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Comprendre
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Economic analysis for management of water and aquatic environments

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N°8

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RÉPUBLIQUE FRANÇAISE

Ministère
de l'Écologie,
du Développement
durable
et de l'Énergie

The French National Agency for Water and Aquatic Environments

Onema is a public agency operating under the supervision of the Ecology ministry. It was created by the 2006 Water law and launched in April 2007. Onema is the main technical organisation in France in charge of developing knowledge on the ecology of aquatic environments and monitoring water status. Its mission is to contribute to comprehensive and sustainable management of water resources and aquatic ecosystems. The agency contributes to restoring water quality and attaining the goal of good chemical and ecological status, the objective set by the European Water framework directive. Onema, with a workforce of 900, is present throughout continental France as well as in the overseas territories in the framework of the national interbasin solidarity policy.
In carrying out its mission, Onema works closely with all stakeholders in the water sector.

This book was written with the valuable contribution of the Economics work group managed by the Water planning and economics office at the Water and biodiversity directorate of the Ecology ministry. The work group comprises economists from the Water agencies and personnel from the Sustainable-development division of the ministry. The work produced by the Water-agency economists constituted the starting point for this *Knowledge for action* book that we then filled out, developed and enhanced.
The Water-agency economists also drafted in 2013 an operational manual intended for people using social-economic data and analyses for sub-basin management plans (SBMP) and river contracts.

This book continues the ***Knowledge for action*** series of books that provides professionals in the water and aquatic-environment sector (scientists, engineers, managers, instructors, students, etc.) with information on recent research and science-advice work.

The book is available on the Onema site (www.onema.fr), in the Resources section, and at the national portal for « Water technical documents » (www.documentation.eaufrance.fr).

Foreword

The European water framework directive (WFD) adopted in the year 2000 boosted the use of economics for management of water resources and aquatic environments. The three main steps in WFD implementation, namely the river-basin characterisation reports on the status of water resources, the formulation of programmes of measures and analysis to justify exemptions to reaching good status in 2015, all call on economic assessments. Sub-basin management plans, prescribed by the Environmental code, also call heavily on economic analysis.

Whether the goal is to characterise in social-economic terms how water is used in a given area or to assess the costs and environmental impacts of a programme of measures or a project, economic analysis is now an integral part of the preparatory and formulation processes of public policy. Cost-recovery analysis, cost-effectiveness analysis and cost-benefit analysis are all assessment techniques that water specialists must use, on both the local and national levels, to comply with regulations and implement water-management policy in their area.

It is with the goal of facilitating, informing and assisting the decisions of water stakeholders that the National agency for water and aquatic environments collected in this book definitions, knowledge and a discussion of the economic-analysis techniques used to manage water and aquatic environments. The goal of this book is to assist in the operational implementation of economic analysis in the fields of water and aquatic environments.

Elisabeth Dupont-Kerlan
Onema general director

Preliminary remarks

For almost 15 years, economic assessment has played an increasingly important role in the management of water and aquatic environments. Environmental economic assessment, which is more social-economic than financial in nature, consists of analysing all the activities of economic agents (individuals, the State, companies, non-profit organisations, etc.) and their effects on society and the environment in order to determine the quantitative and qualitative consequences, both positive and negative.

Remarks on environmental economic assessments

Environmental economic assessment is a branch of economics that is part of both economic assessments and environmental economics. It deals with evaluating, in economic terms, the effects on the environment of certain activities in view of integrating that information into an overall analysis of a policy or project. The effects may be negative, e.g. the damage caused by environmental degradation, or positive, e.g. the advantages resulting from an improvement to the environment.

The activities analysed may:
- target environmental protection (preservation or restoration);
- concern economic activities, e.g. power generation, or construction of infrastructure, e.g. a highway, that have effects on the environment (positive and/or negative) and may require preventive or curative measures.

In the environmental field and particularly concerning water and aquatic environments, economic analysis can contribute to solutions in three main ways:
- it can demonstrate that hydrosystems are a natural capital and a source of goods and services;
- it can present the services, whether potential or effective, provided by hydrosystems in economic terms and compare them with the costs required to safeguard those services. This approach is a means to contrast the costs and benefits to be expected from a planned project. The purpose of environmental economic assessment is thus to assign economic value to the potential environmental degradation or improvements which can then be compared to the cost of a project. For an SBMP (sub-basin management plan) or WFD implementation, the objective is not to assign systematically a price to each factor (which would in any case be difficult and produce uncertain results), but rather to stress the existence of these various values during discussions and decision-making processes;
- it attempts to propose a balanced, long-term and efficient distribution of resources depending on the various needs.

Open negotiations are an essential step in the collective formulation of a project in that they take the public interest into account and do not reduce the choices to a set of optimisations.

Economic assessment contributes to the negotiation process by providing local stakeholders with useful information.

The use of economic assessments for management of water and aquatic environments was significantly boosted by the WFD and by the progressive development of SBMPs.

Economic assessment for the WFD and SBMPs

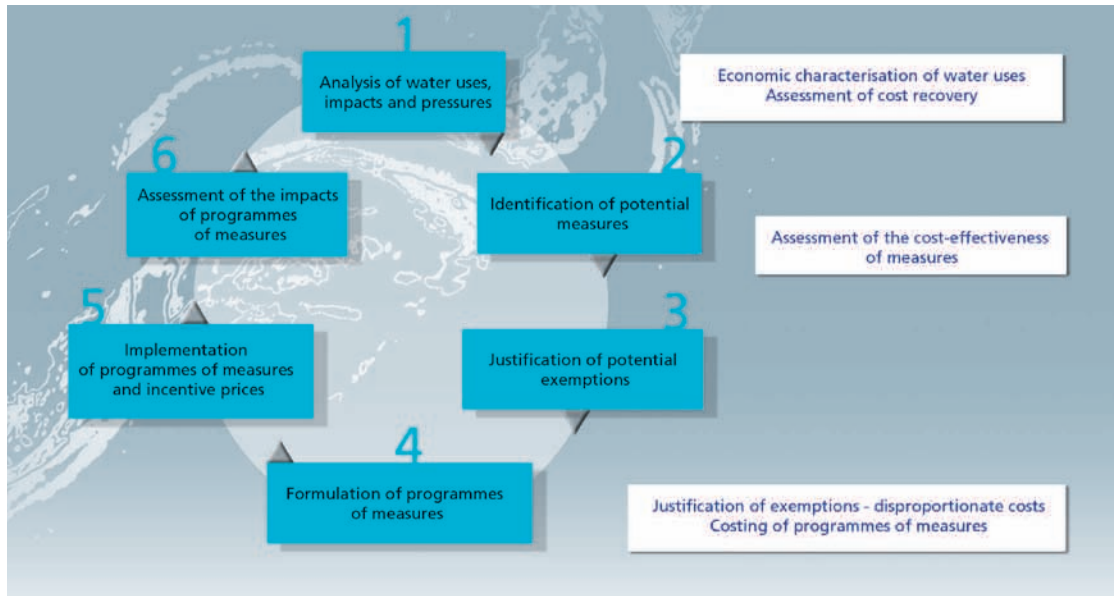
The European water framework directive, voted in December 2000, requires that the Member States reach ambitious environmental objectives for all water bodies in all the major river basins (river-basin districts as per the WFD).

The directive set four essential objectives:
- no further deterioration of water resources;
- reaching good status or good potential of water bodies by 2015;
- reducing or eliminating pollution by priority substances;
- complete compliance with all standards in protected zones by 2015.

To reach these objectives in each river-basin district, it is necessary to characterise the pressures and impacts, run economic analysis of water uses (article 5), draft a water-management plan (article 13) and set up a programme of measures (article 11). In addition, participation by the public is mandatory (article 14).

Economic analysis plays a major role in WFD implementation. It serves as a decision-aid tool throughout the planning process because it can be used to:
- assess and contrast the economic value of water uses and the related issues;
- estimate the degree of cost recovery and the incentive value of price levels;
- determine the most cost-effective combinations of measures to achieve environmental objectives;
- justify exemptions for deadlines and/or objectives on the basis of disproportionate cost.

Economic assessments are thus part of a dynamic process that must be renewed for each WFD cycle.



The economic-analysis cycle in the WFD (source: Economics and the Environment – The Implementation Challenge of the Water Framework Directive, Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance document n°1, 2003).

Economic assessments are used during the three key steps in WFD planning.

Characterising water uses and assessing cost recovery by producing a report on water-related economic activities and informing on who pays what.

The purpose of this step is to inform on the issues involved in water management in the river basin by:

- describing water uses as well as their social and economic importance;
- studying potential changes in economic activities, in pressures on water resources and in the effects of current water policies;
- assessing cost recovery achieved by water and sanitation services.

This work is carried out in the process of drafting the report. When the necessary data do not exist, the goal is to identify the gaps and report on the work undertaken to eliminate them.

Preparing cost-effective programmes of measures to reach environmental objectives as inexpensively as possible.

This step represents the main contribution to the preparation of the river-basin management plan. Economic analysis serves to:

- select measures according to their cost-effectiveness ratio;
- roughly determine the cost of a programme of measures required to reach good status.

Justifying exemptions and final costing of the programme of measures to avoid exceeding financial limits.

During this step, economic analysis is used to justify any exemptions to objectives due to disproportionate costs. Cost-benefit analyses must be run. The ability of water stakeholders to pay is also assessed. The final cost of the programme of measures is then calculated and the funding conditions are set.

The applicable regulations stipulate that economic analysis must also play an important role in preparing SBMPs.

The Environmental code contains the following articles concerning economic aspects:

- article R 212-36 states that "the characterisation report for the SBMP must include:

  1. An analysis of the existing aquatic environment;
  2. A list of how water resources are used;
  3. A presentation of the main possibilities for exploiting the resources given the foreseeable changes in rural and urban areas and in the economic situation, as well as the impact on the resources of the programmes mentioned in the second paragraph of article L. 212-5;
  4. An assessment of the hydroelectric potential of each geographic area."

- article R 212-46 states that "The plan for the development and sustainable management of water resources and aquatic environments must include:

  1. A summary of the characterisation report required by article R. 212-36;
  2. A presentation of the main issues involved in water management in the river sub-basin or set of sub-basins;
  3. Definition of the general objectives selected to comply with the principles listed in articles L. 211-1 and L. 430-1, identification of the priority means to achieve those objectives, notably concerning optimum use of existing or planned infrastructure, and the schedule for their implementation;
  4. Information on the deadlines and conditions under which the decisions on water issues made by the administrative authorities within the perimeter set by the plan must comply with said plan;
  5. An estimate of the physical and financial means required to implement and monitor the plan."

It follows that the economic assessments required during the preparation of an SBMP comprise five steps.

Draw up the list of the significant water uses and functions in the entire aquatic environment, plus the list of potential uses and those currently inhibited by the status of the water resources and the environment.

The potential impacts on the areas upstream and downstream of the SBMP perimeter, notably when the perimeter is only partially set, must not be neglected.

Provide information on the contents of the scenarios selected or proposed, concerning the action programmes and the water uses impacted positively and/or negatively.

Economic analysis requires that the objectives be presented in terms of well defined measures for subsequent costing.

Estimate the investment and operating costs of the action programmes for each scenario and list, without necessarily costing, the related expenses incurred by implementation of the measures and by the full extent of the uses made possible by the action programmes (e.g. the development of tourism following an increase in recreational uses).

Estimate the economic gains produced by the various scenarios and related programmes.

This calculation of the benefits consists of estimating the degree to which a scenario will or will not produce an improvement (or inhibit degradation) of the natural environment and the related water uses.

Finally, once the assessment has been carried out, it is necessary to draft a decision-aid report including summaries and scenario results (total costs and benefits for the period studied with discounted values) to serve as a basis for informed discussion during the preparation of the SBMP.

The purpose of this book

The purpose of this book is to provide information on the use of economic assessments for water management in order to clarify and better understand the issues involved. More precisely, it will attempt to answer the following questions:

- what are the actual components of the economic analyses?
- what work do they involve and what results may be expected?
- why are they necessary for WFD implementation or for the preparation of an SBMP?
- what are the best practices to be followed and the pitfalls to be avoided?

