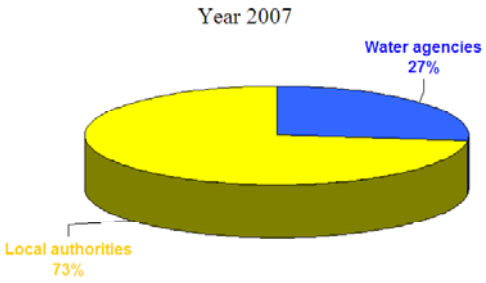

Source: Environmental economics in 2009 - Report of the Commission of audits and environmental economics – 2011 Edition [16]

*Maintenance and recovery of aquatic environments (Biodiversity and landscapes)*

The spending by municipalities and Water agencies in the maintenance and restoration of aquatic environments (rivers and wetlands) amounted to 241 million euros in 2007. These expenses, based on the system of aids granted by the Water agencies, have stagnated since 2005. That year, the increase in spending was particularly important with an increase of 25%. The expense of restoration and maintenance of rivers, helping to improve the ecological status of water increases by 2 million euros in 2007, marking the beginning of the implementation of the commitments of the ninth program Water agencies in which the interventions of restoration of aquatic environments are strengthened. Actions to correct the alteration of streams and wetlands to preserve their features relate to 15% of the existing linear helped by the Water agencies and 20,733 hectares of wetlands [29].

**Figure 26 - Expenditure related to the maintenance and recovery of aquatic environments (in million euros and in percentages for the year 2007)**

| | 2007 |
|---|---|
| Water agencies | 64 |
| Local authorities | 177 |
| **Total** | **241** |




Source: Environmental economics in 2007 - Report of the Commission of audits and environmental economics – 2009 Edition [29]

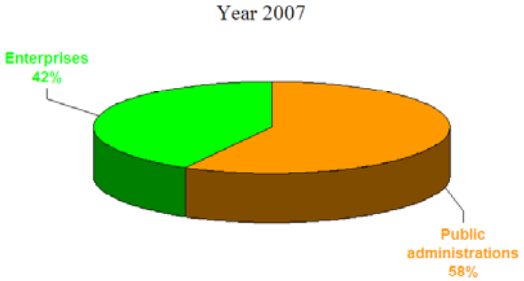
### 3.2.4. Expenditure related to knowledge, administration, research

*Research and Development for water resources protection*

The expenses of Research and Development (R & D) for the protection of water resources are the result of an estimate of SEEIDD from R & D environment expenses provided by the SOeS [16]. These expenses include all activities and R & D with an environmental objective: identification and analysis of pollution sources, mechanisms of dispersion of pollutants in the environment and their effects on humans, the species and the biosphere. It also includes R & D for the prevention and elimination of all forms of pollution as well as those relating to equipment and measuring instruments and analysis of pollution. R & D for the management of natural resources are also included [16].

**Figure 27 - Expenditure related to Research and Development for water resources protection (in million euros for the years 2000, 2005, 2006, 2007 and in percentages for the year 2007)**

| | 2000 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Public administrations | 693 | 898 | 938 | 967 |
| Enterprises | 340 | 495 | 663 | 695 |
| **Total** | **1,033** | **1,393** | **1,601** | **1,662** |




Source: SEEIDD estimates according to environmental economics in 2009 - Report of the Commission of audits and environmental economics – 2011 Edition [16]

*Research and development –" Cart'Eau" study*

R&D is essential in the environment as it determines the innovations which will allow increasing environmental protection while developing the competitiveness of some economic sectors (eco-technologies). To better know the skills that can be mobilised within the scientific community, ONEMA carried out in 2008, following requests from the CNE and the Ministry of Research, a mapping of R&D in France in the field of water and aquatic environments.

In France, the study (called "Cart'Eau") dealt with "inland" and "coastal" water bodies and those associated with them. A first inventory of the distribution of skills in R&D was then drawn up at national level:

- There are approximately 4,300 FTE (Full Time Equivalents) in public and private research (approximately 75% for the public sector and 25% for the private sector),

- 44% of the total staff of the public sector (i.e. 1,400 FTEs out of a total of 3,200 FTEs) are distributed in 6 public research centres (Cemagref, CNRS, IRD, BRGM, INRA, IFREMER), while universities are many, but with few staff members (over 50% of the staff belong to structures of less than 15 people),

- There are more than 70 research communities (groups around topical, geographical or technical fields) that reflect the "fragmentation" of the French R&D arrangement regarding water.

There is also a large variety of national and European funding programmes:

- In terms of success in European research programmes, the example of the 7$^{th}$ Framework Programme for Research and Development (FPRD) shows that for the water topic alone the French teams receive on the average (figures 2007-2008) 5 million euros per year out of 50 to 60 million euros. The annual funding allocated to the French scientific teams by the European Commission on water projects is a little less than 10 million euros.

- The main donor agency for research at the national level, the National Research Agency (ANR), has no programme specifically dedicated to water but a wide range of thematic programmes in which very many components of water research are addressed and require academic and research teams either public or private. The research projects on water amount on the average to 12 million euros per year, which represents about 1% to 2% of the programming of the ANR.

- Over the 2002-2008 period, the Ministry of Ecology initiated at least 14 thematic programmes on water (Water and Land, eco-toxicology, wetlands, risks related to pesticides, endocrine disrupters, floods, tropical ecosystems, biodiversity and global change, biological invasions, etc..). These programmes provide an amount of incentive funding for R&D on water of about 2 million euros per year.

- The ONEMA and Water agencies are subsidiarily involved as compared to the donor agencies for research, especially in supporting the transfer and use of results from research programmes, the development of tools and operational methods for public and private users and stakeholders. The amount of resources provided by the ONEMA and Water agencies is around 15 million euros per year. This amount is of the same order of magnitude as the funding by the ANR in the same field.

- Currently, half of the contracts between the State and metropolitan area (i.e. 11) include R&D actions in the field of water.

- In the absence of a competitive cluster dedicated to inland water, the clusters of public and private research have increased and five French clusters partially or totally deal with inland water and aquatic environments.

*General administration for water resources protection*

This field covers the general government spending not allocated to another area, and which correspond to administration or management activities [28].

**Figure 28 - Expenditure related to general administration for water resources protection (in million euros for the years 2000, 2005, 2006, 2007 and in percentages for the year 2007)**

| | 2000 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Central public administration | 345 | 658 | 717 | 750 |
| Local public administration | 564 | 772 | 862 | 984 |
| **Total** | **909** | **1,430** | **1,579** | **1,734** |


Source: SEEIDD estimates according to environmental economics in 2008 - Report of the Commission of audits and environmental economics – 2010 Edition [28]

### 3.2.5. Expenditure related to heritage and damage to the great water cycle

*Flood risk prevention*

All information presented in this section on funding for the prevention of flood risks in France come from a specific *Studies & Documents* from the SEEIDD which publication is expected in the first half of 2012.

Presentation of the flood risk in France

The flood risk is the major natural hazard in France in terms of cost of damage and casualties. It concerns one third of municipalities, including 300 major cities in the country. Two million people are thus likely to be affected by this risk to an area of 22,000 square kilometers and 160,000 kilometers of rivers.

In the scope of insurance “cat' nat” (see section 4.1.1 of this document for further details on this point), the costs of flood damage was estimated at about 400 million euros yearly between 1995 and 2006. These damages do not include those “uninsured” or damage covered by the agricultural disaster [39]. Logically, the cost of damage varies greatly from year to year. For example, the year 2010 was one of the largest with 2.1 billion euros in damages compensated by insurance only for flood events of the Var and the Xynthia storm [40, 41] .

In terms of victims, floods are the leading cause of death for natural hazards, before the storms. Over the period 2001-2011, the number of victims amounted to 131. The flood risk is also the best known by the public. The events in Paris, Vaison-la-Romaine, Nimes, the Var or the Vendée with Xynthia storm are thus present in the collective memory.

To reduce the severity of flooding, France has almost 7,500 kilometers of levees.

As regards the specific situation of the Capital, the dramatic floods of 1910 and 1921 led to the building, since 1928, of 4 lake-reservoirs in the Seine and the Marne basins between 1949 and 1990 for replenishing low flows in period of drought in addition to protecting the urban area against floods: the Der-Chantecoq Lake (350 $Mm^3$) on the Marne, the Orient Lake (205 $Mm^3$) on the Seine, the Amance and Temple Lake (170 $Mm^3$) on the Aube and the Pannecière Lake (80 $Mm^3$) on the Yonne.

Panorama of actors funding flood prevention

o State

The State is the central actor in policy implementation for flood prevention in France. Its actions are performed at a central level and at a decentralized level through Budget funds and through the Barnier fund, and also through its operators.

- With regard to flood prevention and management, **ministries** concerned are mainly: the Ministry of Ecology, the Ministry of Agriculture and the Ministry of the Interior. Otherwise, the **decentralized administration** is composed of services at regional and departmental levels that contribute to carrying out the tasks of the state defined by each Ministry. The State actions for flood prevention are performed through **Budget funds** (voted by the Parliament) and through the **Barnier fund** (or Fund for the prevention of major natural hazards). It has been created by the law of February 2, 1995. The scope of this fund was to finance the expropriation of property at risk of foreseeable natural landslides, avalanches, flash floods or seriously threatening human lives as well as expenses related to limited access

and possible demolition of property at risk in order to prevent any future occupation. Several Budget laws came broaden the powers of the Fund. Since 2009, the Budget law entitles a maximum of 125 million euros a year for the Barnier Fund to help fund studies and prevention or protection against natural hazards with local authorities or groups provide project management [20, 21].

- **State operators** are agencies that are legally distinct from the State and which are used to implement policy. Operators of the state are primarily public institutions that correspond to public entities with legal and financial autonomy. In 2009, the operators which were involved in flood prevention were: Voies Navigables de France (VNF), Water Agencies, the National Geographic Institute (IGN), Météo-France and the Hydrographic and Oceanographic Department of the Navy (SHOM). In addition, **other operators** like the Paris Transport Authority (RATP) may have an interest in investing in flood prevention.

o Local authorities

In addition to the State, local governments (regions, departments and municipalities) also play a role in the flood risk prevention. It includes:

- **Regional Councils and General Councils**. Although they have no regulatory obligation, some are funding flood risk prevention measures given the importance of the risks that their territories face or may be facing.

- **Municipalities**. They have statutory obligations in terms of natural hazards. The mayors have a global administrative police power and have to disseminate information on risk. Specifically, they are to take all necessary measures to prevent disturbance to public order such as safety, security and public health which involves the prevention of natural risks.

Interventions of local authorities may be in the State-Region Projects Contracts (CPER) contracts, State-Region Interregional Projects Contracts (CPIER) or **Programmes of Action for the Prevention of Flooding (PAPI)**. Launched in 2002, they are intended to promote integrated management of flood risks to reduce their harmful effects on human health, property, economic activities and the environment. Tool contracts between the state and communities, the PAPIs allow the implementation of the national policy, at the basin scale.