This book comprises five main parts:

- characterisation of water uses;
- assessment of costs;
- assessment of environmental impacts;
- cost recovery;
- disproportionate costs.

Contents

Abstract

For almost 15 years, economic assessment has played an increasingly important role in water management. Environmental economic assessment, which is more social-economic than financial in nature, consists of analysing all the activities of economic agents (individuals, the State, companies, non-profit organisations, etc.) and their effects on society and the environment in order to determine the quantitative and qualitative consequences, both positive and negative.

The use of economic assessments for water management was significantly boosted by the launch of the WFD in December 2000 and by the progressive development of SBMPs.

Five aspects are presented here to provide information on the use of economic assessments for water management in order to clarify and better understand the issues involved.

1 Characterisation of water uses

Before launching economic studies to assess the consequences of a project or measure, it is first necessary to list the existing water uses in the given area. Characterisation of water uses is the term commonly employed for this description of water uses lying at the crossroads between economics and the natural environment. An economic characterisation of water uses consists of estimating the importance of water in the economy and the social-economic development of the studied river basin. The analysis must identify the significant water uses and study the basin dynamics in order to contribute to the formulation of a base scenario. It must also attempt to foresee any changes in the main economic and human activities that could impact on pressures and water quality. Study must be devoted to the probable changes in the main social-economic parameters such as the local policies implemented, growth rates of the main economic sectors, investments in the water sector, local population dynamics, etc. The listing of water uses in the area serves to integrate the local social-economic environment and the local water-management issues in the analysis. All the above elements are important factors in the discussions concerning action programmes and measures.

2 Assessment of costs

The first step in assessing the costs of a project or programme is to precisely list all the costs that must be taken into account and quantified. Frequently, it is also necessary to determine the unit costs and the extent of the planned measures in order to calculate the total implementation cost of the project or programme. This type of cost assessment is often used in more elaborate economic analyses such as cost-effectiveness, cost-benefit and cost-recovery analyses.

3 Assessment of environmental impacts

Once the costs of project implementation have been calculated, it is often necessary to estimate the environmental impacts of the project. This consists of identifying the environmental benefits and damages incurred by the project or measure. The point of the assessment of these impacts is to inform on the economic, social and environmental effects caused by the project or measure. An economic assessment indicating the value of an environmental good is based primarily on methods linking a value expressed in monetary terms (euros, dollars, etc.) with changes in the environmental status. The process of monetising does not mean that the environmental good, in this case the aquatic environment, becomes a marketable item that can be freely purchased or exploited. It provides a quantified assessment that can then be compared to economic values more commonly used in analysis such as costs and budgets. A number of different approaches to the economic assessment of environmental goods have been devised. Each sheds light on a particular aspect and is selected depending on the value to be calculated. For example, to determine market or option values, cost-based methods are employed. To calculate non market-related use values, revealed-preference methods are used. Finally, non-use values can be measured by stated-preference methods.

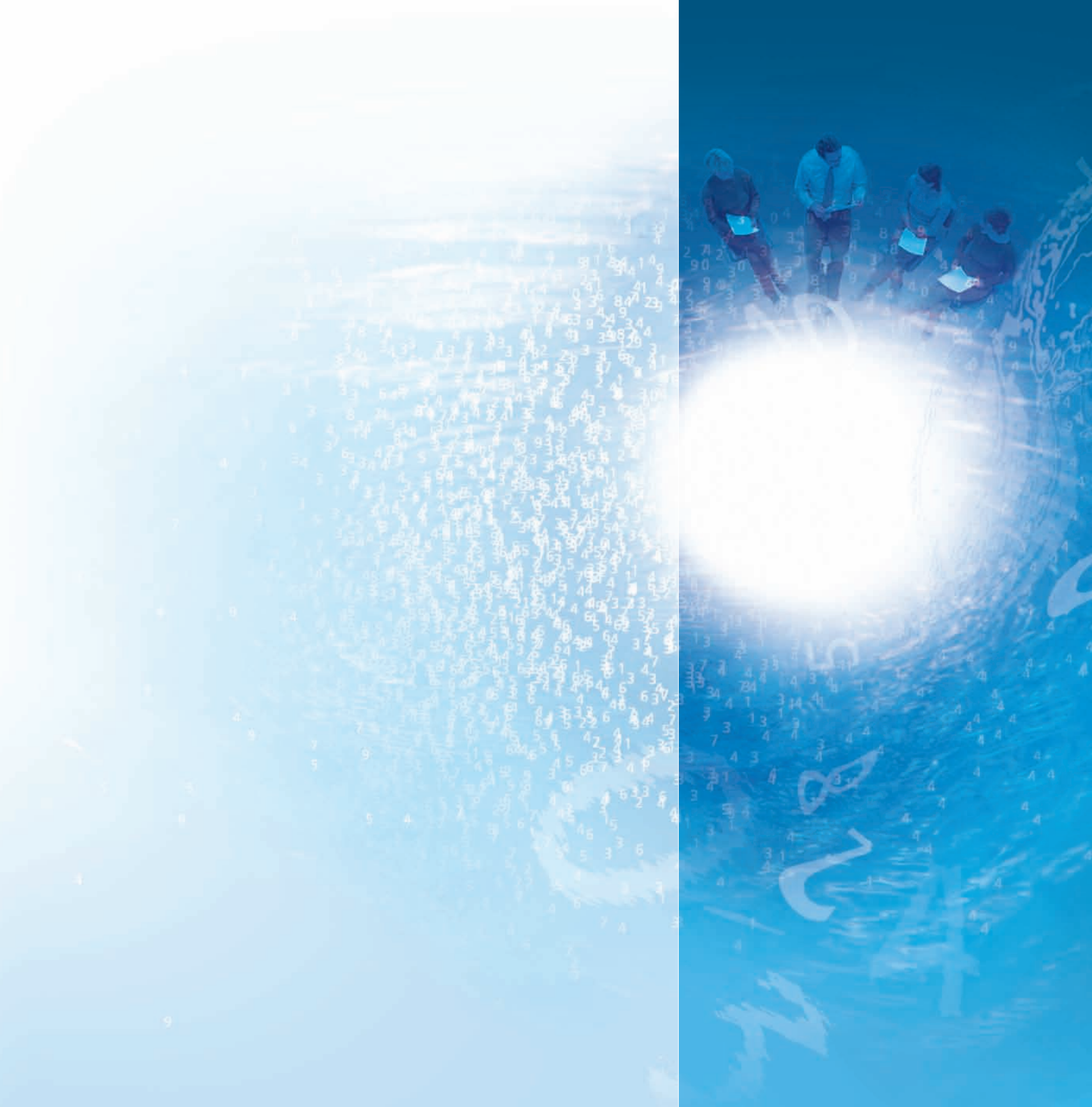
4 Cost recovery

The concept of cost recovery is explicitly mentioned in the WFD. Cost-recovery analysis must be carried out in the process of drafting the characterisation report for each river-basin district. A more simplified form of the analysis may also be carried out for an SBMP. The results can serve as true decision-aid tools in that they facilitate debate and inform on the economic issues in the area covered by the SBMP.

Cost-recovery calculations consist of identifying and estimating all the economic flows resulting from the services pertaining to water use. The objective being that water users cover the costs incurred by their use of water as much as possible, primarily through the price paid for water,. The analysis must therefore indicate the degree to which each category of water-service users in fact pays for the water it consumes and discharges.

5 Disproportionate costs

The European water framework directive requires that the Member States reach environmental objectives for the status of all water bodies in the major river basins by 2015. The concept of disproportionate cost is used to justify exemptions in terms of deadlines or of the final status. It is therefore an important component in the formulation and planning of programmes of measures. However, the WFD did not indicate precisely just what the concept of disproportionate costs means and covers. Each Member State has attempted to better understand and more precisely define the concept by tracing its general outline and meaning, and by proposing the necessary economic-analysis methods. The approaches developed in France and the U.K. are presented and contrasted here.



Characterisation of water uses

What is meant by "water uses"?

Before launching economic studies to assess the consequences of a project or measure, it is first necessary to list the existing water uses in the given area. Characterisation of water uses is the term commonly employed for this description of water uses lying at the crossroads between economics and the natural environment. However, the European water framework directive (WFD) and the related documents use other terms as well (water-related activities, water services) that must be precisely defined.

Water functions and purposes

The use of water is the act consisting of using certain characteristics of the water (which may be seen as a supply in economic terms) and certain functions to satisfy one or more needs (which may be seen as a demand in economic terms).

Water uses differ depending on whether the aquatic environment serves as:

- a means (transportation, transferral of materials, energy) ;
- an environment or space (for living, activities, protection).

The first type of use generally requires water flows whereas the second requires volumes.
The various water uses may be grouped according to the **purpose** involved.

Figure 1 lists characteristics, functions and purposes of water, with examples shown in Figure 2.

Figure 1

Water characteristics (SUPPLY)

- qualitative characteristics of aquatic environments
- quantitative characteristics of water
- physical characteristics of aquatic environments

Examples of FUNCTIONS

- cleansing
- dilution
- refrigeration
- energy
- supply of drinking water
- recreation
- ecological functions
- navigation
- watering of plants
- services for fauna and flora
- amenities
- flood protection

DEMAND expressed in terms of purposes

- agriculture (irrigation)
- industry (abstractions, hydroelectricity, nuclear power, sand and gravel mining)
- household use (drinking water, sanitation)
- recreation (boating, bathing, skiing, fishing)
- transportation (navigation, marinas)
- commercial fishing (professional fisheries, fish farming, shell fishing)
- tourism (boating, bathing, vacations on seashores, rivers, camping)
- real estate (use by local inhabitants, amenities, flood protection)
- ecosystems (observation, study areas, biodiversity)

Figure 2

a- b © C. Forst - Onema

Fishing and bathing are two recreational uses of water.

Water uses

Water uses concern both the economic sphere and the natural environment.
They may be defined directly in terms of the user's objectives, in which case a use is characterised with respect to the economic sphere because it corresponds to either production or consumption.

They may also be defined in terms of the impacts caused in the environment. Any use of water transforms its characteristics in the natural environment, a transformation that takes place between the abstraction and the discharge to the environment.

Water uses may be grouped in three main categories.

■ Water uses viewed from the economic standpoint

These uses correspond essentially to the objectives of economic entities:

- human consumption;
- other household uses (sanitary uses, air-conditioning, decoration);
- various types of production:
  - agriculture (plants), livestock farming (watering), fish farming, aquaculture,
  - industry (uses specific to products, to manufacturing processes, conditioning, conservation), including production of drinking water (though this is a special case),
  - energy,

- uses required for the production activity (consumption and hygiene of the workforce, maintenance, safety of facilities);

- transportation (navigable or raftable waterways);
- commerce and other services;
- public uses (public services), cultural uses (recreation, living conditions), rituals;
- security (fire, protection, defence).

■ Water uses viewed from the environmental standpoint

These uses may be divided into two subcategories:

- **extractive uses** that remove water from the natural environment and where the abstraction and return to the environment are distant in time and space;
- ***in situ* uses** that do not remove water from the natural environment, but use on-site some of its functional characteristics.

■ Water neutralisation

Water neutralisation consists of efforts to mitigate potential damage and/or eliminate problems (see Figure 3). Neutralisation work is defined by the **objectives pursued**:

- safety of life and property (flood control);
- land use, construction, development (evacuation of rainwater);
- underground installations (dewatering);
- agricultural production (drainage);
- mining (mine drainage);
- transportation and communications security (flood control, evacuation of rainwater).

Neutralisation removes water from the natural environment or modifies its regime. These efforts to control the environment have economic value, but are not water uses.

Figure 3

a © M. Bramard - Onema

Floods.

b © M.Carrouee - Onema

Flood control and evacuation of rainwater are defined as water neutralisations.