- **Local Public Basin Authority (EPTB)**. They are involved in the management of rivers and streams, especially on floods at watersheds and subwatersheds scales.

- The **other supporting structures of SAGE**. The number of EPTB supporting SAGE is lower than the total number of SAGE. Thus, many other supporting structures of SAGE exist (Local Water Commissions).

*Focus on an EPTB: Seine Great Lakes*

The EPTB "Seine Grands Lacs" or "Seine Great Lakes" is a public authority created in 1969 and managed by a board of directors made up of 24 general councillors from four departments (Paris, Hauts-de-Seine, Seine-Saint-Denis, Val-de-Marne).

It is entrusted with a two-fold assignment: to lower high water levels and replenish low water levels. The objective of this public authority is to intervene on the flows of the Seine and its tributaries (the Marne, Aube and Yonne) in order to avoid significant variations (flood or drought). It cannot prevent natural variations of river flow but contributes to alleviating them and limiting human and economic consequences. In this context, this authority is in charge of managing the four lake-reservoirs which were built upstream from the city of Paris to prevent damage due to a flood. The four lakes provide a storage capacity of over 800 million $m^3$ [13].

The budget of Seine Great Lakes is divided as follows: 12.2 million euros for current expenditure and 5.2 million for capital expenditure. 50% of this budget (8.7 million) is allocated to flood prevention.

o Europe

At European level, the European Regional Development Fund (**ERDF**) is intended to subsidize measures for the prevention of natural hazards. From a general point of view, this Fund aims to strengthen economic and social cohesion, and to correct regional imbalances. In addition to funding direct aid to investments in business and technical assistance measures, it can intervene in the financing of related infrastructure including research and innovation, telecommunications and the environment.

o Civil Society

Civil society (companies, associations, individuals) may also intervene in the prevention of natural hazards. However, its contribution is difficult to quantify and could not be assessed precisely here.

- The **companies** provide funding for the prevention of natural risks, but this contribution is very difficult to assess. This item may overlap that of the operators mentioned above.

- In France, several **associations** have skills (study and expertise) in terms of prevention of natural disasters, especially: the European Centre for Flood Risk Prevention (CEPR), the French Association for Disaster Reduction Natural (AFPCN) and the Institute of Major Hazards (IRMA).

- **Individuals** play an important role in the politics of natural disaster prevention. On the one hand, they are required to strengthen the planning law and building regulations. On the other hand, they must maintain the non State-owned waterways and protection works they own.

Expenditure for flood risk prevention in 2009

The costs of flood risk prevention are presented in the following table. They reached 432 million euros a year. 55.5% of these expenses come from the State, 40% from local governments, 4% from Europe within the ERDF and 0.5% of civil society. However, this figure should be considered temporary since the work of data collection could not be fully comprehensive. Thus, some actors (businesses) expenses could not be registred by lack of reliable data. Similarly, funds generated outside contracts have not been taken into account.

**Table 9 – Expenditure for flood risk prevention for the year 2009 (in million euros)**

| Actors | Amounts (in million euros) |
|---|---|
| State | 239.94 |
| ➢ Ministries and decentralized administration | 211.47 |
| • *Budget funds* | *165.60* |
| • *Barnier fund* | *45.87* |
| ➢ State operators | 27.47 |
| • *VNF* | *18.30* |
| • *Water agencies* | *5.28* |
| • *IGN* | *2.18* |
| • *Météo-France* | *1.44* |
| • *SHOM* | *0.27* |
| ➢ Other operators | 1.00 |
| • *RATP* | *1.00* |
| Local authorities | 173.03 |
| ➢ Regional councils trough the CPIER | 35.63 |
| ➢ Regional councils trough the CPER | 16.38 |
| ➢ General councils and municipalities trough the CPIER | 19.96 |
| ➢ General councils and municipalities trough the CPER | 4.52 |
| ➢ Flood Prevention Action Plan (PAPI) | 21.13 |
| ➢ Local Public Basin Authority (EPTB) | 13.7 |
| ➢ Autres structures porteuses de SAGE | 61.71 |
| Europe trough the ERDF | 16.65 |
| ➢ Europe trough the ERDF under the CPIER | 12.33 |
| ➢ Europe trough the ERDF under the CPER | 4.32 |
| Civil society | 2.76 |
| ➢ Individuals | 1.63 |
| ➢ Associations | 1.13 |
| **Total expenditure related to flood risk prevention** | **432.38** |

Source: CGDD/SEEIDD/ERNR2, 2010-2011

*Waterways and coasts*

o **Voies Navigables de France**

In terms of infrastructures, France has 18,000 km of waterways including 8,500 km considered as being navigable. The French Inland Waterways public body, “Voies Navigables de France” (VNF), was entrusted in 1991 with the management of inland

waterways transport, as well as with the exploitation, maintenance and development of most of the network of French Inland Waterways, i.e. 6,700 km (of which 500 km are the subject of an experiment of transfer to the Burgundy region), including 3,800 km of canals and 2,900 km of rivers. On this network, there are 4,120 works (Table 10).

**Table 10 - VNF network works (except network experiment Burgundy)**

| | Reaches | Locks, flights of locks, door guard | Barrage navigation and water intake sets | Barrage navigation and mobile water intake | Food system, Dam reservoir | Sluicing, pumping, circumventio n of locks | Channel tunnel | Channel Bridge & Bridges Mobile | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| Greater Mainline Template | 111 | 195 | 4 | 70 | 0 | 44 | 4 | 6 | **434** |
| Related mainline routes | 305 | 354 | 3 | 65 | 5 | 190 | 9 | 60 | **991** |
| Secondary network | 681 | 734 | 75 | 135 | 23 | 328 | 10 | 93 | **2,079** |
| Complementary network | 169 | 185 | 6 | 34 | 4 | 95 | 3 | 32 | **528** |
| Water management system | 27 | 31 | 0 | 5 | 0 | 8 | 1 | 16 | **88** |
| **Total** | **1,293** | **1,499** | **88** | **309** | **32** | **665** | **27** | **207** | **4,120** |

Source: Interviews VNF

Including the natural public domain (on which man did not intervene) and the artificial public domain (man-made), its surface area covers approximately 40,000 ha and crosses 2,254 counties (including 18 with more than 100,000 inhabitants) [19].

In 2007, operating expenses of VNF were 121 million euros with 72 million euros allocated to the network (Table 11).

**Table 11 – Operating expenses of VNF in 2007 (in euros)**

| | |
|---|---|
| Infrastructure and environment | 72 015 435 |
| o Operation and Running | 22 526 362 |
| o Dredging and polls | 16 882 614 |
| o Maintenance | 15 630 325 |
| o Health and safety | 3 125 143 |
| o Environment | 1 136 108 |
| o Grants | 10 866 275 |
| o Other costs in investing activities | 918 142 |
| o Labor operations | 393 797 |
| o Management Consulting | 76 856 |
| o Geomatics and Mapping | 5 485 |
| o Other | 454 328 |
| Development | 7 473 000 |
| Operation VNF | 39 822 000 |
| Seine-North Europe project | 1 829 000 |
| Total operating expenses VNF | **121 139 435** |

Source: Management report 2008 of VNF [19] + Interviews VNF

The expenditures of VNF (without Seine-North-Europe project) are presented in the following table.

**Table 12 – Capital investments of VNF in 2007 (in euros)**

| Year | Total investments |
|---|---|
| 1993 | 68 281 915 |
| 1994 | 100 418 168 |
| 1995 | 107 252 000 |
| 1996 | 58 692 872 |
| 1997 | 69 432 905 |
| 1998 | 84 677 807 |
| 1999 | 103 563 191 |
| 2000 | 114 441 953 |
| 2001 | 113 672 000 |

| Year | Total investments |
|---|---|
| 2002 | 114 611 000 |
| 2003 | 131 710 000 |
| 2004 | 109 104 000 |
| 2005 | 107 692 000 |
| 2006 | 161 988 000 |
| 2007 | 169 540 000 |
| 2008 | 140 708 000 |
| 2009 | 182 215 000 |
| 2010 | 188 244 000 |

Source: Management report 2008 of VNF [19] + Interviews VNF

For 2007, the expenditures of VNF amount to around 170 million euros, with an additional 6.8 million euros devoted to the Seine-North-Europe project.

The total expenditure of VNF (operating + capital) for 2007 were 297 million euros.

With the Grenelle for the Environment, a national transport policy was adopted by the French National Assembly in 2007 in order to develop an alternative to transport by road. This multimodal and integrated policy aims at increasing by 25% the share of river transport which is more ecological. One of the objectives consists in doubling seaport access by 2012. To achieve this goal of competitiveness improvement, investments are planned for the development of harbour capacities and the creation of conditions supporting better inland service.

The main waterways system, especially with heavy loading gauge, will be the subject of a restoration and modernisation plan, including the heavy gauge Seine-Northern-Europe canal, which will allow the diversion to the waterway of 4.5 billion ton-kilometres per annum, i.e. a saving of 250,000 tons of $CO_2$ per annum. On the whole, this programme, with a cost of about 4 billion euros, will be jointly financed within a public-private partnership contract, by the European Commission, local governments and the State, over the 2009-2020 period.

VNF plans to modernise infrastructures on waterways such as dikes, dams (rebuilding of man-handled dams, renewal of mechanised dams of more than 30 years old), locks, raising of bridges, improvement of berths.

Investments will also be made for developing “sea highways” on the Atlantic between France, Spain and Portugal and on the Mediterranean between France, Spain and Italy, in order to offer alternatives to the crossing of the Pyrenean and Alpine mountains. The objective is to divert from 5% to 10% of the traffics concerned. The State will support these projects especially through public bonds and, if necessary, by financing a maximum amount of 80 million euros.

These new developments will have to integrate biodiversity protection as well as the respect of inland and estuarine aquatic environments into the design, building and maintenance of the infrastructures.

- **Coastal Conservancy**

Coastal Conservancy is a public authority in charge of applying a land policy aiming at protecting natural spaces and landscapes on the sea and lake shores. Thus, it purchases fragile or threatened lands by amicable agreement, by pre-emption, or exceptionally by expropriation. Properties can also be given or bequeathed to it. At the end of 2007, the Conservancy was in charge of 113,000 hectares, spread over about 800 sites.

After having made the necessary repair, it entrusts land management to the municipalities, other local authorities or associations so that they take care of its management while complying with the formulated guidelines. With the assistance of specialists, it determines the way in which must be arranged and managed the sites it acquired and defines the uses, especially agricultural and recreational uses, complying with these objectives.

Since 2007, the budget of the Coastal Conservancy has increased considerably with regard to the disposal of the right to French language and navigation of vessels collected by the Directorate General of Customs on pleasure boats. The total budget therefore amounts to 45 million euros for 2007 and follows the following pattern:

- 35.5 million euros from the annual fee francization 2008,
- 8 million of revenue from specific Water agencies, Europe, regions, departments, and patronage,
- 1.5 million of own resources [33].

*Hydropower*

French hydropower is the first of the European Union. In France, hydropower produced by hydraulic resources provides about 12.4% of the total energy and 80% of renewable energy. There are about 400 hydropower dams of more than 4.5 Megawatt (MW) on the French territory. These dams represent a total power of 23.5 Gigawatt (GW) and can produce 63 Terawatt (TW). Concessions are granted by the State for the exploitation of these dams. Today, Electricity of France (EDF) operates 80% of the dams and the National Company of the Rhone (CNR) 20%.

An audit is currently carried out by VNF in order to estimate the value of the French inheritance in terms of hydropower infrastructures.

- **Electricity of France**

  - In 2008, 18.23% of the electricity produced by EDF came from hydraulics.
  - Research and development expenditures were 99 million euros in 2008 including 3% for water, i.e. 2.97 million euros.
  - The cost of maintaining the waterworks amounted to 110 million euros.
  - In addition, a programme for the modernization and development of industries called "SuPerHydro programme" is mobilising 560 million euros between 2007 and 2011 in addition to routine maintenance, i.e. 112 million euros per annum on the average [2, 17].

- **National Company of the Rhone**

  - To keep hydraulics safe and its production facilities in good working order, CNR spent about 60 million euros for its maintenance programme in 2008 [18].

## 3.3. Experiences in reducing costs

### 3.3.1. Cost reduction by increasing the operational efficiency of water resources management infrastructures

As we already clarified previously, France seeks to make efforts to reduce the volume of leaks in its networks. Thus, the estimated achievements of 2010 of the Grenelle for the Environment in the field of water include an analysis of the data of the annual mayors' reports and an assessment of the leaks in the drinking water supply networks.

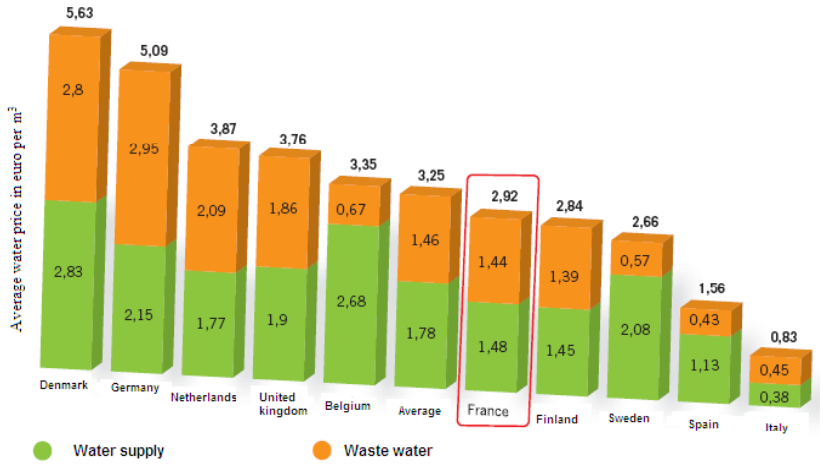
### 3.3.2. Cost reduction by applying an integrated approach to infrastructure development and management

If water utilities are to be managed by the municipalities since the decentralisation laws, the costs appear sometimes too high to be supported by a single municipality. In the same way, the building of some installations is not justified on the scale of a sole municipality because their operation is only viable beyond a certain threshold of population. Thus, many municipalities decided to regroup in order to manage more effectively the four services that they have to deal with: drinking water production and supply, waste water collection and treatment in waste water treatment plants and their discharge into the environment.

Whatever the form it takes (inter-municipal syndicate with single or multiple purposes, mixed syndicate, urban district, urban community, community of agglomerations), inter-municipality has always been encouraged by the State and public authorities. Thus, currently, no less than 70% of the municipalities (covering 60% of the French population) belong to an inter-municipality to deal with drinking water production or supply. Their number is, on the other hand, lower as regards sanitation.

These cost reductions have an impact on the households' water bill. In France, the water price remains highly reasonable: it is on the average 1 euro per day and per family for 330 litres daily delivered then treated after use and the share of the water-related expenditure in the household budget is only 0.8%. Moreover, the study of NUS Consulting on the prices per $m^3$ practised in the large European cities also reveals that the average water price in the five large French cities was 2.92 euros in 2007 and that it is lower by 10% than the European average.

**Figure 29 - Average water prices (in euros per $m^3$) of the five larger cities of the European countries in 2007**




Source: NUS Consulting 2007

### 3.3.3. Cost reduction by reformulating the objectives of water policy

As regards cost reduction by reformulating the objectives of water policy, the best example is to be found in the Water Framework Directive of 2000 establishing, as already specified, a framework for Community action in the field of water policy and imposing to the Member States of the European Union to achieve "good status" of all their water bodies (surface or groundwater) in 2015.

In Seine-Normandy basin, before application of WFD, only 29% of the surface water bodies and 17% of the groundwater bodies was currently having "good status". To achieve the ambitious objective laid down by the WFD, the Seine-normandy Water agency must contribute to the implementation of a Programme of Measures (PoM).

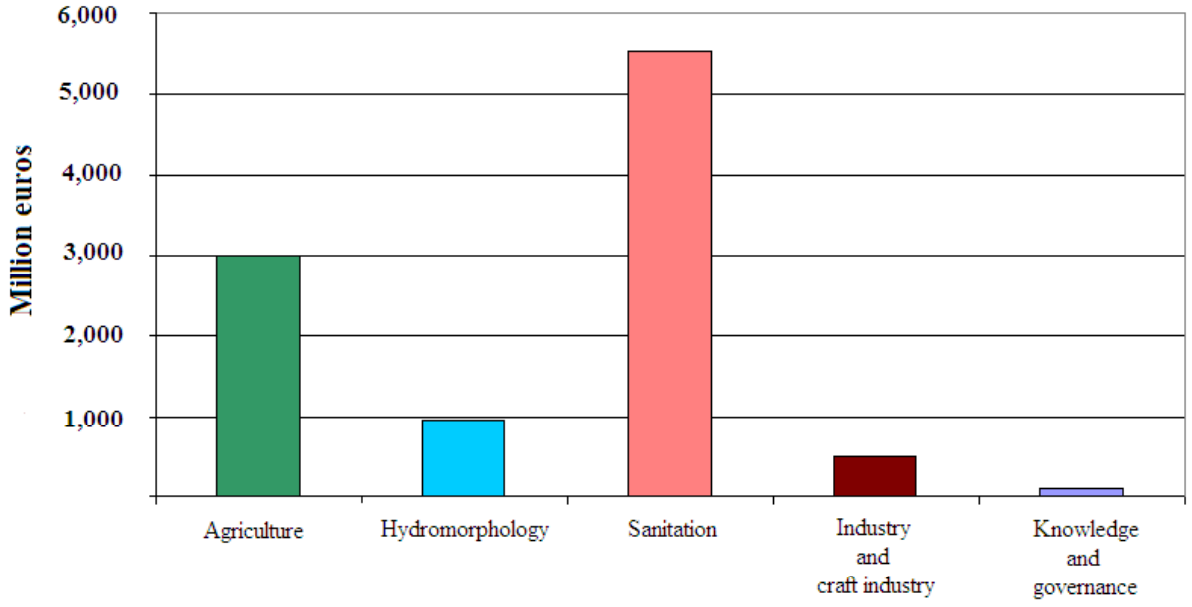
However, it may not be possible for all the water bodies to reach this objective. Indeed, for reasons of a natural, technical or economic nature, it could be necessary for some of them to require exemptions in delays or objectives. This possibility is considered in the texts of the WFD and allows, for example, in the case of disproportionate costs of the measures to be implemented, spreading out these costs until 2021 or 2027 or having a less ambitious objective on the long term. In this case, in Seine-Normandy basin, it was deemed necessary to require exemptions for approximately 1/3 of surface water bodies and 2/3 of groundwater bodies. However, these exemptions will have to be duly justified by a cost-benefit comparison of reaching "good status". Costs-benefit analysis (CBA) for water bodies were thus carried out to legitimate the requests for exemption.

The definition of less stringent objectives concerns the water bodies affected by a very strong human activity or whose natural conditions make them strictly inapt to meet the objective or whose costs would remain disproportionate even after spreading out until 2027. With regard to France, it was decided to limit the recourse to less strict objectives and to rather aim at exemptions in delays for achieving good status.

Thanks to exemptions, an effective reduction of the costs of water resources management thus could be achieved. However, this process of cost reduction by reformulating the objectives of water policy does not stop there as the notion of "good status" (GS) can be reformulated in a less constraining concept called "good potential" (GP). "Good status" is the objective laid down for natural water bodies, either surface or groundwater, whereas "good potential" is the objective laid down for heavily modified water bodies and artificial water bodies. If, for surface and ground natural water bodies, the objectives of ecological status, quantitative status and chemical status must be validated, on the contrary, the objectives are softened for artificial water bodies. The reformulation of "good status" into "good potential" for some water bodies thus also allows reducing the costs of water resources management in a way different from that given in the preceding paragraph.

On the whole, in the case of the Seine-Normandy basin, the reformulation of the objectives of water policy allowed spreading out the costs of achieving good status until 2027. Taking into account the spreading out of the costs, the PoM over the 2010-2015 period is estimated at 9.1 billion euros and is distributed as shown in the following figure.

**Figure 30 - Distribution by type of measures of the cost of the Seine-Normandy PoM for the 2010-2015 period (in million euros)**




Source : Achieving good water status in Seine-Normandy – cost-benefits analyses on various scales. Jérémy Devaux [22]

Out of these 9,115 million euros:

- Agriculture: 2,096 million euros (23% of the PoM)
- Hydromorphology: 912 million euros (10% of the PoM)
- Sanitation: 5,560 million euros (45% of the PoM), including 1,458 million euros for the Rainwater drainage: (16% of the PoM)
- Industry and craft industry: 456 million euros (5% of the PoM)
- Knowledge and governance: 91 million euros (1% of the PoM)

# 4. Financing water resources management

## 4.1. Policy framework for financing water resources management

### 4.1.1. Who pays for water resources management, why and how?

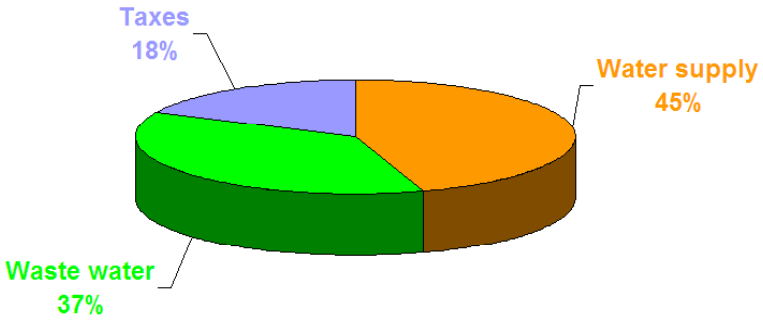
*From water services free of charge to the payment of a water bill by the users*

For a long time, and as in many other countries, local authorities have applied the rule of free water and free water service in France. Thus, in the 19th century, when the supply of drinking water to the population was carried out by means of public fountains or stand pipes, the municipality delegated the service to a private operator but supplied water to the user free of charge. Small and large municipalities broadly subsidised the water price, especially when, after 1880, direct supply to the house was developed and individual connections were generalised. The subjacent intention was hygienic since it meant guaranteeing an essential component of public health at the living place of each inhabitant.