Water services

In the WFD, there is also the notion of “water services”, notably in view of cost recovery. Water services are water uses characterised by the existence of installations for water abstraction, storage, treatment and discharge, e.g. for irrigation, production of drinking water, hydroelectric generation, etc.

The 22 April 2004 instructions concerning the analysis of water tariffs and cost recovery of services in compliance with WFD article 9 notes however that:

“*The notion of “service” is extensive because it implicitly includes, absent any contrary indications in article 2-38, public and private services for third parties or for the provider itself, characterised by the presence of installations (abstraction, storage, discharge) and likely to influence significantly the status of water bodies.*”

The definition of water services is developed further a bit later in this document, in the chapter on cost recovery.

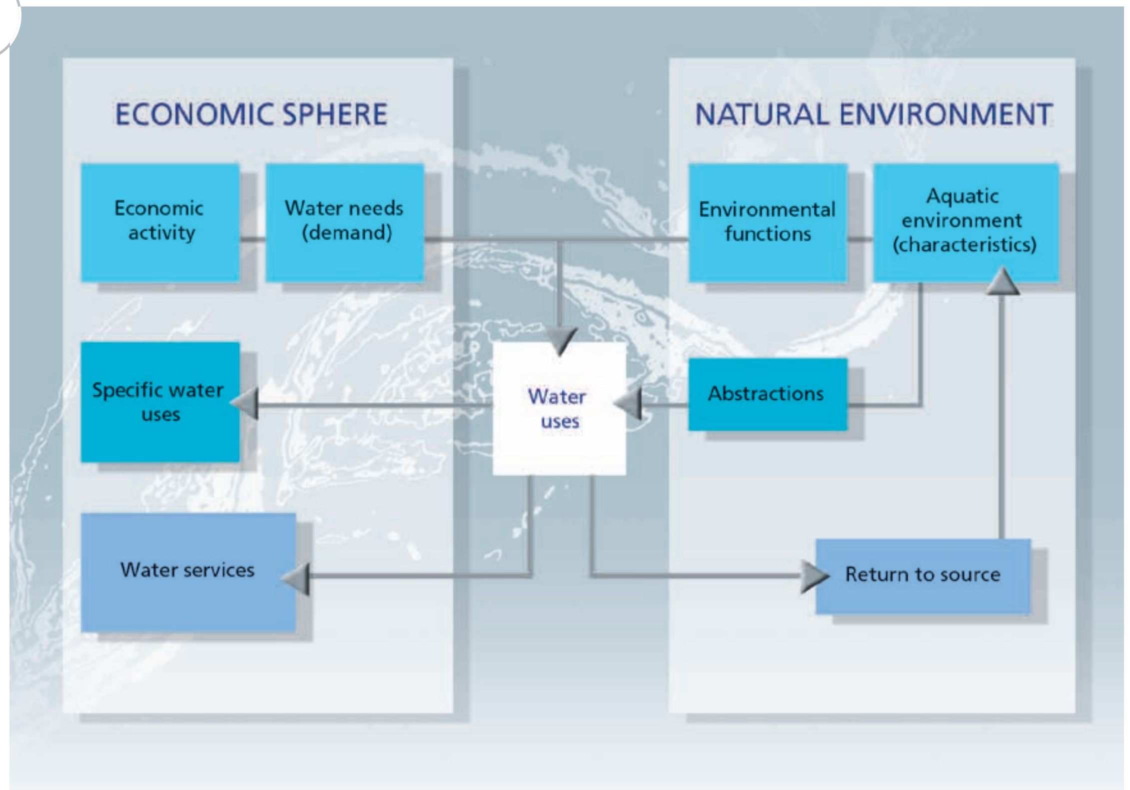
Water activities

This term is mentioned a number of times in the WFD, but never defined. It designates both human activities having an impact on water status and economic activities (see Figure 4).

The notion of “activity” is thus wider than that of “use” because there are certain activities that do not have any significant impact on water status and are not “services” in the WFD sense, nor “uses”, e.g. recreational activities and fishing. This distinction is not systematic and must be based on case by case analysis. For example, fishing in itself does not have a significant impact on water status, however overfishing may.

Analysis of water activities must be included in studies to characterise uses. This is the means to determine the relative economic importance of the activities and to assess, at a later time, the social and economic impact of programmes of measures and action plans on the activities.

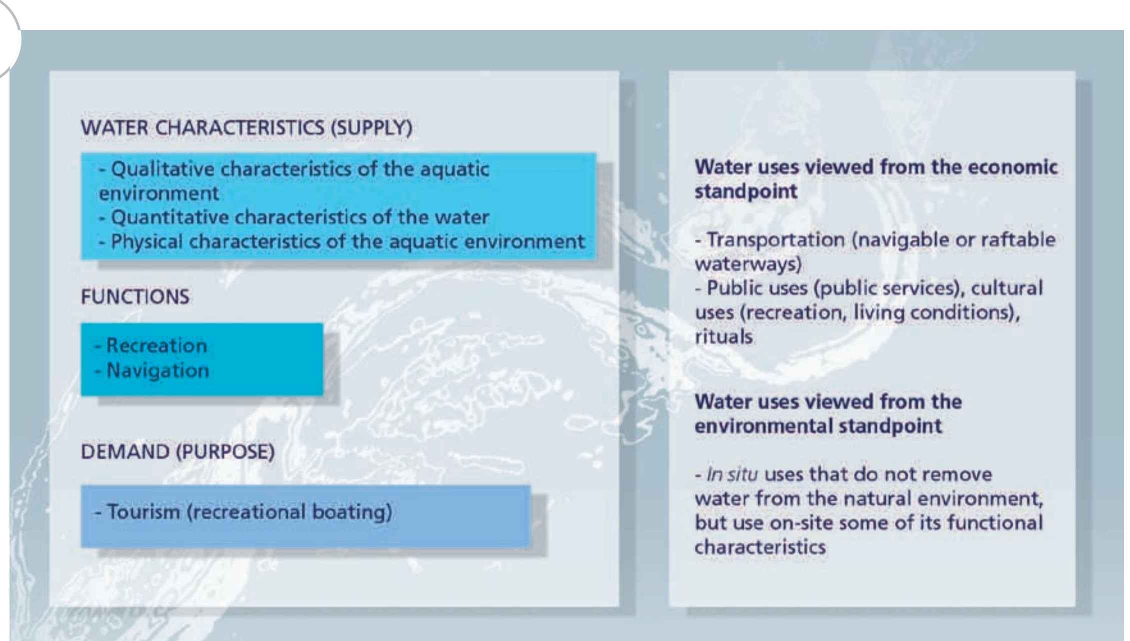
Figure 4



Water uses, interaction between the natural environment and the economic sphere.
Source: the Water agencies.

The purpose of the work to characterise water uses in a given area may, in some cases, be to describe the economic activities, or in others to describe water services, uses or functions. For example, characterisation of recreational boating (see Figure 5) concerns the economic activities pertaining to recreational boating in the area (or beyond if applicable) analysed using certain indicators providing information on its significance.

Figure 5



An example of elements characterising recreational boating.
Source: the Water agencies.

Which water uses must be characterised and how should that be done?

An economic characterisation of water uses consists of estimating the importance of water in the economy and the social-economic development of the studied river basin. The analysis must identify the significant water uses and study the basin dynamics in order to contribute to the formulation of a base scenario. It must also attempt to foresee any changes in the main economic and human activities that could impact on pressures and water quality. Study must be devoted to the probable changes in the main social-economic parameters such as the local policies implemented, growth rates of the main economic sectors, investments in the water sector, local population dynamics, etc.

Identification of uses clarifies the local objective. Listing water uses in the area serves to integrate the local economic environment and the local water-management issues in the analysis. In this sense, it constitutes an aid in thinking through problems and decision-making. Listing of uses also provides information on the social acceptance of measures and/or their compatibility with local, traditional or cultural uses that are not necessarily perceived from the start. It can thus help in adjusting objectives.

Identification of uses helps in shifting from "desirable" to "feasible". Inclusion of economic data in the analysis is the means to shift from the first step in the work devoted to the technical selection of measures (the "desirable") to a second step consisting of finalising the proposal, taking into account social-economic aspects (the "feasible").

All the above elements are **important factors in the discussions concerning programmes of measures and action plans.** The database containing the geographic data on uses assists in determining the areas concerned by a given use. It also lists the economic participants that should be consulted for discussions on the compatibility of the proposed environmental objectives and the related social-economic issues.

This type of economic analysis is thus the means to describe:
- the importance of water in the river basin;
- the main economic players influencing the pressures on and the uses of water;
- how the economic players will evolve over time and how they will influence pressures;
- how supply and demand for water will evolve over time and the problems that may emerge.

The water uses to be listed and characterised may be determined on the basis of existing typologies. The geographic location of economic uses in the basin and the assessment of the link between those uses and the chances of achieving the environmental objectives together constitute a key factor in the system intended to carry out the economic analyses. **It was with that in mind that, in the the Rhône-Méditerranée-Corse basin, the local groups were asked to inventory the uses in the basin according to their relative importance (major, long-standing, emerging, inexistent)** and using a fairly complete list of known uses in the basins, broken down into groups (see Box and Figure 6).

Example of a typology to assist in the geographic location of water uses

Agriculture
- Large-scale, irrigated farming
- Farm irrigation
- Other large-scale farming
- Wine growing - orchards
- Livestock
- Forestry
- Vegetable farming

Industry
- Mechanics - surface treatment - naval repair
- Paper - cardboard - publishing
- Food industry (except bottled water)
- Dry-cleaning - printing - textiles
- Chemicals - petrochemicals
- Trades - artisans
- Wood sector

Energy
- Hydroelectricity
- Nuclear
- Thermal power

Mining and abstractions
- Sand and gravel mining
- Production of bottled water
- Salt production, salt marshes
- Watering for aesthetic purposes (public, private)

Navigation
- Commercial navigation on rivers
- Recreational navigation on rivers
- Maritime commercial navigation and trading ports
- Maritime recreational navigation and marinas

Urbanisation and infrastructure
- Transport of untreated water (canals)
- Soil sealing (flooding)
- Transportation networks and infrastructure
- Industrial port zones
- Building in the floodplain of a river
- Sanitation
- Supply of drinking water (networks)

Fishing
- Fish farming
- Shell fishing
- Freshwater commercial fishing
- Maritime commercial fishing
- Freshwater recreational fishing
- Recreational fishing in littoral zones (on foot and otherwise)
- Fishing ports

Water-related sports and recreational activities
- Diving, bathing, water games (requiring bathing-quality water)
- Canoeing, kayaking, rowing
- Motor boating, sailing, windsurfing
- Caving, canyoning

Tourism and recreational activities in aquatic environments
- Golf courses (watering, treatment)
- Winter sports, skiing (snow making)
- Hunting
- Powerboating (jet ski, water skiing, etc.)
- Non-aquatic tourism (rural tourism in contact with the hydrosystem)
- Tourism in general
- Campgrounds
- Water cures, thalassotherapy, balneotherapy

Non-commercial uses
- Observation (plants, birds, whales, etc.)
- Walking, hiking, snorkelling
- Contribution to real-estate value

Functions of environments in good condition
- Water resources (local)
- Additional self-cleansing (and dilution)
- Flood mitigation (retention systems, resource regulation)
- Self-regulation of sediment (fewer interventions)
- Biological richness (biodiversity)

Source: Rhône-Méditerranée-Corse water agency

Figure 6

a © V. Marty - Onema
b © F. Weingertner - Onema
c © M. Bramard - Onema

Walking, recreational boating and recreational fishing are free-time activities taken into account when characterising water uses.

A simple way to characterise water uses in economic terms

It is not always easy to initiate an in-depth study on uses. It is preferable that each type of use be characterised precisely, however, a two-level approach is also possible. Depending on the available means and resources, one option can be to reserve a detailed description for the main water uses in an area (e.g. for agricultural and industrial use). Less important uses (from an economic standpoint), for example water cures, may receive less in-depth study.

The example below presents a simplified method used in the Rhône-Méditerranée basin to collect basic information for the WFD characterisation process.