From now on, the households pay a water bill comprising three large elements:

- Payment of the water service (production and supply),
- Payment of the sanitation service (waste water collection and treatment),
- Taxes and water charges.

**Figure 31 - Average breakdown of a typical water bill (data 2007)**




Source: Professional Federation of Water Companies (FP2E) and BIPE, February 2008 [23]

The water price can vary a lot from one municipality to another because the costs supported by the utility depend on local characteristics:

- Nature of the resource (spring, river, groundwater), its accessibility, its availability, its quality requiring more or less thorough treatments,
- Nature of the dwellings to be covered (urban or rural areas, tourist areas, etc) and number of inhabitants to be served,
- Investments already made by the municipality, either for drinking water treatment and supply or for waste water drainage (sewers) and treatment (waste water treatment plant), maintenance, renewal or compliance of equipment with the standards (for waste water, this thus depends on the sensitivity of the receiving environment and the condition of the equipment),
- The pricing method chosen by the municipality (management by a public authority or by a private company),
- Planning of investments,
- Quality of the service provided to the customers, etc.

***Principle of cost recovery and components of the water bill***

To comply with the new European and national environmental and health standards, to meet the increasingly large requirements of the users, it is necessary to build new facilities, to take care of their maintenance, their modernisation and their management. All this has a cost that the users must agree to pay. The cost of water services must be covered by the water users ("water pays for water").

When connecting to the network, the user must pay "a connection price" and bear the cost of the work required by his individual connection.

The water bill compulsorily includes:

- a variable part, depending on the consumed volume.
- a fixed part (the subscription), intended to cover the management costs of the facilities. This fixed part must comply with a limit given by ministerial decree: a maximum of 40% of the water bill for urban areas and 50% for rural areas. This arrangement is however softened for tourist areas which have high seasonal variations of population.

***Methods for determining the water price and taking acceptability into account***

The public organisations determine the amount of the taxes and water charges that can be applied to the water price. The remainder is determined by the municipality in two different ways, according to the management method used: in direct management, the price is determined by the municipality or the syndicate, whereas in delegated management, there is negotiation between the municipality and the private company.

Social acceptability of the water price is obviously taken into account in the pricing decisions. Determining the water price is a political decision, which must make a balance between contradictory constraints:

- The needs for renewal (or for construction) of infrastructures are huge: environmental objectives, compliance with the European directives, and must be met in a very constraining situation: balanced budget of the utilities, reduction of public subsidies, performance requirement, etc.
- The services must maintain water at a price “acceptable” for the population.

Balance between these two constraints is difficult. The issue of the water price, taking especially into account the specific nature of water, is extremely sensitive. The development of indicator systems, by ensuring transparency on the management of utilities, is likely to reinforce the acceptance of price increases. But the acceptability issue also arises at the European and international level due to the competition and competitiveness problems which may arise (influence on the installation and delocalisation of companies).

The share in the expenditure of the water service in the household budget remains marginal and stable (0.8% since 1996) [24].

But regarding the poorest populations, the law of 30 December 2006 reaffirmed the right to water, with a very strict supervision of the possibility of water cut-offs. At the financial level, write-offs of unpaid bills are often practised and it is possible to resort to the “Fonds de Solidarité Logement” or mutual housing fund which exists in each department.

*The users and polluters pay water charges to the Water agencies*

Today, in France, the **“polluter-pays”** and **“user-pays”** principles are applied to water resources management. Thus, the budget of the Water agencies comes from taxes on abstractions and discharges of all the users which affect water quality or modify the water regime. More interesting still, since the application of the budgetary and accounting order M49 of 1st January 1997 to all utilities, a limitation of transfers between the main budget of the municipalities and their specific budget for drinking water supply and sanitation was introduced. Thus, the practice which consists in pricing at a level higher than the one which allows balancing the utility budget, with the aim of feeding the general budget by the transfer of surpluses, is from now on impossible (please note however that, at the national level, this system transfers nearly 700 million euros per annum of Value Added Tax (VAT) from the water accounts towards the general budget of the State). Conversely, a situation, where the general budget finances the water budget is now prohibited.

It is the **“water pays for water”** principle, which applies not only to the budget of the municipalities, but also to the water charges levied by the Water agencies: these charges are taxes assigned to water which means that not only are they levied on activities having an impact on water resources, but also that the product of these taxes is allocated to actions for water resources conservation [25].

The aim of the water charges levied by the Water agencies is to integrate environmental costs, with incentives to the water users to bear the cost related to their polluting discharges or abstractions of water resources. The rate of these charges is modulated according to the uses and to the fragility of the environment.

Before the establishment of LEMA, there are two types of taxes: taxes on the abstraction of water resources and taxes on water pollution.

Obviously, the objective of the taxes on the abstractions of water resources was to encourage water saving. The amount of these taxes depended on the volumes of water abstracted during the year. The rate was modulated according to the economic value of water depending on its use (irrigation, drinking water, industrial cooling, feeding of a canal, etc.) and according to water resource scarcity (abstraction from a balanced or unbalanced zone).

As regards the taxes on water pollution, they were incentives for preserving water quality. They depended on the discharged pollution. For industrial uses, the taxes were calculated from the net annual pollution discharged into the natural environment and according to various pollution parameters: Suspended Solids (SS), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD-5), Reduced Nitrogen (RN) toxic metals (metox), etc. Taxes calculations were based on a regular follow-up of the discharges. For domestic uses, the taxes were calculated for each municipality according to the permanent and seasonal populations. They were levied through the drinking water bill paid by the user according to the consumed volume measured by the meter.

Since 1st January 2008, the water charge system of the Water agencies somewhat evolved as there are now seven different types of taxes. Two of them are the old taxes on abstraction and pollution which have been changed. Two taxes (tax on diffuse pollution and tax for the protection of aquatic environments) correspond to the allocation to water agencies in taxes or fees collected so far by other agencies. Finally, three taxes were established by LEMA (tax for modernisation of the waste water drainage systems, tax for storage in low water level periods and tax on obstacles on rivers). Here are their details:

- *Tax on the abstraction of water resources*. This tax is paid by any water user according to the annual volume he takes. The tax payer is thus the organisation, either public, private or industrial, which withdraws water. The rates are differentiated according to water bodies concerned by this abstraction and the water uses. These are six types of water uses: irrigation, surface irrigation, drinking water, industrial cooling with a refund of more than 99% of water, feeding of a channel, other economic uses. For households, the tax is limited to 0.6 euro per $m^3$, with the exception of areas for which quantitative pressures exist. In the latter case, the limit is 0.8 euro per $m^3$.

- *Tax on water pollution*. This tax includes, on the one hand, the tax on domestic water pollution and, on the other, non-domestic water pollution.

  - As regards tax on domestic water pollution, the tax basis is the annual volume of water invoiced to each user. It should be noted that, in addition to the people subscribing to the drinking water supply service, those having a borehole or withdrawing water from sources other than the supply network are also liable to payment when they are connected or connectable to the sewerage system. The tax rate has a maximum to 0.5 euro per $m^3$ and can be modulated according to "coherent geographical unit".

  - The tax on non-domestic water pollution has to be paid by the users who have agricultural and industrial activities. The tax basis is from now on the annual pollution discharged into the natural environment, equal to twelve times the average between the monthly average pollution and the highest monthly discharged pollution. Article L. 213-10-2 of the code of the environment presents a summary table of the various pollution components, and gives the applicable maximum price for each element as well as the threshold under which the tax is not levied.

- *Tax on diffuse pollution*. This tax, which concerns the plant protection products (pesticides), replaces the General Tax on Polluting Activities (TGAP). The TGAP was already applied to pesticides, but the new tax is paid by the distributors and no more by the manufacturers or importers. This evolution aims to make the tax more perceptible for the farmers and to allow the Water agencies adapting its rate according to the quantity of product residues found in the water of each basin (from 0.5 to 3 euros per kg).

- *Tax for the protection of aquatic environments*. This tax is the old fish tax paid by every fisherman (amateur or professional) engaged in freshwater fishing to his fishing federation.

- *Tax for modernisation of the waste water sewerage*. This tax has to be paid by the all domestic and non-domestic users connected to a sewer system. It is based on the drinking water volumes (taken into account in the calculation of the tax on sanitation). Its ceiling is 0.30 euro per $m^3$ for domestic users and 0.15 euro per $m^3$ for non-domestic users.

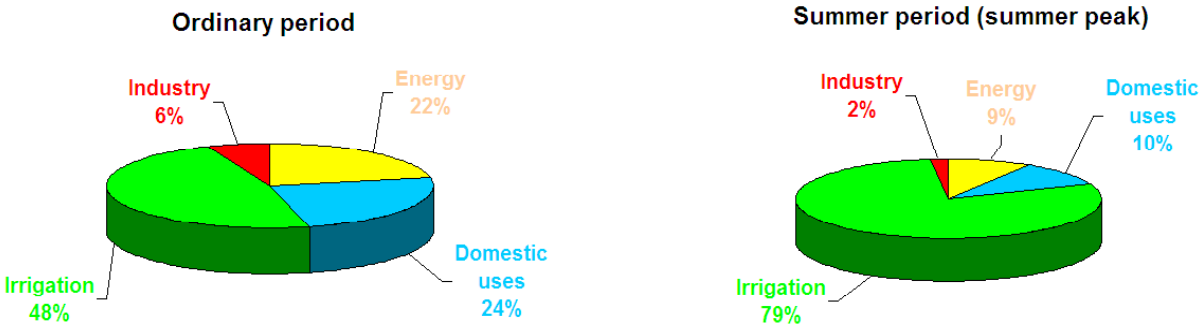
- *Tax for storage in low water level periods*. It concerns the owners of water reservoirs that store all or part of the volume flow in a river during low flow periods, more than 1 million $m^3$. The rate is 0.01 euro per $m^3$.

- *Tax on obstacles on rivers*. It has to be paid by any person having an installation which is a continuous obstacle between the two banks of a river blocking sediment transport and fish migration.

The rate of the water charges is defined at the national level by the Parliament. The rate is then precisely calculated and modulated by the Basin committee according to the priorities and local qualitative objectives given in the SDAGE and SAGEs.