A list to assist in the geographic location of economic factors

The list to assist in the geographic location of economic factors may be used to inventory the various uses in a river basin and to distinguish whether those uses are major, established, emerging or inexistent. The type of link between the listed use and the environmental objective is also noted. The goal is to determine whether the use does not depend on good status, or whether the use is dependent on or benefited by good status.

What are the criteria determining whether a use is major, established, emerging or inexistent?

- **A use is considered "inexistent or marginal"** if it is not present (or very limited) in the basin and if it is not emerging. The term "not emerging" means there are no plans to create an activity involving the use or the conditions that would enable the use to emerge.
- **A use is considered "emerging"** if it does not yet exist in the basin, but there are plans to launch an activity involving the use or to create, in the near future, the conditions that would enable the use to emerge. A use may also be considered emerging if it already exists, but is marginal (or only recently launched), though projected to grow in the years to come in numbers of users, direct and indirect jobs, volumes of water needed, participants, etc.
- **A use is considered "established"** if it is sufficiently well set up in terms of quantities, duration, quality, cultural and traditional aspects, or if its local impact is strong, e.g. snow making, highways, golf courses, etc. The local group running the survey may conclude that a use is established if a number of criteria exist, but are not sufficient for "major" status. This decision should be made by the local experts.
- **A use is considered "major"** if it is an important factor in the economic and/or social landscape of the given area.

Using the above terms, it is possible to fill out the list to assist in the geographic location of economic factors and indicate the link with good status, as shown in Table 1 for the Rhône-Méditerranée river basin.

Tableau 1 *List to assist in the geographic location of economic factors (Source: Rhône-Méditerranée-Corse water agency).*

Established uses		Link with good water status
Agriculture	Livestock farming	INDEPENDANT
	Forestry	INDEPENDANT
	Vegetable farming	DEPENDANT
Industry	Trades - artisans	INDEPENDANT
	Mechanics - surface treatment	INDEPENDANT
Mining and abstractions	Watering for aesthetic purposes (public, private)	DEPENDANT
	Sand and gravel mining	INDEPENDANT
Urbanisation and infrastructure	Supply of drinking water	DEPENDANT
	Soil sealing (flooding)	INDEPENDANT
	Sanitation	DEPENDANT
	Building in the floodplain of a river	INDEPENDANT
Fishing	Freshwater recreational fishing	BENEFITED
Water-related sports and recreational activities	Diving, bathing, water games	BENEFITED
	Caving, canyoning	INDEPENDANT
Tourism and recreational activities in aquatic environments	Hunting	BENEFITED
	Non-aquatic tourism	BENEFITED
Non-commercial uses	Observation	BENEFITED
	Walking, hiking	BENEFITED

Major uses		Link with good water status
Agriculture	Wine growing - orchards	DEPENDANT
Industry	Food industry	DEPENDANT
Urbanisation and infrastructure	Transportation networks and infrastructure	INDEPENDANT
	Transport of untreated water (canals)	DEPENDANT

Detailed characterisation of water uses

For detailed characterisation, it is necessary to collect a number of economic indicators and data. They serve to describe the economic importance of the use on the local level and to compare it to other uses and/or to the same use on a different geographic scale. The value of this work lies in shifting from the simplified approach (is the use important in the area?) to a more complex set of questions (does use A have greater economic impact than use B?, is the use in the studied area of importance on the regional and national level?, etc.).

Examples of representative data on economic issues in the Rhône-Méditerranée basin

Table 2 presents examples of the economic data that may be collected. The complete table may be found in the Annexe to this document. Of course, the accuracy of the collected data will depend of each use, on the access to the data (on or off site, existing databases, surveys, etc.), on the cost (fee or free, negotiated under certain conditions, etc.), and on the level at which it exists (town, farm, industrial company, professional association, etc.). It is preferable to collect chronological series of data rather than for a given year in order to estimate future trends.

Figure 7

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Fishing and tourism along the coast are important factors in the local economy.

Tableau 2 *Detailed economic characterisation of water-related activities and uses (Source: Rhône-Méditerranée-Corse water agency).*

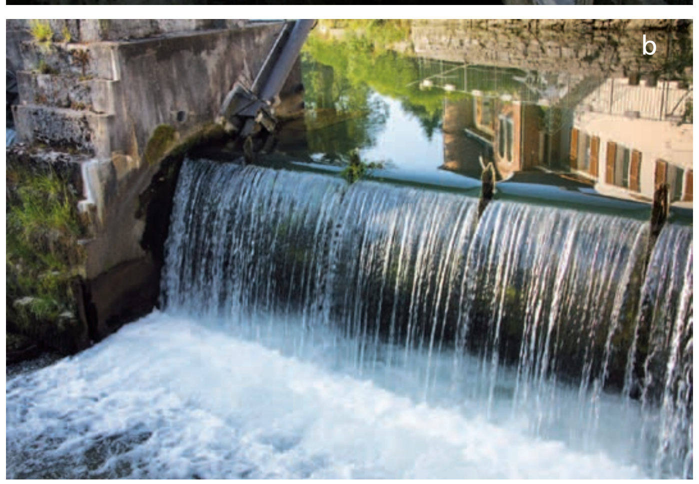
Activities - Uses	Economic characterisation
Irrigation	■ The RMC basin has the highest percentage of crop irrigation. The basin represents 16% of the usable farm area in France, but 20% of the irrigated land with approximately 375 000 hectares (i.e. 8% of the usable farm land in the basin). ■ Irrigation is extensively used. The basin comprises 22% of French farms, but 35% of the farms using irrigation. A total of 25% of farms in the basin use irrigation, compared to 15% nationally.
Energy and petrochemical industries	■ The Rhône-Alpes region is the source of 21% of the primary energy in France and a quarter of the electricity. ■ In terms of nuclear power, the Rhône-Alpes region is the foremost French region with 30% of the total nuclear capacity and 24% of the electricity produced in nuclear plants. ■ The PACA region is home to 30% of French oil-refining capacity.
Sanitation and supply of drinking water	■ Percentage of the population whose water is directly managed by the local government: 28% ■ Percentage of the population for which water management is delegated by the local government: 72% ■ Number of customers for drinking water: 5 381 790 ■ Volume of drinking water billed: 1 148 million cubic metres ■ Length of drinking-water networks approximately 150 000 km ■ Length of sanitation networks approximately 70 000 km ■ Drinking-water production units: 437 ■ Wastewater-treatment plants: 4 315 ■ Non-collective sanitation units: approximately 1 million ■ Jobs in the water sector: over 120 000 in France and approximately 30 000 in the basin
Production of bottled drinking water	■ 3 700 million litres of bottled water were produced in 2002 in the river-basin district (40% of total French production). ■ The basin represents 33% of the companies and 44% of the jobs in the table-water sector in France.
Energy	■ Two-thirds of French hydroelectric generation are located in the basin. ■ A quarter of French nuclear generation is located in the basin.
Golf courses	■ Of the 531 courses in France in 2002, over 150 were located in the basin, including 57 in the Rhône-Alpes region and 53 in the PACA region, the two regions having the most courses in France. ■ A high-end, 18-hole golf course has an average consumption of 5 000 cubic metres per day, which corresponds to that of a town of 12 000 inhabitants. ■ The total water consumption for the irrigation of golf courses in 2002 amounted to 36 million cubic metres, equivalent to the annual consumption of a town of 500 000 inhabitants.

Linking economic use with the natural environment

It is also necessary to position the studied use with respect to the natural environment and to characterise the interaction between the economic sphere and the natural environment:

- how is water in fact utilised in the framework of a given use?;
- what demands are made by the use in terms of the quality and available quantities of water resources and natural environments?;
- what pressures does the use place on water resources and/or on aquatic environments? (see Figure 8).

Figure 8



a © G. Parfait - Onema
b © M. Bramard - Onema

Dams must be taken into account when characterising uses given the pressures they create and the activities that they modify or make possible.

Finally, given the relative rarity of water resources, it is important to identify as early as possible the potential for conflict between uses. Tables 3 and 4 provide basic data on these issues for each type of use. The information provided here is very general and must be filled out by the local experts.

Tableau 3 *Links between uses and natural environments (Source: the Water agencies).*

Activities - Uses	Water uses	Main requirements weighing on water resources	Main pressures weighing on water resources and/or aquatic environments	Potential conflicts concerning water uses
Agriculture	Factor of production for irrigation and watering of livestock, cleaning of production sites and products (e.g. cheese).	Available quantities.	- Direct pressure on water resources due to abstractions from surface and groundwater, organic and toxic pollutants, mainly nonpoint source (livestock effluents, fertilisers and plant-protection treatments, effluents from wine-growing installations, etc.). - Physical pressure on the environment caused by irrigation canals, water transfers, upland reservoirs, draining, etc.	Resource sharing during periods of high demand with other uses, e.g. drinking-water suppliers and industry, and taking into account the needs of aquatic environments and species.
Sanitation and supply of drinking water	Consumption for various household uses.	Physical-chemical and microbiological quality (suitability for drinking water), available quantities.	- Direct pressure on water resources due to abstractions from surface and groundwater, primarily organic pollution (discharges from wastewater-treatment plants). - Physical pressure on the environment caused by soil sealing (urbanisation, communication infrastructure, flood prevention, etc.).	- Resource sharing during periods of high demand with other uses, e.g. agriculture and industry. - Use for drinking water put into question by the pollution caused by other uses (leading to a halt in abstractions or to additional treatments).
Production of bottled drinking water	Raw material.	Naturally drinkable, special physical-chemical composition that is stable over time, available quantities.	Direct pressure on water resources through abstractions of groundwater.	Except in exceptional cases of mineral water that participates significantly to the balances ensuring the functioning and good status of neighbouring environments, the potential is for indirect conflict with other sectors, e.g. the drinking-water sector.
Water cures	Raw material.	Naturally drinkable, special physical-chemical composition (therapeutic properties) that is stable over time, available quantities.	Direct pressure on water resources through abstractions of groundwater.	- Rare cases of massive abstractions producing significant imbalances in groundwater and/or in linked surface water bodies (very rare). - Conflicts may concern the use of water resources or heat resources.
Energy	- Factor of production, the driving force for hydroelectricity. - Thermal exchange, used for cooling nuclear power plants.	Sufficient hydrological regime (quantity and discharge).	Physical pressure on water resources through abstractions (reservoirs, dams, hydropeaking, etc.), discharges of warm water from power plants.	- Breaks in hydraulic continuity and need to maintain sufficient discharge downstream of dams can lead to conflict with fishing groups, aquatic recreational activities, etc. - Mortality of migratory fish during downstream migration when passing through turbines.
Golf courses	Factor of production used to water greens.	Available quantities.	Direct pressure on water resources through abstractions and pollution caused by fertilisers and plant-protection products.	- Potential conflict with all users and uses requiring high-quality water. - Conflict with other recipients of local water sources is possible if the volumes consumed (always high per surface unit) are significant compared to potential uses elsewhere. - Tensions, during periods of restricted use, with uses for drinking water and irrigation.

A different type of typology is possible. It is structured around the links between activities, the corresponding pressures and the uses potentially harmed.

Tableau 4 *Another typology for links between uses and the environment.*

Activities - Sources	Pressures	Uses harmed
Industry, agriculture, fish farming, nuclear power plants, golf courses, supply of drinking water	Abstractions	Supply of drinking water, agriculture, industry, recreational fishing, ecological heritage, nuclear power plants, white-water sports and kayaking, recreational boating, shipping, bathing
Industry, slaughter houses/rendering, dairy/cheese industry, fish farming, sanitation, sealed surfaces, recreational boating	Oxidisable matter	Supply of drinking water, bathing, recreational fishing, ecological heritage
Industry, livestock farming, crop farming, dams (emptying), sealed soils	Heavy metals	Supply of drinking water, recreational fishing, ecological heritage, fish farming, shell fishing, fishing on foot
Industry, crop farming, sealed surfaces, recreational boating	Micropolluants	Supply of drinking water, recreational fishing, ecological heritage, fish farming, shell fishing, fishing on foot
Livestock farming, crop farming, sanitation	Nitrates and marine eutrophication	Supply of drinking water, river navigation, recreational fishing, ecological heritage
Livestock farming, crop farming, fish farming, dams (releases), sanitation	Phosphates, continental eutrophication	Supply of drinking water, river navigation, recreational fishing, ecological heritage
Fish farming, sanitation	Ammonium salts	Supply of drinking water, recreational fishing, ecological heritage
Livestock farming, sanitation, sealed surfaces	Bacterial pollution	Supply of drinking water, bathing
Sand and gravel mining, crop farming, fish farming, sealed surfaces	Suspended matter	Recreational fishing, ecological heritage, coastal fishing (drop in coastal-ecosystem productivity)
Sand and gravel mining, nuclear power plants, hydroelectric plants, dams, weirs, embankments	Warming and continental eutrophication	Recreational fishing, ecological heritage, supply of drinking water, river navigation
Sand and gravel mining, supply of drinking water, crop farming, sealed surfaces	Modification of the hydrological regime	Supply of drinking water, regional development, wetland functions, ecological heritage
Sand and gravel mining	Exposure of the water table, vulnerability to accidental pollution	Supply of drinking water
Sand and gravel mining	Damage to the landscape	Tourism, real-estate market
Sand and gravel mining, crop farming, golf courses, camp grounds, infrastructure, urbanisation, etc.	Destruction of wetlands	Supply of drinking water, ecological heritage, wetland functions
Fish farming, dams, weirs, embankments	Difficult passage	Recreational fishing (migratory fish), ecological heritage, white-water sports and kayaking
Hydroelectric plants	Variations in discharge	Recreational fishing, ecological heritage, bathing, white-water sports and kayaking
White-water sports, kayaking	Disturbances to wildlife	Ecological heritage
Tourism, river transport of goods	Pressure on river morphology	Ecological heritage, recreational fishing, wetland functions

Source: the Water agencies.

For the more complex cases, it may be necessary to sub-contract a specific study on one or more uses, on the interactions and/or the impact on the environment. In this case, it is best to contact the Water agencies which can help with the study, either by funding it if the issue is of major importance in the river basin or by providing assistance in drafting the technical specifications for the study.

■ Description of the economic players in the area covered by the St-Brieuc SBMP

The economic activities in the area covered by the SBMP (sub-basin management plan) for the St-Brieuc bay are characterised by their great diversity. The current economic importance of the various sectors covered by the SBMP (jobs, sales, added value) is presented in Table 5.

Tableau 5 *Economic importance of business sectors in the area covered by the St-Brieuc SBMP. (Source: Saint-Brieuc SBMP).*

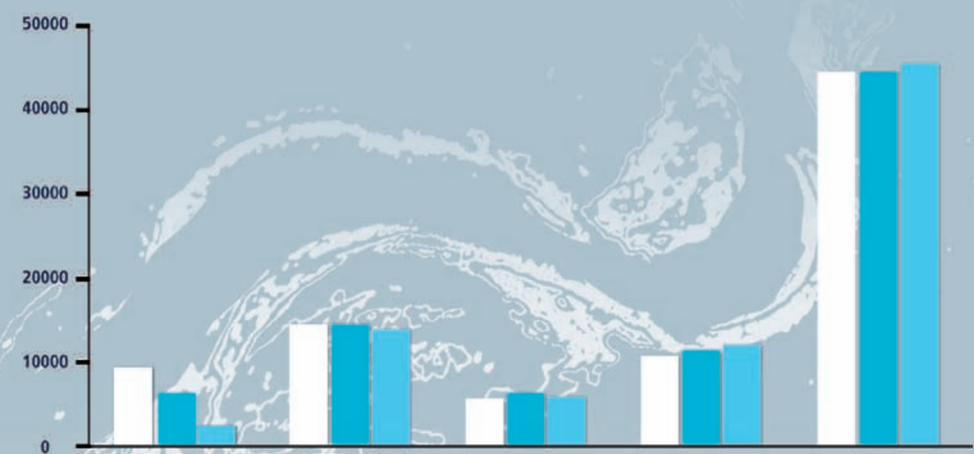
Business sector	Activity	Jobs (direct and indirect)	% total employment	Sales (€ million)	% total sales	Gross added value (€ million)	% total added value
Agriculture		4200	6%	225	3%	130	3%
Industry	Food industry	4400	6%	1200	17%	190	
	Other industry	6500	8%	950	14%	310	
	Subtotal	10900	14%	2150	31%	500	12%
Construction		5600	7%	470	7%	390	10%
Trade and services	Tourism	2900	4%	130	2%		
	Others	52400	68%	3920	56%		
	Subtotal	55300	72%	4050	58%	3000	75%
Littoral sector	Sea fishing	500	1%	30	0%		
	Shell fishing	140	0%	8	0%		
	Recreational boating	200	0%	40	1%		
	Subtotal	840	1%	78	1%		
Total		76840	100%	6973	100%	4020	100%

The main business sectors in the area are:

- the tertiary sector with trade and services, representing 72% of total jobs and 75% of gross added value;
- the industrial sector, representing 14% of total jobs and almost one-third of total sales. The food industry represents almost 40% of all industrial jobs and 55% of industrial sales;
- the construction sector, representing 7% of total jobs;
- agriculture, with approximately 4 200 direct and indirect jobs (6% of total jobs).

Figure 9 shows the evolution in jobs for each major business sector between 1990 and 2005 in the St-Brieuc job basin (which comprises 125 towns and 210 187 inhabitants, whereas the St-Brieuc SBMP covers only 68 towns and 196 500 inhabitants).

Figure 9



	Agriculture, forestry and fisheries	Industry	Construction	Trade	Services
1990	8668	13720	5596	10583	37139
1999	6367	14147	5958	11578	44734
2005	2576	14031	6110	12062	46243

Evolution of jobs in the Saint-Brieuc job basin.
(Source: INSEE data)

The data for the major business sectors reveal two stable trends over the 15-year period, i.e. a continuous drop in agricultural jobs (stronger in the St-Brieuc region than in the rest of Brittany between 1999 and 2005) and a regular increase in the tertiary sector (trade and services). In the industrial sector, the GREF Bretagne data reveal a drop in food-industry jobs between 1999 and 2005 in the St-Brieuc region whereas they were stable in the Brittany as a whole. Jobs in the rest of the industrial sector remained stable from 1999 to 2005.

Drafting a summary document to facilitate communication

Work to summarise the data is required in view of sharing the results on use characterisation with the various local stakeholders. One method is to create a geo-economic typology combining the economic issues and a consistent set of clearly defined areas in the river basin. The goal is not only to summarise the analyses carried out, but to present a diagnosis that can be used as a backdrop to inform the discussions and debates (see Figure 10).

Figure 10

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The step involving the feedback and all communication concerning the results of the economic analysis is fundamental in providing factual substance and in clarifying the debates between stakeholders.

This information draws attention to the uses **generating high sales**, but that are also the source of **high pressures** on water resources and/or aquatic environments, and that also impact negatively on **other activities** ("sensitive" uses).

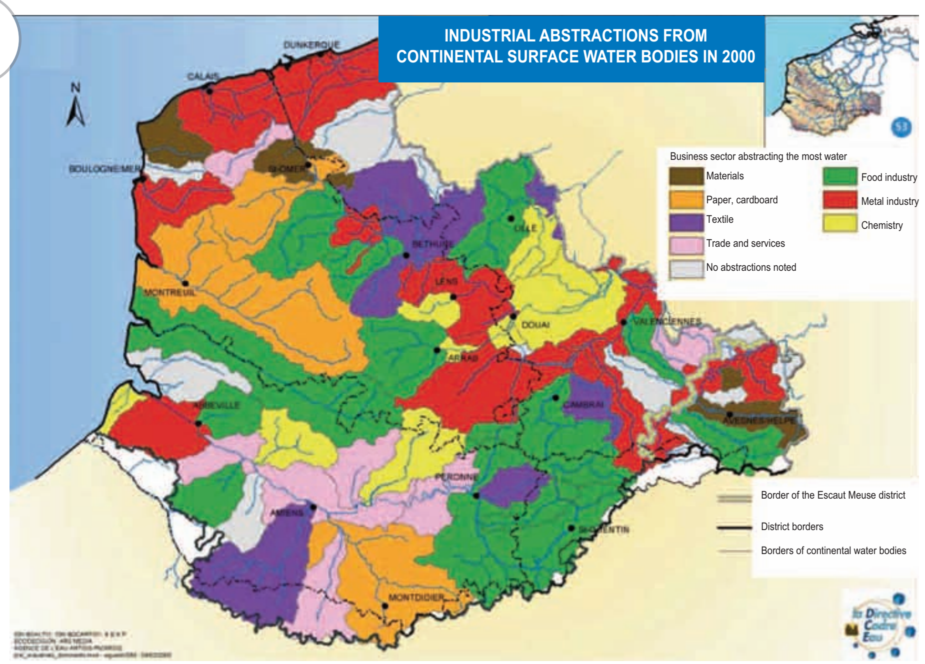
When speaking of important/major economic activities, that may mean:

- an activity causing damage and thus likely to fall in economic importance if environmental policy is implemented;
- an activity sensitive to the quantity and quality of water resources and thus likely to rise in economic importance if environmental policy is implemented;
- an activity that could both gain and lose depending on the policies implemented.

The relative importance of the various economic sectors may vary depending on whether they are considered on the local or river-basin scale. An important/major sector may be considered dominant locally (e.g. for a given water body), but that is not necessarily the case on the river-basin scale. A sector may be totally absent locally, but nonetheless remain an important/major sector for the river basin as a whole.

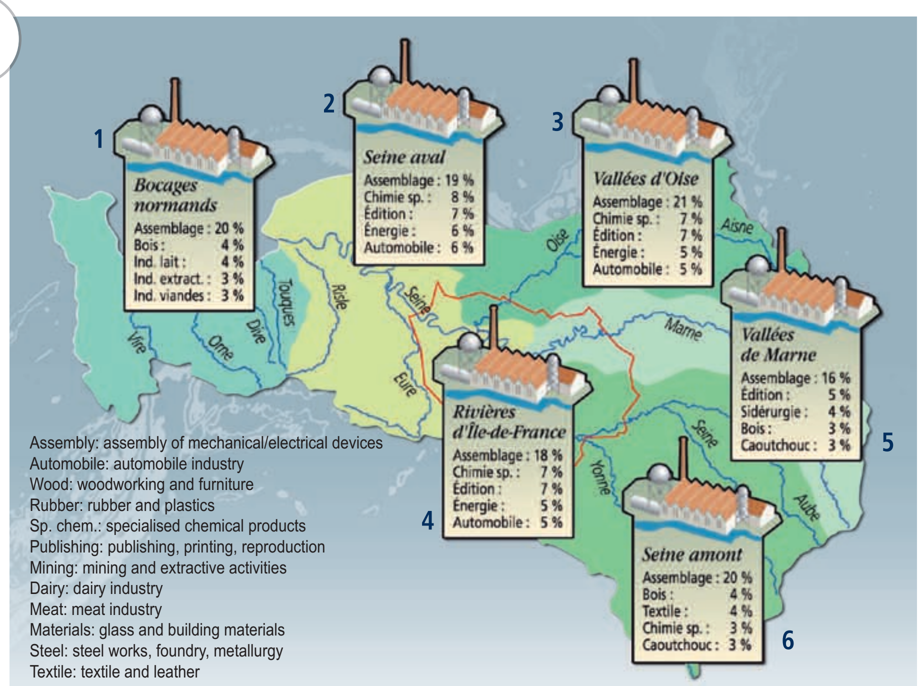
Practically speaking, the summary document can be structured by comparing the local business sectors with the characterisation of uses for several other areas in the river basin. The use of maps is advised for the presentation of data (see Figure 11).

Figure 11



Main industrial abstractions by surface water body (2000).
Source: Characterisation process for the Escaut-Meuse district, Artois-Picardie water agency.