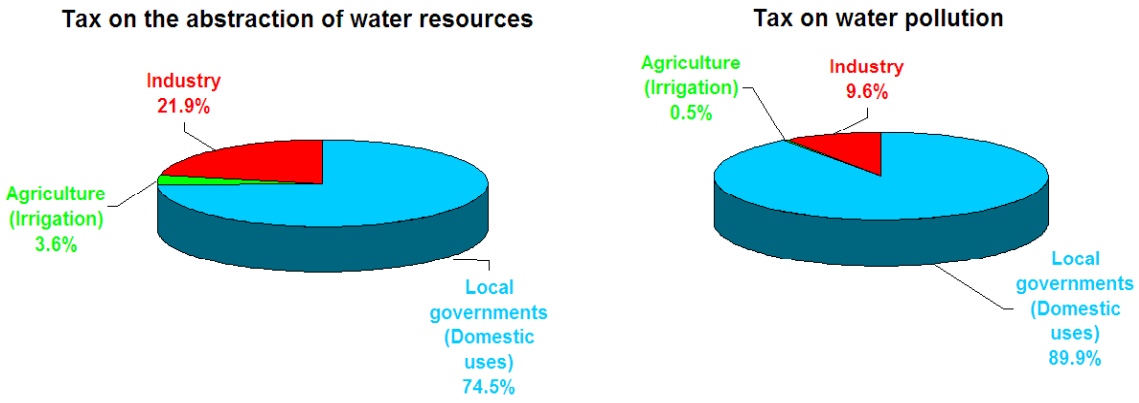
The division into seven taxes introduced an uncertainty in foreseeing the income of the Water agencies. Indeed, before this law, the amounts to be levied were defined by the Water agency and were distributed among the tax payers (tax known as apportionment). This procedure guaranteed some predictability as, even if the consumed water volumes differed from the predictions, the amount which had to be paid by the tax payers remained the same. From now on, the income from the water charges is directly related to the consumed volumes of water or emitted pollution, which involves a greater volatility of income from water charges.

**Figure 32 - Water consumption in France**




Source: Annual report 2010 of the State Council - The hydrosystem and its right [1]

**Figure 33 - Taxes levied by the Water agencies according to users**




Source: Appendix to the finance law for 2010 - Water agencies [26]

*The users connected to the storm water drainage network*

Since the LEMA of 2006, the municipalities can create a **"tax for the drainage, conveyance, storage and treatment of storm waters"**.

This tax has a two-fold objective:

- To facilitate the financing of the drainage, storage and treatment of run-off water,
- To incite the people responsible for discharges to develop storage systems at the source.

It is based on the surface area of the buildings connected to a public storm water drainage network. The price is determined by deliberation of the deliberative assembly (of the municipality or the grouping qualified to create the tax), within the limit of

0.20 euro per $m^2$ per annum. The tax is thus paid by the owners of the buildings connected to the public storm water drainage network or, when there are several owners, by the condominium or the co-ownership real estate company.

The owners who develop systems avoiding or limiting the discharge of rain water into the corresponding network benefit from an abatement, ranging from 10% to 90% of the tax amount. The tax is no more paid when the developed system allows avoiding any discharge or leads to the effective suppression of the connection to the public storm water drainage network.

The product of the tax is exclusively assigned to:

- The creation, operation, renewal, extension of the installations of drainage, conveyance, storage and treatment of rain water,
- The maintenance of these installations,
- The control of the systems avoiding or limiting the discharge of this water into the public networks.

*The users of waterways pay a tax to the "Voies Navigables de France"*

VNF has three types of taxes on water uses [19]:

- **Tolls.** Those are broken down into two categories**:**
  - Tolls on freight which are levied for any carriage of goods on the VNF network, either public nature or private nature,
  - Tolls on yachting which are levied for all the boats of more than five metres long or equipped with an engine of more than 9.9 Horsepower (HP).
- **The hydraulic tax.** This tax, relative to article 124 of the law of finances for 1991 n°90-1168 of 29 December 1990, is paid by the owners of intakes, water outlets or any other hydraulic work intended to take or discharge water volumes in the river public domain which is entrusted to him. The conceded hydropower stations and their works and ancillary facilities are excluded from this tax, such as those planned in the specifications of these concessions.
  The amount to be paid by the owner includes two elements:
  - An element related to the area of the occupied river public domain, equal to the product of the land surface area of the works multiplied by a basic rate which varies according to the number of inhabitants in the county where the installation is located.
  - An element related to the volume, equal to the product of the volume that the installation can withdraw or discharge multiplied by a basic rate of 0.00325 euro per $m^3$.
- **Tax on State lands.** They result from national protocols with the operators of telephone and electronic communication networks. They are also made up of the taxes on stationary boats, nautical events, the occupations of buildings and lands on the waterway bank.

*The policy-holders pay a mechanism for compensation and prevention of natural disasters: the 'cat nat' and the Barnier Fund*

Covering the expenditure of flood prevention and distribution of the damage concerned is possible through a kind of insurance against natural disasters called "cat nat", which covers all the natural hazards (except storms and hails). The principle of common cause of "cat nat" is expressed by several ways. Firstly, it is expressed by the legal obligation of insurance since an insurance contract relative to damage to properties obligatorily covers natural disasters. Secondly, it is expressed by a uniform rate for the extra "cat nat" premium paid by any policy-holder (12% for a package policy for dwellings, 6% for an insurance contract for vehicles). Lastly, it is expressed by the State guarantee to the Central Reinsurance Fund as the State is intrinsically involved in "cat nat" by the public prevention policy and insurance mechanism: it gives its guarantee to reinsurance and imposes insurance obligation and uniformity of the insurance premium rate. 60% of the "cat nat" compensations over the 1982-2006 period (7.3 billion euros) concern damage from floods.

The natural risk prevention fund, known as Barnier Fund, is managed by the State. Created in 1995, this fund was recently considerably reinforced, its resources passing from 2% to 12% of the extra "cat nat" premiums between 2007 and 2009 [20, 21].

### 4.1.2. Rules for allocating the financial burden to the various water users and beneficiaries

*The action plan of the Water agencies*

The taxes levied by the Water agencies feed the budget of their multi-year action plan for six years. This financing programme allows subsidising the investments made by municipalities or industrialists or farmers, to preserve water resources and to improve the performances of the treatment plants. The Water agencies contribute with subsidies of 30% to 45%. The financing programme gives priorities for action and their financing. It is formulated in a concerted way by the basin committee which gathers the various water stakeholders. It is then approved by the Basin Co-ordinator Prefect after harmonisation at the ministerial level.

*The principles of common cause and equalisation between the users*

For water to be available for everyone, including for the people encountering financial difficulties, various mechanisms for public aid were created in France. Although the water share in the household budget is relatively low (0.8% on the average) and that the rate of unpaid bills is very low (less than 1% for the delegated services), common cause is indeed necessary for the poorest people. Thus the Mutual Housing Fund ("Fonds de Solidarité Logement", FSL), created in 1990 and managed by each Department is in charge of developing this common cause. This fund allows helping underprivileged people to face their expenditure related to their dwelling: water, electricity, gas, telephone. More specifically, it allows maintaining the water supply and dealing with the water bill thanks to close co-operation between the departmental services and the water companies. The water bill can be totally or partially dealt with and jointly financed by the Department (General Council) and the water company concerned.

In the same vein, a bill by Senator Cambon was adopted in 2011. This allows water operators to pay 0.5% of their revenues to the FSL. Thus, FSL will be well equipped with potentially a further 50 million euros from 2012.

In addition to common cause between users (also materialised by the insurance system for natural disasters as we already specified), the French system also includes support to rural communities. On the one hand, the Regions and Departments especially support the investments of rural municipalities, from their own budgets and under certain regulations, either in the form of subsidies, or interest rebates on loans. On the other, there has been an "urban-rural areas" mutual aid fund for a long time, called National Fund for Rural Water Supply (FNDAE), created in 1954. The FNDAE levied a tax on each invoiced $m^3$ of drinking water and the collected sums were redistributed in each Department to subsidise the investments of rural municipalities The FNDAE budget amounted to 144 million euros per annum. Although the FNDAE was removed in 2006, part of the subsidies of the Water agencies is still directed towards urban – rural common cause in each basin.

There is also international solidarity as the Water agencies and local authorities have been authorised since the Oudin Law of 2005 to finance water-related international solidarity actions to the amount of 1% of their respective budgets. This decentralised co-operation dedicated to water mainly concerns objective 7 target 4 of the Millennium Development Goals (MDG), i.e. access to drinking water and sanitation for the underprivileged populations of developing countries. It has significantly developed and provided 17 million euros of subsidy to several hundreds of microprojects in Africa, Asia and Latin America in 2008.

## 4.2. Instruments for levying the budget of water policy

### 4.2.1. What are the levied amounts?

*Amounts levied via the water bill*

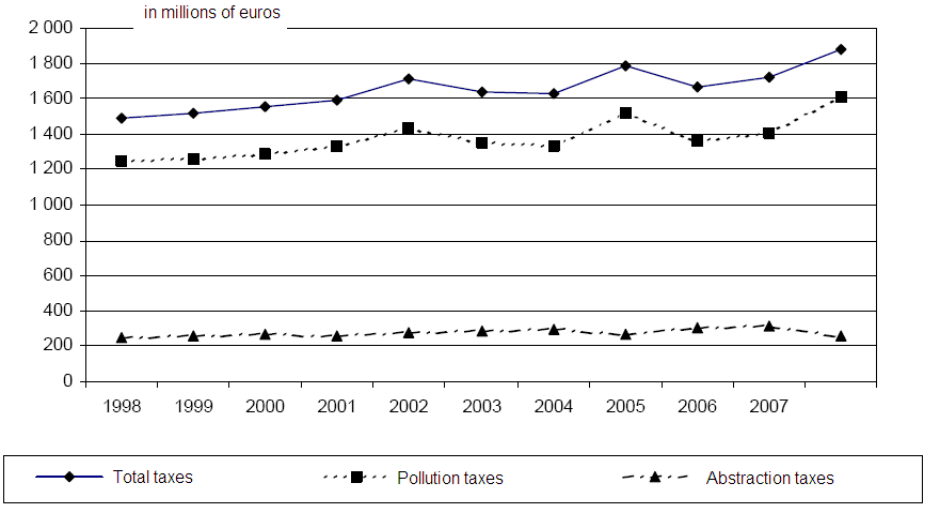
In 2006, the water bill paid by the users amounted to 11.8 billion euros, including 7 billion for drinking water supply and 4.8 billion for sanitation. After a period of very strong increase in water prices, this evolution is now stable as most of the investments necessary for compliance of the installations to the standards were made. For 10 years, the rising of water prices has slowed down with rates ranging between -0.4% and +3.5% per annum. The total invoice of 11.8 billion euros paid by the users is distributed as follows:

- 629 million euros for the State (VAT and tax repaid to VNF),
- 2,993 million euros for local authorities (for the services managed by a "public authority"),
- 1,445 million euros for the Water agencies (taxes later repaid in the form of assistance),
- 6,753 million euros for the delegated operators (for the services under "delegated management"), 2,022 million euros of which (about 30%) are repaid to the local authorities.