Figure 12



1- Lower Normandy
Assembly:
Wood:
Dairy:
Mining:
Meat:
2- Lower Seine:
Sp. chem.:
Publishing:
Energy:
Automobile:
3- Oise valleys
4- Île-de-France rivers
5- Marne valleys
Steel:
Rubber:
6-Upper Seine:

Main industries with respect to jobs.
Source: WFD characterisation process, Seine-Normandie water agency.

Foreseeing changes in uses to develop prospective scenarios

When formulating management plans and programmes of measures, it is important to make sure that any changes in uses over the next 9 to 15 years are correctly taken into account in the analysis of the future situation and in selecting the environmental measures to be taken.

The preparation of a **prospective scenario,** describing what would occur in the river basin if no measures and action are taken, is considered essential in order to:

- assess the possible **deficit in water status compared to the environmental objectives,** that would result from the potential trends if no specific measures or action are taken;
- identify the main **water needs over the long term** and the solutions required in terms of the water policy for the river basin;
- formulate a programmes of measures in response to the **pressures present in the area;**
- run the **cost-recovery calculations** for services provided (this requires a long-term forecast of water supply and demand, and of the necessary investments).

The main thrust of this work lies in identifying the **driving forces** (planned investments in the water sector, demographics, current economic policies, new technologies, land-use policies, climate change, etc.) operating on the various geographic levels in the area and in foreseeing the resulting changes in terms of pressures, impacts and water status.

The general method proposed here to identify and characterise the driving forces is made up of four steps.
1) **Extrapolate** the current trends of parameters and driving forces.
2) Integrate into the parameters and driving forces any **changes that are certain,** given implementation of the European directives in the water sector (Bathing directive, Urban wastewater-treatment directive, Nitrates directive, etc.).
3) Integrate any **uncertain changes,** selecting the most probable outcomes.
4) Propose an array of scenarios diverging from the base prospective scenario, e.g. on the basis of best-case and worst-case hypotheses.

The available means to produce a relevant set of scenarios include many possibilities, including statistical analysis of past data, economic and environmental modelling, study of planning documents including those for each business sector and discussions with important stakeholders.

The prospective scenario covering the Seine-Normandie basin for the WFD characterisation process

The purpose of preparing a prospective scenario for each river-basin district by 2015 is to foresee changes in pressures weighing on water and the resulting environmental status, if current policies are pursued. The scenario should indicate the main issues and assist in formulating water policy for the river basin, notably by supplying information for the discussions, foreseen by the WFD, between the participants in water policy in the basin. The work entails a prospective analysis of changes in human activities (see Figure 13), an estimate on the point-source discharges of macropollutants (organic matter, nitrogen and phosphorus) in rivers and a calculation of the resulting water quality.

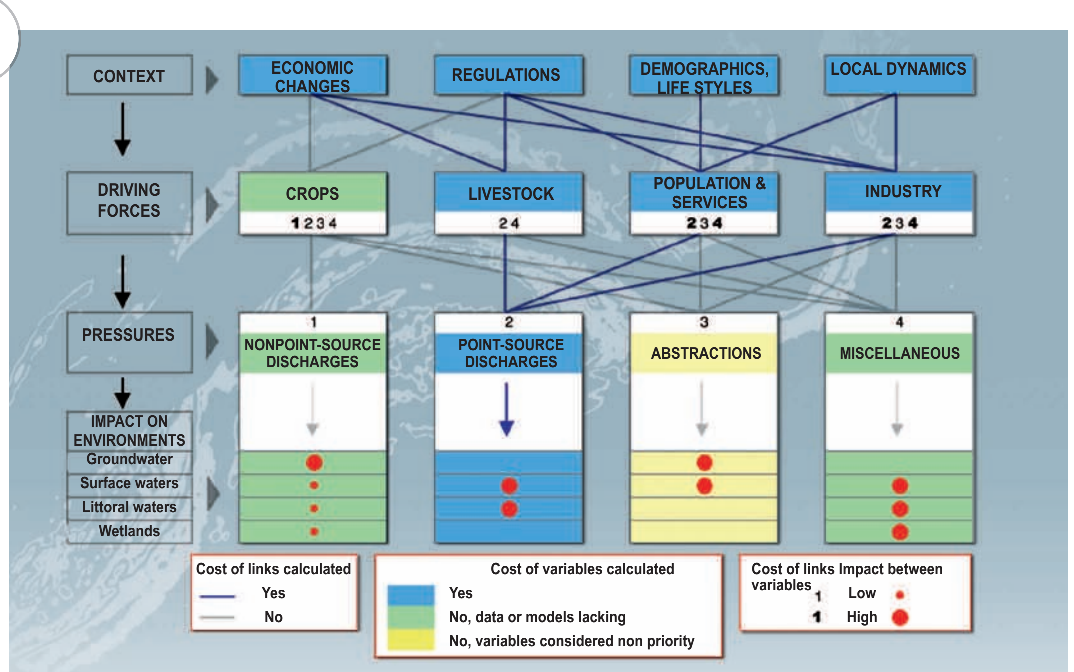
Initially, the objective is to describe a reference hydrological and social-economic system and then to identify the main variables characterising the environmental status and the human activities influencing the status and its evolution.

The technical-social-economic system determining any changes in water quality may be broken down into four levels:

- the **context,** consisting of the main factors behind the driving forces, notably demographics, local development, regulations and the economic situation;
- the **driving forces,** the human activities influenced by the context and causing the pollution and other pressures are grouped according to the four types of stakeholders involved (population and services, industry, crop farming and livestock farming);
- the **pressures** weighing on the environment, i.e. the consequences of the driving forces producing an impact on the environment, e.g. discharged pollutants, abstractions and physical damage;
- the **environmental status** resulting from the pressures, taking care to distinguish the type of environment (rivers, groundwater, littoral waters and estuaries).

The links between these four levels in the system are presented in Figure 13.

Figure 13



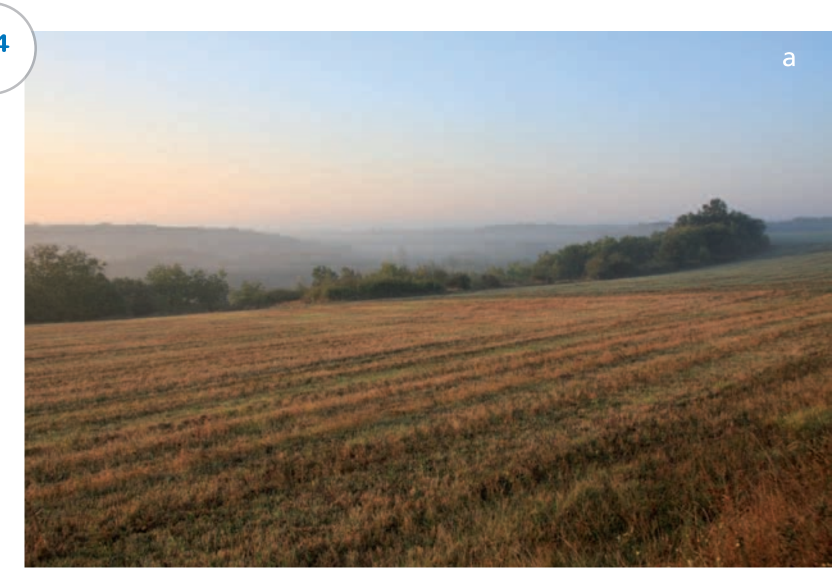
Technical-social-economic system determining the evolution of water quality and used as the baseline for the prospective scenarios.
Source: Preparation of the prospective scenario in 2004, Seine-Normandie water agency.

In addition to these links are many interdependent relationships within each category and the dynamics specific to each element. For example, changes in industrial activity depend in part on the creative capacity of companies (internal dynamics), but also on the presence of high-quality labour (interdependence between driving-force variables).

This set of links, though simplified in the diagram, would still appear fairly complex. However, an analysis of the impact of the various factors revealed certain key aspects:

- the environment is more or less sensitive (more or less reactive, more or less rapidly) to variations in the pressures weighing on it;
- the pressures resulting from driving forces depend mainly on two characteristics of the forces, i.e. their quantity and the policy to reduce the pressures);
- the national economic environment, itself largely dependent on the world situation, is a fundamental variable in explaining variations in the driving forces, notably economic activities and migratory flows;
- demographics and life styles influenced by values, but also by constraints such as the types of employment, will have a decisive impact on both the national economy and on the temporary and/or permanent migratory flows within the country.

Figure 14



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b © P. Bossard - Onema

Crop farming was one of the driving forces studied when formulating a prospective scenario for the Seine-Normandie river basin.

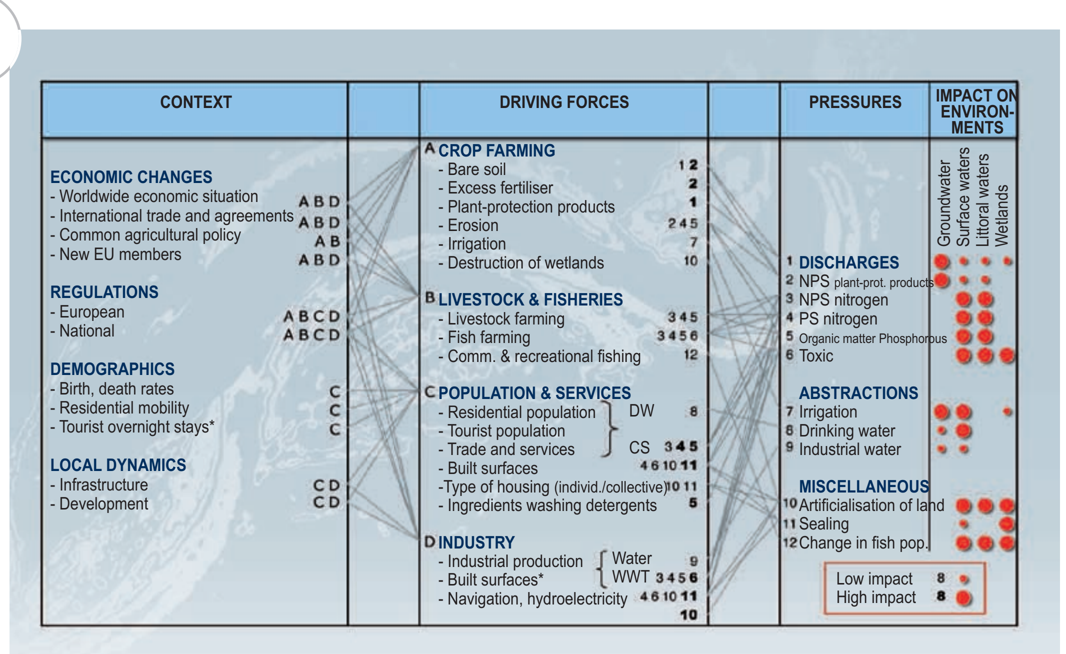
During a second stage, the actual prospective analysis was carried out starting with a complete review of the available literature and three prospective workshops on the sectors causing pollution (population & services, industry, agriculture). Experts from a number of fields (the State, local governments, scientists, representatives of the various professions) contributed to the workshops. This work served to:

- highlight the most important variables in terms of the driving forces and the context;
- study the recent trends in these main variables;
- look at the possible futures in terms of both a continuation of current trends and probable shifts;
- formulate a prospective scenario comprising three versions based on consistent, but divergent sets of trends in variables. Three versions were deemed necessary due to uncertainty concerning the decisive variables.

In preparing the prospective analysis, the entire technical-social-economic system (see Figure 15) impacting water quality was taken into account. However, to assess the trends in pressures and in water quality, the scope was limited to direct, point-source discharges in rivers of macropollutants (organic matter, nitrogen and phosphorus). This was because these discharges are monitored (fees) and geo-located, numerical data are available. Two main reasons contributed to the decision to reduce the scope of the simulation with respect to the entire hydrological and social-economic system determining water quality:

- the difficulty in obtaining basin-wide data and/or models made it impossible to take into account nonpoint-source pollution, notably by pesticides and nitrates (a simplified assessment was carried out for the latter), toxic discharges to surface waters, "artificialisation" of the environment, soil sealing (however, its impact on rainwater run-off was taken into account) and modifications in fish populations;
- abstractions were not addressed because their impact basin-wide was deemed less important than that of the discharges, even if they can constitute a non-negligible pressure locally.