*Amounts levied by the Water agencies*

As shown in the figure and table below, the income from the pollution taxes contributes, for the most part, to the total income, which indicates once more that France did not think, until the recent law of 2006, in terms of quantitative aspect of water resources but almost exclusively in terms of qualitative aspect. The introduction of the new taxes should however lead to a positive evolution in the multi-aspect approach to water resources in the coming years.

**Figure 34 - Income from taxes over the last 10 years (in current euros)**




Source: Appendix to the finance law for 2010, Water agencies [26]

**Table 13 - Income and income prediction of the Water agencies, 2004-2012**

| Income in million euros | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|
| Taxes on abstraction of water resources | 293.1 | 271.4 | 307.0 | 314.5 | 267.2 | 353.7 | 354.4 | 373.3 | 345.8 |
| Taxes on domestic water pollution | 1,190.6 | 1,190.0 | 1,209.8 | 1,272.1 | 1,378.8 | 1,124.2 | 1,225.9 | 1,295.4 | 1,325.2 |
| Taxes on non-domestic water pollution | 147.3 | 328.1 | 149.0 | 143.9 | 116.6 | 129.8 | 137.6 | 140.7 | 142.8 |
| Taxes on diffuse pollution | 0.0 | 0,0 | 0.0 | 0.0 | 0.0 | 24.3 | 32.4 | 31.8 | 31.3 |
| Taxes for protection of aquatic environments | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.7 | 4.7 | 4.7 | 4.7 |
| Taxes for modernisation of waste water sewerage | 0.0 | 0.0 | 0.0 | 0.0 | 113.6 | 200.7 | 203.4 | 204.1 | 205.5 |
| Taxes for storage in low water level periods | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Taxes on obstacles on rivers | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.3 | 0.3 |
| **Total taxes** | **1,631.0** | **1,789.3** | **1,665.8** | **1,730.4** | **1,876.2** | **1,838.7** | **1,959.6** | **2,044.7** | **2, 084.0** |
| **Total income** | **2,052.1** | **2,191.3** | **2,058.6** | **2,197.2** | **2,248.2** | **2,214.2** | **2,384.0** | **2,488.8** | **2,490.5** |

Note : The values of the years 2009 to 2012 are predictions.

Sources : *For 2004* : Finance law for 2006 - Water agencies [34]
*For 2005* : Finance law for 2007 - Water agencies [35]
*For 2006* : Finance law for 2008 - Water agencies [36]
*For 2007, 2008, 2009, 2010, 2011, 2012* : Appendix to the finance law for 2010 - Water agencies [26]

*Amounts levied by VNF*

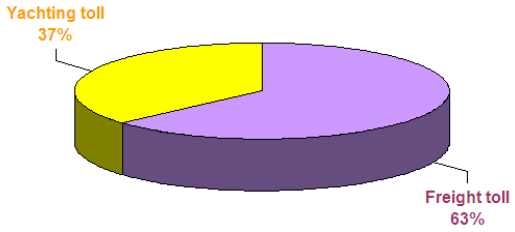
**Table 14 - VNF operational income for 2007 and 2008**

| Operational income (in thousand euros) | 2007 | 2008 | Variation |
|---|---|---|---|
| Tolls | 12,513 | 12,387 | - 1.01% |
| Hydraulic taxes | 120,461 | 124,522 | + 3.37% |
| Taxes on State lands | 23,527 | 25,769 | + 9.53% |
| Other income | 16,902 | 15,936 | - 5.72% |
| **Total** | **173,403** | **178,613** | **+ 3.00%** |

Source: VNF, Financial report 2008 [19]

In 2008, the operational income of VNF amounted to 178.6 million euros, which represents an increase of 5.2 million euros as compared to the previous year. This increase is not to be found in tolls as the income of the latter shows some stability (12.4 million euros in 2008 against 12.5 million euros in 2007). When the two tolls components are detailed, one observes that those related to freight have decreased as they amounted to 7.8 million euros in 2008 against 8.2 million in 2007, which represents a fall of 4.9%. On this subject, it should be noted that in 2008, the river traffic recorded a total fall in its activity of 0.5% with 7.504 billion ton-kilometres against 7.544 a year before. This evolution however masks strong disparities according to the nature of the transported goods. In a difficult economic situation, some sectors indeed show highly increasing performances such as agricultural products (+7.2%), foodstuffs (+13.5%), mineral fuels (+7,7%) or fertilisers (+5.8%) whereas other sectors more sensitive to the current economic situation show a marked decrease such as metallurgical products (- 13.0%) and petroleum products (- 6.7%). In parallel, tolls on yachting increased in 2008 to 4.6 million euros, a rise of 6.4% as compared to year 2007.

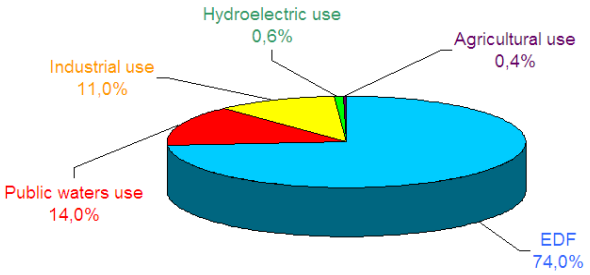
**Figure 35 - Distribution of the income from Tolls**




Source: VNF, Financial report 2008 [19]

In 2008, the income related to the Hydraulic tax amounted to 124.5 million euros, i.e. a progression of 3.4% as compared to 2007. This rise is explained by the opening of a new section of EDF power station of Porcheville on the Seine with a volume of 564 million $m^3$ representing 3 million euros each year.

**Figure 36 - Distribution of the income from the Hydraulic tax**




Source: VNF, Financial report 2008 [19]

In 2008, taxes on State lands amounted to 25.8 million euros against 23.5 million euros in 2007, i.e. an annual progression of 9.5% due to two concomitant effects, the revalorisation of INSEE building cost index of 5.5% applied in 2008 and the massive regularisation made for stationary houseboats by the Local Directorate of the Seine Basin on non-authorised occupations [19].

**Table 15 - Taxes on State lands levied by VNF in 2007 and 2008**

| Income from taxes on State lands (in thousand euros) | 2007 | 2008 | Variation |
|---|---|---|---|
| Temporary occupation of lock houses | 1,244 | 1,502 | + 20.70% |
| Temporary occupation outside lock houses | 9,231 | 9,639 | + 4.42% |
| Products from houseboats | 4,566 | 5,839 | + 30.08% |
| Fiberoptics | 6,863 | 7,125 | + 3.82% |
| Concessions commercial ports and light equipment | 818 | 789 | - 3.59% |
| Other products | 805 | 775 | - 3.71% |
| **Total** | **23,527** | **25,769** | **+ 9.53%** |

Source: VNF, Financial report 2008 [19]

*Amounts levied via the "cat nat"' insurance system*

Each year, compensation for disasters is ensured by an extra premium of 12% on the package policy for dwellings and 6% on the insurance contracts for vehicles, representing an annual provisioning of about 1.3 billion euros per annum, including the part which feeds the Barnier Fund. The 2010 estimated income of this fund is budgeted at 154 million euros, of which not less than 140 million euros are assigned to flood prevention.

### 4.2.2. Use of the financial resources

*Water agencies*

The main expenditure of the Water agencies is subsidies and advances to the various stakeholders in water policy. These subsidies are governed by their multi-year action plan. In accordance with the law, there are three great fields for action for the Agencies:

- **Knowledge, planning and governance**.
- **Overall measures for water management,** including the national measures for implementation of the directives (UWW, DWS directives), for compliance of the industrial facilities to the standards (except hazardous substances) and animal husbandry, technical assistance and implementation of urban-rural common cause.
- **Local measures for water management,** including operations complementary to the national measures relative to the protection of the resource (installation of protection areas, purchase of land), control of diffuse pollution, curative treatments of drinking water (qualitative interconnection, treatment plants, etc.), actions on priority substances and actions on protection and maintenance of aquatic environments and wetlands.

**Table 16 - Expenditure of the 6 Water agencies for the 2007-2012 period (in million euros)**

| | Adour-Garonne | Artois-Picardy | Loire-Brittany | Rhine-Meuse | Rhone-Mediterranean-Corsica | Seine-Normandy | Total |
|---|---|---|---|---|---|---|---|
| **Knowledge, planning and governance** | 230.50 | 164.27 | 478.60 | 282.42 | 460.90 | 471.60 | **2,088.29** |
| **Overall measures for water management** | 714.00 | 508.12 | 885.50 | 428.40 | 1,379.60 | 2,790.40 | **6,706.02** |
| **Local measures for water management** | 240.00 | 195.50 | 501.60 | 329.87 | 631.10 | 937.90 | **2,835.97** |
| **Total** | **1,184.50** | **867.89** | **1,865.70** | **1,040.69** | **2,471.60** | **4,199.90** | **11,630.28** |

Source: Appendix to the finance law for 2010, Water agencies [26]

If assistance to sanitation and drinking water supply still takes a great place in the use of the income of the Water agencies, the implementations of the WFD and the LEMA allowed developing assistance to environmental protection and to the control of diffuse pollution which now represent respectively 7% and 4% of the total amount. Remember that “Environmental protection” includes several types of intervention: protection of wetlands through land acquisition and the setting up of protection areas,

construction of dams to restore ecological continuity, rehabilitation of rivers and river banks to restore the capacity of aquatic environments to absorb any pollution, operations for reducing run-off from cultivated lands to rivers.

### 4.2.3. Lessons learned thanks to these instruments

*Lessons learned from the taxes levied by the Water agencies*

Interesting findings can be drawn from the last years insofar as the entry into force of the LEMA, in 2008, allowed water policy fitting in with a broader field of sustainable development by understanding better the quantitative aspect of water resources. The Water agencies were thus entrusted with the implementation of the WFD management plans (SDAGE new formula) and were requested to support the "balanced and water-saving management of water resources and aquatic environments, drinking water supply, flood control and sustainable development of economic activities".

The incomes from taxes, which are now seven, depend on the consumed volumes of water and emitted pollution. Consequently, this new operating mode led to certain income volatility. In parallel, it allows better taking into account the new stakes related to water resources and going beyond the restricted considerations of the small water cycle.

However, the taking into account of these new stakes is variously achieved:

- Concerning water pollution control, the policy of compliance of the waste water treatment plants to the standards was recently accentuated in order to avoid heavy financial fines from the European Court of Justice. The protection of drinking water intakes, on the other hand, did not reach the anticipated results because of delays in the decrees of public utility declaration. The control of agricultural pollution has not yet achieved its objectives because the agricultural profession is not at present much implied and the time is not sufficient for observing positive effects on the natural environments.

- As regards water saving and the protection and management of the environments proposed by the WFD, the involvement of the local stakeholders must be very strong and, for the moment, the results of year 2008 are simply in the continuity of 2007. The implementation of the new river basin management plans (SDAGE), adopted at the end of 2009, and the field application of the PoM on water bodies will allow accelerating the pace.

## 4.3. Use of commercial financing

In France, in the water sector, the contracting authorities are public bodies. The use of "commercial financing" thus does not precisely apply to the French situation.

Possibly, the concept of commercial financing can send back to the delegated management of drinking water supply and sanitation utilities, and more particularly to the principle of concession. Indeed, in this case, the local authority subcontracts the management of the water service to an operator who builds the facilities and operates them at his own expenses while being entirely repaid on the water price. Please be reminded that, whatever the management method used for the water service (direct, delegated or mixed), the local authorities remain owners of the installations and responsible towards the users.

The delegated management system has largely proven reliable for several centuries of it existence in France. The big companies of the water sector (Veolia Eau, Suez Environnement / Lyonnaise des Eaux, Saur) as well as the small and medium-sized enterprises developed important know-how and carried out research, which place the French water industry as the very first worldwide.

In parallel to the previously mentioned collected water charges, the incomes of the Water agencies can also come from other sources. Indeed, the Water agencies can borrow (this was particularly the case of the Loire-Brittany and Rhine-Meuse Water agencies at the beginning of the programme when they encountered financial difficulties).

Since 2009, the Water agencies have been able to benefit from soft loans from the "Caisse des Dépôts et Consignations" (Consignments and Loans Fund) to finance the additional expenditure of the action plan for compliance of the waste water treatment plants with the Urban Waste Water EU Directive.

# Conclusion

The French example greatly widens the range of instruments for financing sustainable water resources management and its combination with legal and normative instruments:

- National law and European Community standards strictly govern the regulations on public health and the environment applicable to the availability and quality of the water resources.

- Multiple financing bases are used to meet targeted goals: the invoicing of drinking water according to the volume used thus not only supports the sustainable financing of the service and the amortisation of its investments, but also supports urban sanitation costs, taxes on domestic pollution, basin governance, maintenance of the aquatic environments and the public waterways domain and production of knowledge. The electricity bill finances part of the storage infrastructure and its maintenance. The insurance policy for dwellings and vehicles is the main basis of the management and compensation for flood hazards. The tax on abstractions applied to industries and companies covers some expenses related to quantitative management. The national or local taxpayer takes responsibility for his part of the expenditure for general administration of the system, via the budgets of the State, local authorities and their public bodies: research, national information system, water policing, health, environment, risks, monitoring of the environments, biodiversity conservation, etc.

This French case highlights the seniority and coherence of an institutional architecture of water management at the level of river basins, facilitated by governance (Basin committees) and financing authorities (Water agencies), allowing dialogue and equalisation between the interested parties. In France, the river basin thus became a space for solidarity, sharing information, negotiation, planning and participatory decision-making, multi-year financial planning. Comparable to a "Water Parliament", the Basin committee is the place for public debate and decision-making with representatives of all the users of the resource and environments, including associations for nature conservancy, local contracting authorities, economic partners and users. It permanently endeavours to allow for collective and consensual appropriation of national commitments regarding sustainable water management, and to reconcile environmental protection goals with local needs for local and joint development. Agencies' financial resources come from the water price, the basic rule being "water pays for water and pollution pays for pollution removal". This approach allowed considerable benefits and progress in sustainable investment on water since the creation of the Water agencies in 1964.

From that time in France[16], the financial challenge dealt more with the safeguarding of the resource quality - especially with respect to industrial pollution – than with strategic investment on supply security, whose inheritance was essentially already in place: great hydraulic infrastructures for storage, regulation, civil safety, drinking water supply, irrigation, hydropower production and navigation.

However, the European commitment to recover good ecological status of all the inland and coastal water bodies, adopted in 2000 and extended to the marine environments in 2008, shows the limits of a "whole water pricing" vis-a-vis the environmental requirements which considerably increased. Indeed, water is a transverse stake upstream of all socio-economic activities, and the aquatic resources are impacted in their turn by the externalities of all these activities. Resources, lake, coastal or marine in particular, thus concentrate (solid and liquid) waste and untreated pollution from industrial, agricultural and economic activities, drained by the rivers or dissolved in groundwater and in the atmosphere.

It thus appears that many externalities impacting aquatic resources are not related to current or measurable water abstractions: inherited orphan industrial pollution (ruins of war, sediments, sludge, dredging residues, etc.), rain pollution, leachate from quarries and mines, solid waste -buried or not-, agricultural or contaminated soil leaching, salting of roads and treatments of frontages of buildings, air pollution fallout, etc. For those, the pricing of abstracted water proves to be inoperative as it results in transferring to other economic agents the pollution load which they did not cause. Other legal or financial instruments are then to be considered: prohibition of toxic products, taxation at the source of the polluting products, greater responsibility of the producers who internalise the costs of removing pollution in the prices of the products concerned, funds for eliminating orphan pollution, etc.

These ways were especially used on pesticides and phosphates by the Grenelle for the Environment, and are already partly active in the waste policy and following the European REACH regulation, or are being explored, in particular by using the square metre of built land as a taxation basis to finance the treatment of rain pollution.

[16] And still today

The French case clearly shows that water policy cannot be "proofed" from the other sectoral policies, either those on waste and agriculture, or those on biodiversity. It also shows that quantitative water management cannot be dissociated from qualitative management: the quantitative availability of the resource is not sufficient, it is also necessary that its good quality makes it usable at an acceptable cost! Regarding these two aspects, it is to be observed that the financial programmes of the Water agencies gradually made eligible to their assistance the financing of the elimination of some categories of solid waste strongly impacting the aquatic environments or the acquisition of wetlands with strong potentials for purification, ecological habitats and flood prevention. The Grenelle for the Environment especially aims as a priority at tripling the surface areas for biological agriculture, upstream of water intakes, and the reform of the Common Agricultural Policy should extend the conditions for agricultural aid to the conservation of lands and aquatic resources. Actions regarding quantitative resources management will also be developed in the 9$^{th}$ and 10$^{th}$ Action Plans of the Water agencies (2007-2018).

# Bibliography

***Bibliographic sources mentioned in this report***

[1] State Council (06/2010)
*Rapport annuel 2010 du Conseil d'Etat – L'hydrosystème et son droit / Annual report 2010 of the State Council - The hydrosystem and its right*

[2] EDF Group (2009)
*Rapport Développement Durable 2008 du Groupe EDF / Report on Sustainable Development 2008 of EDF Group*

[3] Seine-Normandy Water Agency (2010)
*http://www.eau-seine-normandie.fr/*

[4] Water Information Centre (April 2009)
*Baromètre C.I.EAU – TNS SOFRES 2009 – Les français et l'eau / C.I.EAU – TNS SOFRES 2009 Barometer – The French people and water*

[5] Seine-Normandy Basin Committee (2008)
*25 ans de politique d'assainissement de l'agglomération parisienne – Impact sur la qualité de la Seine / 25 years of sanitation policy in Paris agglomeration: Impact on the quality of the Seine".*

[6] Patrick Chegrani – D4E (Séries d'études 2005-2008)
*Evaluer les bénéfices environnementaux sur les masses d'eau / Evaluating the environmental benefits on water bodies*

[7] Nadine Barthelemy – MEEDDAT/CGDD (2009)
*Les bénéfices non marchands de l'atteinte du bon état des eaux : évaluation à l'échelle de la France / Non-merchant benefits of achieving good water status: evaluation on the French scale*

[8] Ministry for Health and Sports (June 2009)
*Etat sanitaire des eaux de baignade en mer et en eau douce / Health status of bathing water in the sea and fresh water*

[9] General Commission for Sustainable Development (June 2009)
*Chiffres et Statistiques n°43 – La facture énergétique de la France en 2008 / Figures and Statistics n°43 – the French energy bill in 2008*

[10] Détente Consultants,
*Impact des politiques territoriales sur le secteur thermal en France / Impact of local policies on the spa sector in France*

[11] Conseil National des Exploitants Thermaux/National Council of Spa Operators
*Aspects économiques du thermalisme français / Economic aspects of the French spa sector*

[12] Directorate for Tourism,
*Tourisme de santé et de bien-être / Health and well-being tourism*

[13] Seine Grands Lacs / Seine Great Lakes
*http://www.seinegrandslacs.fr/*

[14] Voies Navigables de France (2009)
*Le trafic fluvial, meilleur mode de transport terrestre en 2008 / Waterway transport, the best land transport in 2008*

[15] Voies Navigables de France (2009)
*Economic newsletter Nr. 17*

[16] General Commission for Sustainable Development (June 2011)
*L'économie de l'environnement en 2009 – Rapport de la Commission des comptes et de l'économie de l'environnement – Edition 2011 / Environmental economics in 2009 - Report of the Commission of audits and environmental economics – 2011 Edition*

[17] EDF Group (June 2009)
*Dossier de presse – Journée découverte de l'hydraulique le 27 juin 2009 / Press release – Discovery day on hydraulics on 27 June 2009*

[18] National Company of the Rhone (2009)
*Rapport annuel 2008 de la Compagnie Nationale du Rhône / Yearly 2008 report of the National Company of the Rhone*

[19] Voies Navigables de France (2009)
*Rapport de gestion 2008 de Voies Navigables de France / Management report 2008 of the Voies Navigables de France*

[20] General Commission for Sustainable Development (March 2009)
*Le point sur – Le rôle de l'assurance dans la prévention des catastrophes naturelles / The point on - the role of insurance in the prevention of natural disasters*

[21] General Commission for Sustainable Development (March 2009)
*Etudes & Documents n°1 – Assurances des risques naturels en France : Sous quelles conditions les assureurs peuvent-ils inciter à la prévention des catastrophes naturelles ? / Studies & Documents n°1 – Insurance on natural hazards in France: Under which conditions insurers can promote the prevention of natural disasters?*

[22] Jérémy Devaux (2008)
*Atteinte du bon état des eaux en Seine-Normandie – Analyses coûts bénéfices à différentes échelles / Achieving good water status in the Seine-Normandy Basin – Cost-benefit analyses on various scales*

[23] BIPE/FP2E (January 2008)
*Les services d'eau potable et d'assainissement en France – Données économiques, sociales et environnementales / Drinking water supply and sanitation utilities in France – economic, social and environmental data*

[24] International Office for Water (February 2008)
*Case study: Financing of drinking water supply and sanitation utilities in France*

[25] International Office for Water (June 2009)
*Organisation of French Management in France*

[26] Water agencies (2010)
*Annexe au projet de loi de finances pour 2010 – Agences de l'eau / Appendix to the finance law for 2010 - Water agencies*