Figure 15



Aspects of the technical-social-economic system taken into account for the simulation of pressures and water quality.
Source: Preparation of the prospective scenario in 2004, Seine-Normandie water agency.

The aspects covered constitute a coherent set capable of providing an image of foreseeable trends that is not complete, but is nonetheless valid, at least initially, given the often preponderant impact of macropollutant discharges on the quality of surface water.

In addition to the dynamics specific to the various stakeholders, notably their demographics, two factors stood out in the characterisation of the possible trends in context, driving forces and pressures.

- The economic situation

The long-term trend of the economic situation is the same for all three versions, i.e. a slowing average growth rate (1.76% on average for the years 1990 to 2000), compared to the rates observed in France over the previous decades (3.2% on average for the years 1970 to 1980 and 2.35% for the years 1980 to 1990). However, there are also strong annual fluctuations in economic growth rates. For example, for a given average growth rate over 15 to 20 years, GDP growth can be virtually stable or it can rise rapidly over a few years, then stagnate.

- Actions by stakeholders to protect water resources

Protection of water resources involves many stakeholders having different powers/responsibilities and variable capacity to modify their position. The overall results of protection efforts may be reduced by just one participant making less effort. In general, the prospective scenario assumes that policies will be implemented within the deadlines. However, delays have already been noted and the difficult economic conditions may hinder some stakeholders in fulfilling their obligations.

Given the above, three versions of the prospective scenario were formulated:

- one version based on a continuation of the long-term trends and that sees the recent shifts in the factors as "background noise" and not as signalling long-lasting changes, i.e. a "steady" version;
- a version seeing certain recent trends as major shifts in the future development of pressures. This version is hereinafter called the "better" version for water protection;
- a version combining the social-economic assumptions of the "steady" version with an assumption of lesser effort on the part of stakeholders to protect water resources, called the "worse" version.

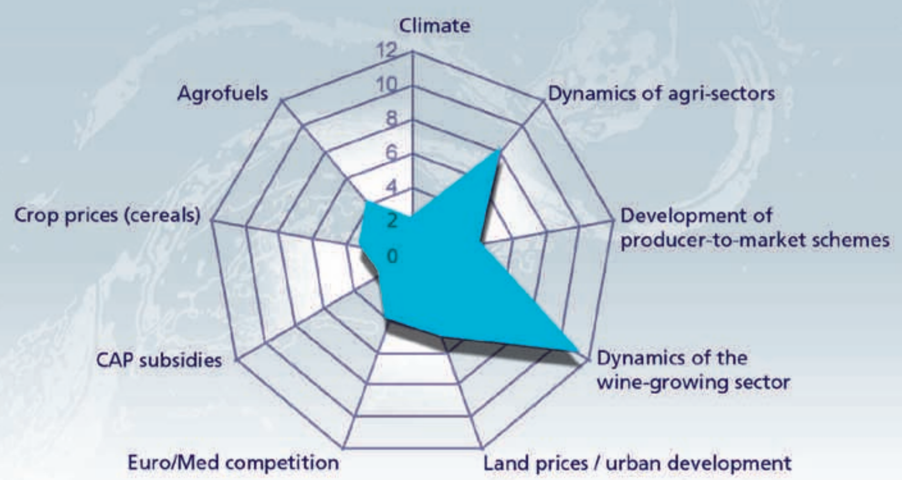
Formulating the prospective scenario for the Hérault SBMP

The prospective scenario for changes in demand for water by farmers was based on a series of meetings in June and July 2007 with some 15 stakeholders involved in water management and from the agricultural sector in the area covered by the study. Factors of change were identified prior to the meetings, on the basis of earlier prospective studies, and presented to the stakeholders. The discussions were an occasion to learn their opinions on the trends noted for the factors and, in some cases, to identify other factors, then to list the factors by order of importance.

The subsequent steps of the process were based on the results of the discussions. Generally speaking, there were a number of possible trends for each factor.

In the opinion of the participants, the factor “abstractions for vineyard irrigation” was the most important for future abstractions for irrigation in the area, as shown in Figure 16. Using this information, three scenarios were devised, one “trend” scenario corresponding to the most probable future situation and two scenarios corresponding to greater and more divergent change. These scenarios were then “translated” into numerical projections on the future surface areas for different irrigated crops.

Figure 16



Main factors of change according to the participants in the study.
Source: Hérault SBMP.

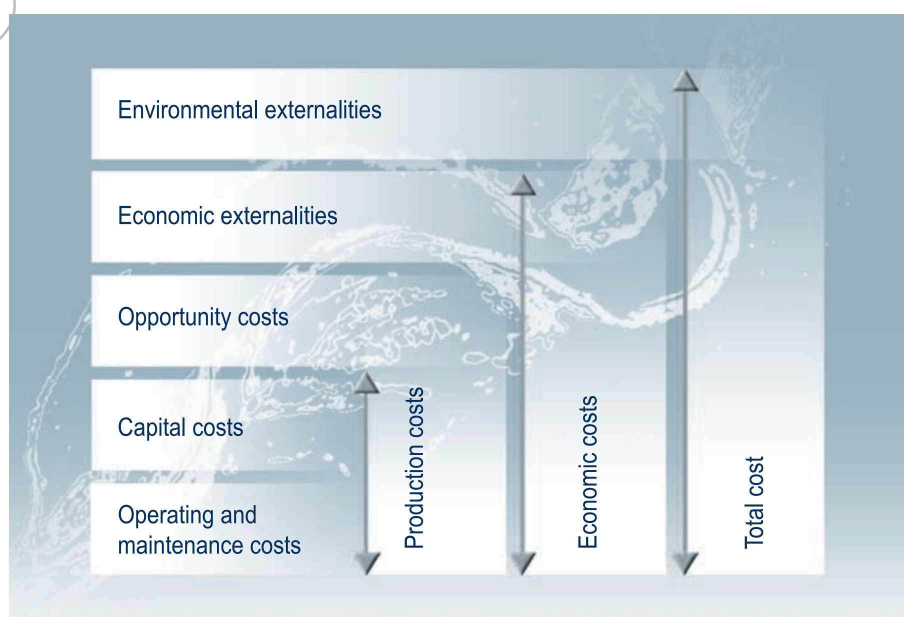
Assessment of costs

Which costs must be assessed?

The first step in assessing the costs of a project or programme is to precisely list all the costs that must be taken into account and quantified. Frequently, it is also necessary to determine the unit costs and the extent of the planned measures in order to calculate the total implementation cost of the project or programme. This type of cost assessment is often used in more elaborate economic analyses such as cost-effectiveness, cost-benefit and cost-recovery analyses.

The overall cost comprises a number of components listed in Figure 17.

Figure 17



The various components of the total cost.

Production costs

Production costs consist of the capital costs and the operating and maintenance costs.

- Operating and maintenance costs comprise all the expenses incurred by the operation of an infrastructure or a company. The main operating costs include payroll expenses, the purchase of raw materials, other external procurement (energy, transport, etc.), taxes, fees and depreciation of tangible assets.
- Capital costs include consumption of fixed capital, the cost of new investment and the opportunity cost of capital.

Consumption of fixed capital is defined as the theoretical value of the investment required each year to replace infrastructure. It is calculated taking into account:

- fixed capital expressed in physical quantities (capacity of reservoirs, lengths of networks, number of connections, number of treatment plants);
- the unit cost assigned to each type of installation or each characteristic entity;
- the assumed service life of each type of asset.

The cost of new investments includes not only the work to produce the new facilities, but also the cost of all preliminary studies. These costs are generally borne over a number of years.

The opportunity cost of capital corresponds to the estimated financial return that would have been gained had other investments been made, i.e. it is the profit that would have been produced if the capital had been spent on a different use. The opportunity cost is the economic expression of the consequences of a choice made, of a selection between competing solutions.

Economic costs

Economic costs consist of the production costs, opportunity costs and economic externalities.

In general terms, the opportunity cost corresponds to the value of the opportunity lost because one use of available resources was preferred over another, in cases where the resource is limited. In situations where a number of choices are possible, the opportunity cost represents the loss incurred when a decision is made to devote resources to one use and not to another. In the water field, the cost of the resource represents an opportunity value.

Irrigation and hydroelectricity as an example of resource opportunity cost

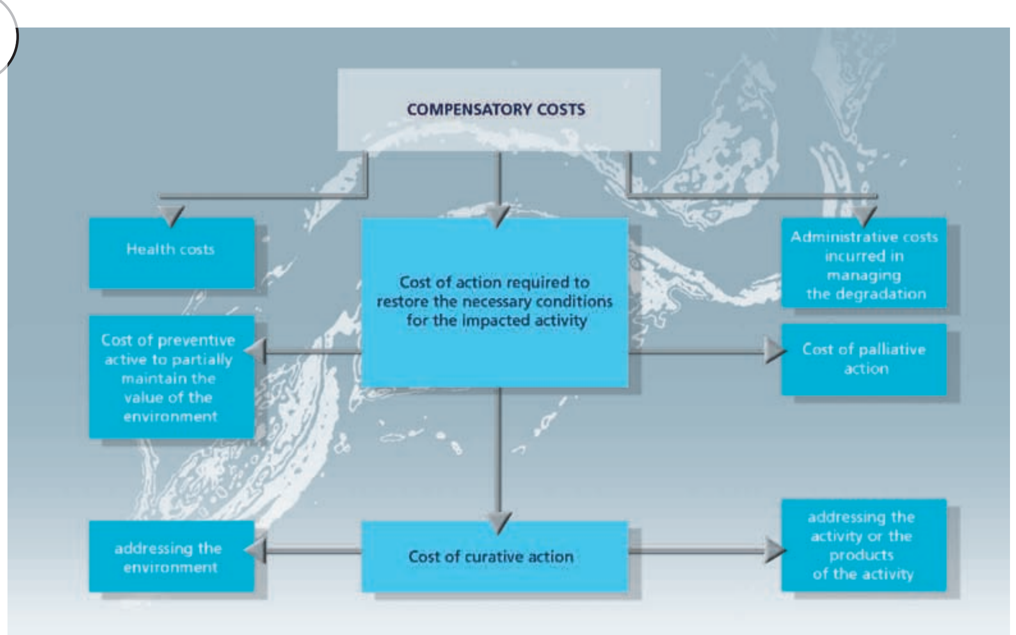
In Provence, vast quantities of water are drawn from the Verdon and Durance Rivers to irrigate fruit and vegetable crops. The water not used for irrigation serves to generate electricity in hydroelectric plants. There is therefore competition between tomatoes and kilowatts. If farmers are allowed to pay a lower price, they are encouraged to consume additional quantities of water that produce less value than if used for electrical generation, with as a result a waste of resources.
It is by making farmers pay a price equal to the value of the electricity not produced that the best distribution between the two competing uses can be ensured. The last cubic metre of water used will then produce as much value in terms of tomatoes as kilowatts.

Economic externalities correspond to the costs incurred by one activity to the detriment of another and not compensated or assumed by the entity generating those costs. Some compensatory costs represent negative economic externalities. For example, the “polluter pays” principle is a means to have the external costs of pollution paid by the entities causing the pollution.

Compensatory costs as an example of economic externalities

Compensatory costs are “observed excess costs imposed on a water user following degradation of an aquatic environment and/or water resources by another water user. Compensatory costs correspond to an outlay in response to a degradation (or a clear threat) to return to and theoretically maintain the initial status or an equivalent resource activity” (Analysis of compensatory costs in France and Europe for the WFD by Onema-Actéon-Ecodécision).