[27] Détente consultants (February 2005)
*Impact des Politiques territoriales sur le secteur thermal en France / Impact of local policies on the spa sector in France*

[28] General Commission for Sustainable Development (July 2008)
*L'économie de l'environnement en 2008 – Rapport de la Commission des comptes et de l'économie de l'environnement – Edition 2010 / Environmental economics in 2008 - Report of the Commission of audits and environmental economics – 2010 Edition*

[29] General Commission for Sustainable Development (July 2009)
*L'économie de l'environnement en 2007 – Rapport de la Commission des comptes et de l'économie de l'environnement – Edition 2009 / Environmental economics in 2007 - Report of the Commission of audits and environmental economics –2009 Edition*

[30] General Direction for Health (September 2005)
*Information document: drinking water quality in France, health and regulatory aspects*

[31] Interdepartmental union for sanitation in the greater Paris (2008)
*Activity report 2007*

[32] Egis Eau for Seine Great Lakes, (December 2010)
*Note on the approach to cost-benefit analysis of the draft Bassée and issues of funding*

[33] Coastal Conservancy, (2007)
*Annual activity report 2007*

[34] Water agencies, (2006)
*Projet de loi de finances pour 2006 – Agences de l'eau / Finance law for 2006 - Water agencies*

[35] Water agencies, (2007)
*Projet de loi de finances pour 2007 – Agences de l'eau / Finance law for 2007 - Water agencies*

[36] Water agencies, (2008)
*Projet de loi de finances pour 2008 – Agences de l'eau / Finance law for 2008 - Water agencies*

[37] Natural mineral water
*http://www.eaumineralenaturelle.fr/economie/production-eau.html*

[38] General Commission for Sustainable Development (September 2011)
*Etudes & Documents n°52 – Coûts des principales pollutions agricoles de l'eau / Studies & Documents n°52 – Assessing water pollution costs of farming in France*

[39] General Commission for Sustainable Development (May 2011)
*Etudes & Documents n°22 – Le régime d'assurance des catastrophes naturelles en France métropolitaine entre 1995 et 2006 / Studies & Documents n°22 – The insurance of natural disasters in France between 1995 and 2006*

[40] French Federation of Insurance Companies
*http://www.ffsa.fr/sites/jcms/p1_429021/inondations-du-var-le-bilan-chiffre-un-an-apres?cc=fn_7360*

[41] French Federation of Insurance Companies
*http://www.ffsa.fr/sites/jcms/p1_395637/catastrophes-naturelles-xynthia-un-an-apres?cc=fn_7360*

***Other bibliographic sources having assisted in the writing of this report***

[42] French Environment Institute, Ministry of Ecology (November 2005)
*Les dossiers IFEN – Les dépenses d'environnement des Départements et des Régions (1996-2002) / IFEN documents - environmental expenditure of the Departments and Regions (1996-2002)*

[43] National Agency for Water and Aquatic Environments (June 2008)
*L'ONEMA, un an d'actions / ONEMA a year of actions*

[44] Eau France
*http://www.eaufrance.fr/*

[45] Economie Eau France
*http://www.economie.eaufrance.fr/*

[46] MEEDDM, AESN, Seine Great Lakes, Ile-de-France Region (August 1998)
*Evaluation des dommages liés aux crues en région Ile-de-France – Rapport de synthèse / Evaluation of the damage related to floods in the "Island-of-France" area – summary report*

[47] Ministry of Ecology, Energy, Sustainable Development and the Sea (2009)
*Les services publics d'eau potable et d'assainissement en France / Public drinking water supply and sanitation utilities in France*

[48] General Commission for Sustainable Development, Ministry of Ecology (July 2009)
*Etudes & Documents n°10 – Les éco-activités et l'emploi environnemental / Studies & Documents n°10 - eco-activities and environmental employment*

[49] Ministry of Ecology, Energy, Sustainable Development and the Sea (March 2009)
*Police de l'eau – Rapport d'activité 2008 / Water policy – 2008 progress report*

## List of the acronyms used

**AESN**: Seine-Normandy Water Agency
**AFPCN** : French Association for Disaster Reduction Natural
**ANR** : Agence National de la Recherche / National Research Agency
**ASTEE** : Association Scientifique et Technique pour l'Eau et l'Environnement / Scientific and Technical Association for Water and Environment

**BOD** : Biological Oxygen Demand

**CEPA**: Classification of Environmental Protection Activities
**CEPR**: European Centre for Flood Risk Prevention
**CGDD**: Commissariat Général au Développement Durable / General Commission for Sustainable Development
**CLE**: Commission Locale de l'Eau / Local Water Commission
**CNE**: Comité National de l'Eau / National Water Committee
**CNR**: Compagnie Nationale du Rhône / National Company of the Rhone
**CNRS**: Centre National de la Recherche Scientifique / National Scientific Research Centre
**COD** : Chemical Oxygen Demand
**CPER** : State-Region Projects Contracts
**CPIER** : State-Region Interregional Projects Contracts
**CPMA**: Cotisation Pêche et milieu Aquatique / Contribution to Fishing and Aquatic Environments
**CSP** : Conseil Supérieur de la Pêche / Higher Council for Fisheries

**DWW**: Drinking Water Supply

**EDF**: Electricité de France / Electricity of France
**EPCI** : Public bodies for inter-municipality cooperation
**EPTB**: Etablissement Public Territorial de Bassin / Local Public Basin Authority
**ERDF**: European Regional Development Fund

**FNDAE**: Fonds National pour le Développement des Adductions d'Eau / National Fund for Rural Water Supply
**FNPF**: Fédération Nationale pour la Pêche en France / French National Federation for Fishing
**FP2E (or FPEE)**: Fédération Professionnelle des Entreprises de l'Eau / Professional Federation of Water Companies
**FRPD**: Framework Programme for Research and Development
**FTE**: Full Time Equivalents

**GW**: Gigawatt
**GP:** Good potential
**GS**: Good status

**HP**: Horsepower

**IFEN**: Institut Français de l'Environnement / French Environment Institute
**IFREMER**: Institut Français de Recherche pour l'Exploitation de la Mer / French Institute for Research and Exploitation of the Sea
**INRA**: Institut National de Recherche Agronomique / National Agronomic Research Centre
**INSEE**: Institut National de la Statistique et des Etudes Economiques / National Institute for Statistics and Economic Studies
**IRMA**: Institute of Major Hazards

**LEMA**: Loi sur l'Eau et les Milieux Aquatiques / Law on Water and Aquatic Environments

**MDG**: Millennium Development Goals
**MEEDDM**: Ministère de l'Ecologie, de l'Energie, du Développement Durable et de la Mer / Ministry of Ecology, Energy, Sustainable Development and the Sea
**Métox** : Toxic metals
**MISE**: Mission Inter-Ministérielle de l'Eau / Inter-Ministerial Mission for Water
**MSFD**: Marine Strategy Framework Directive
**MW**: Megawatt

**OECD** : Organisation for Economic Co-operation and Development
**ONEMA**: Office National de l'Eau et des Milieux Aquatiques / National Agency for Water and Aquatic Environments

**PAPI** : Programmes d'Actions de Prévention des Inondations / Flood Prevention Action Plan
**PIREN Seine**: Programme Interdisciplinaire de Recherche sur l'Environnement de la Seine / Interdisciplinary Research Programme on the Environment in the Seine
**PNRM** : Plan National sur les Résidus de Médicaments dans les eaux / National Plan on Drug Residues
**PNSE2**: Second Plan National de Santé Environnement / Second national health and environment plan
**PoM**: Programme of Measures

**REOM**: Redevance d'Enlèvement des Ordures Ménagères / Fee for Garbage Collection
**RN**: Reduced Nitrogen
**RNDE**: Réseau National des Données sur l'Eau / National Water Data Network

**SAGE**: Schéma d'Aménagement et de Gestion des Eaux / Water Development and Management Scheme
**SDAGE**: Schéma Directeur d'Aménagement et de Gestion des Eaux / Master Plan for Water Development and Management
**SEEIDD**: Service Economie Evaluation et Intégration du Développement Durable / Department of Economy, Evaluation and Integration of Sustainable Development
**SEQ-Eau** : Système d'Evaluation de la Qualité des cours d'Eau / System Quality Assessment of watercourses
**SIAAP**: Syndicat Interdépartemental pour l'Assainissement de l'Agglomération Parisienne / Interdepartmental Union for Sanitation in the Greater Paris
**SME**: Small and Medium-sized Enterprises
**SOeS**: Service de l'Observation Et de la Statistique / Information and Statistics Department
**SS**: Suspended Solids

**TEOM**: Tax Collection of household waste
**TGAP**: Taxe Général sur les Activités Polluantes / General Tax on Polluting Activities
**TW**: Terawatt
**TWh**: Terawatt hour

**UNPF** : Union Nationale pour la Pêche en France et la protection du milieu aquatique / National Union for Fishing
**UWWD**: Urban Waste Water Directive

**VAT**: Value Added Tax
**VNF**: Voies Navigables de France

**WFD**: Water Framework Directive
**WIS**: Water Information System

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**Department of the Commissioner-General for Sustainable Development**
(Commissariat général au développement durable)
**Department for the Economics, Assessment and Integration of Sustainable Development**
(Service de l'économie, de l'évaluation et de l'intégration du développement durable)
Tour Voltaire
92055 La Défense cedex
phone number : 00 (33) 1.40.81.21.22

You may connect to the following web site to view this publication :
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## *Abstract*

*This update of January 2012 of a case study on « financing integrated water resources management in France » (produced in 2010 for OECD works) explores benefits of a policy targeting the good and sustainable ecological status of all water bodies. The infrastructure of domestic water supply has already been completed in France. Urban and industrial pollutions are more and more under control, and the new priority is to restore the ecological sustainability of water bodies. In big cities, water bills related to water supply and sanitation utilities are generally cheaper than European average, although they cover most of utilities costs and include basins consumption and pollution taxes. Water Agencies have demonstrated the efficiency of financial solidarity at the watershed scale for treating point source pollutions and investing on water infrastructure. Navigation infrastructure is maintained through various taxes (gates taxes, hydraulic tax,...). Flood damages of private properties are financed through an insurance mechanism with a state guarantee, that feeds a public fund for flood prevention: the Barnier's fund. The scale of this fund has been consequently increased since 2008. Despite these achievements, the study shows that:*

- *This old system based on the "water pays for water" principle has been convenient for charging well identified pollutors such as industries and cities; but it has failed to charge other categories of pollutors specially in the case of diffuse pollutions. Complete cost-recovery of all water externalities on the water supply bills has reached the limits of social acceptability.*
- *The present system has put the emphasis on water quality and should move now to promoting and implementing a sustainable quantitative management of the water resource.*

*These new priorities have been identified in the water commitments of the "Grenelle" policy roadmap and should be reflected in the 9th and 10th Water Agencies financial programs (2009-2021).*



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