Figure 18



Analysis of compensatory costs in France and Europe for the WFD by Onema-Actéon-Ecodécision.

Total cost

The economic cost and the environmental externalities together represent the total cost.

The environmental externalities correspond to all the impacts, both positive and negative, caused by human activities on the environment and ecosystems. Concerning the impacts on resources that do not have a market price, as is often the case with environmental resources, it is necessary to assess and quantify the impacts in order to ensure that the cost is borne by the responsible entity. The concept of negative environmental externalities (environmental damage or costs) will be developed in the next chapter.

Assessing the costs of a project or measure

In the various economic analyses that are carried out in preparing an SBMP (sub-basin management plan) or for the WFD, the costs that must be assessed may vary.

For example, for an SBMP, the costs listed below are worth studying:
- the cost of new investments;
- consumption of fixed capital;
- operating and maintenance costs related to new investments.

On the other hand, there is no point in calculating the opportunity costs.

Finally, the economic and environmental externalities may be assessed as needed. For example, it may be worthwhile to list the compensatory costs in order to study the budgetary impact of a project on the local stakeholders.

WFD article 9 requires cost-recovery analysis taking into account “the costs of water services, including environmental and resource costs”. That means it is necessary to study the total cost of water services and not only the production costs or the economic costs of the services.

Once the SBMP scenarios or the WFD programmes of measures have been turned into actual projects, the assessment of their cost begins. In general, the goal is to solve the following equation:

$$C = Q * P$$

where

C = the total cost of the project or measure.

Q = the number of units involved, e.g. the number of population equivalents concerned by a project to reduce carbon pollution.

P = the unit cost of implementing the project or measure, e.g. the cost per population equivalent of treating the carbon pollution.

Consequently, there are two studies that must be carried out and that may be totally distinct:
- the first consists of determining the number of units (Q);
- the second attempts to set the unit cost (P) best suited to the characteristics of the study perimeter.

The study on Q may consist simply of listing the units concerned by the given project within the perimeter set for the assessment, e.g. the number of population equivalents. These data are available in more or less detail depending on the situation, e.g. per administrative sector, per area served by a collection system, etc.). In some cases, this may not be possible because the information on the desired units is not available, e.g. for confidentiality reasons. In this case, calculation of Q is no longer an inventory, but becomes an estimate on a case-by-case basis taking into account the data collected and using corrective coefficients.

The study on P consists of obtaining, from other studies or from experts, a value for the unit cost in situations as close as possible to that studied. In any case, P is determined using more or less rough estimates that must be refined and that should be clearly explained in the report on the assessment results.

In addition, the interaction between the two factors must be adapted to the operational conditions. The type of data (degree of detail, dates, etc.) for one of the factors in the equation (P or Q) is an important aspect in determining the other factor. For example, processing of the data selected to calculate Q may depend on the value of P, and vice versa. This means that the two studies must be carried out on an iterative basis, always taking into account the situation for the other factor.

Project sizing is often a source of data-aggregation difficulties. For example, it is very common to estimate the unit cost of a project, e.g. the cost of renaturalising a kilometre of river or the cost of water-treatment capacity for 100 population equivalents. However, it is much more difficult to determine the number of kilometres of river that must be renaturalised or the number of population equivalents that must be treated to reach the good-status objective. In other words, there is real difficulty in sizing measures due to the remaining uncertainty concerning their impacts (dose-response analysis) and the effects of data aggregation on their effectiveness.

To make progress, it is indispensable to:
- accept the uncertainty, discuss it and propose sizing solutions indicating the selected assumptions;
- continue with efforts to determine unit costs by developing more detailed typologies than those currently available in order to produce more realistic total costs. That is the purpose of the cost observatories that the Water agencies are in charge of setting up.

Managing uncertainty in WFD economic assessments and presenting uncertainty to political decision-makers

The WFD set environmental objectives for all water bodies that must be reached by 2015. If it is unlikely that a water body will reach the set objectives by 2015, the WFD requires that measures be implemented. An economic assessment serves to describe, formulate and select the necessary measures.

Uncertainty is an unavoidable factor when running the economic assessments required by the WFD. There may be uncertainty about:
- the amount of quality that a water body must gain in order to achieve the good-status objectives;
- the effectiveness of a measure or combination of measures;
- the cost of a measure or combination of measures;
- the benefits of a measure or combination of measures;
- the relative importance of the factors contributing to a pressure;
- the time required for a measure or combination of measures to produce the expected improvement in quality.

It is therefore indispensable for an economist to:
- correctly manage uncertainty during economic assessments;
- take uncertainty into account when presenting the results of an economic assessment to decision-makers.

The goal is not to reduce uncertainty, but to correctly manage it and to provide decision-makers with concise and actionable information on its implications. It is important to remember that any attempt to reduce uncertainty must be proportionate to the importance of the decision to be taken and the consequences of an incorrect decision.

Using an example of a cost-benefit analysis (CBA), this section discusses how to take uncertainty into account and how to present the uncertainty inherent in a CBA. In this case study (see the Tables on the following pages), economists use CBA to assess three measures:
- measure 1 = management of development work;
- measure 2 = creation of wetlands;
- measure 3 = depollution of an old mine site.

Three values are provided for the costs of each measure (high, medium, low) to indicate the uncertainty of the assessments (see Table 7, page 47). A few costs not related to water and concerning implementation of the measures are also listed and quantified (see Table 8, page 47). In this example, the first measure would result in the elimination of a public road, which would in turn reduce recreational activities and the number of visitors. This reduction was calculated under the heading of costs not related to water. A few benefits, both related and not related to water, concerning implementation of the measures are also listed (see Table 6, page 46). Some are quantified with cost data, but others can only be evaluated qualitatively given the uncertainty.

This chapter is drawn from a presentation made by Maria Salvetti during the conference on integrated water management held in Basel in September 2007.

In this example, all costs are identified and quantified, but only some of the benefits could be quantified. It is often difficult to cost all the identified benefits given the uncertainty inherent in this type of assessment. That is why the cost-benefit ratio only partially reflects the overall effects of measures (see Table 9, page 47).

Tableau 6 *Assessment of benefits.*

Measures	Main category	Secondary category	Type	Description	Present value (best estimate)
Water-related benefits	Production		Commercial fishing		
			Recreational fishing		
			Water-related products		
			Energy production		
			Abstraction		
	Visitors		Informal recreational activities on the banks		
			Bathing	More frequent visits by current visitors and perhaps new visitors	57 148 £
			Fishing	Major uncertainty concerning the effects of a reduction in metals and other pressures on fishing	863 202 £
			Other visitors with specific activities	Low potential advantage to be drawn from an increase in the numbers of these visitors	19 596 £
			Education and research		
			Health		
	Other advantages		Navigation		
			Amenities		
	Ecosystem services	Physical	Flood/storm protection	Limited advantage from flood protection for neighbouring properties	217 518 £
			Water regulation		
			Preservation of wetlands	Major advantage from increase in size of wetlands and salt marches	Not calculated
		Chemical	Wastewater treatment		
			Nutrient recycling		
		Biological	Nursery/feeding zones for fish	Limited advantage, already partially taken into account in recreational fishing	Not calculated
			Biodiversity/habitat reserve	Major advantage from the improvement of a listed SPZ	Not calculated
	Non-use		Non-use	Major advantage in that the improvement will affect a nationally and internationally important site	5 150 082 £
Benefits not related to water	Soil quality			Cleaning of the mining sites would improve water and soil quality	Not calculated
	Ecosystem services	Chemical	Carbon sequestration	Limited advantage	104 084 £
TOTAL					**6 411 630 £**

Tableau 7 *Cost of measures.*

Measures	Adjusted (non recurrent) financial costs (present value)		
	Low	Medium	High
Natural techniques to develop Whitton Ness	5.0 M£	6.5 M£	8.0 M£
Creation of wetlands	2.1 M£	2.8 M£	3.0 M£
Depollution of an old mine site	1.2 M£	2.3 M£	3.1 M£
Total	**8.3 M£**	**11.6 M£**	**14.1 M£**

M£ = millions of pound sterling

Tableau 8 *Costs not related to water.*

Costs not related to water	
Reduction in recreational activities due to loss of public road following development project with no replacement	276 557 £

Tableau 9 *Summary of CBA (cost-benefit analysis) results.*

Cost (present value)	11 876 557 £	Other costs not quantified	Cost of amenities and landscape not quantified
Benefit (present value)	6 411 630 £	Other benefits not quantified	This includes non-use (Ramsar). Some benefits were not quantified.
Net present value	5 464 927 £	Cost-benefit ratio	0.54

How can economists present the uncertainty affecting CBA results in a completely transparent manner? Is it possible to provide decision-makers with useful results without masking the difficulties created by the uncertainty?

It is necessary to achieve a common understanding on uncertainty with the local stakeholders and experts in order to present it correctly. The use of graphs indicating “tipping points” (see below) can also help in providing better information on uncertainty.

Qualitative assessments to the rescue?

During a cost-benefit analysis, it is often more difficult to analyse the benefits than the costs. To avoid neglecting or underestimating benefits that may be difficult to cost or even to quantify, qualitative assessment is often proposed. It can indicate whether the value of the expected benefit is high, medium or low, positive or negative, known or negligible. The level of confidence in the assessment is also indicated qualitatively (high, medium, low).

Of course, this type of assessment is easier to carry out than a quantitative assessment, however it may incur other difficulties. For example, if the results of the benefit assessment are expressed in both monetary and qualitative terms, it may be more difficult to draw conclusions shared by an entire group. It is also difficult to calculate together benefits that have been assessed quantitatively and qualitatively. Finally, attempts to compare benefits assessed quantitatively and/or qualitatively with monetary costs are very difficult and sometimes impossible. That is why efforts to manage uncertainty by mixing qualitative and quantitative assessments do not always produce a clear set of conclusions and do not necessarily simplify discussions with stakeholders.

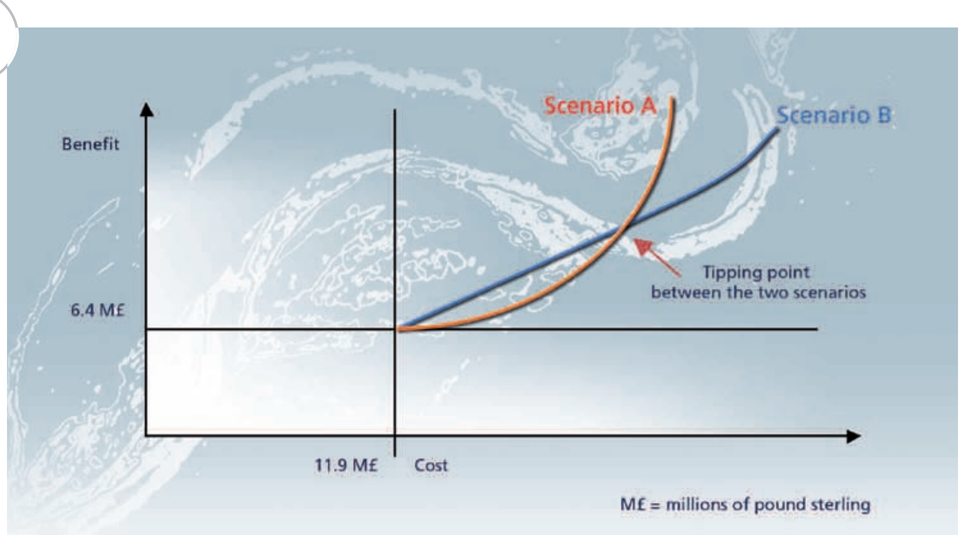
Graphs indicating "tipping points" to help in providing better information on uncertainty

One technique used to manage uncertainty consists of identifying "tipping points". They correspond to the values at which one scenario (measure, policy, etc.) becomes more favourable than another scenario. Even though this technique does not provide any information on the statistical confidence level, tipping points can help decision-makers in ascertaining the robustness of the analysis.

This technique can be very useful in presenting the uncertainty concerning cost and benefit assessments to a group of people having varying degrees of scientific and technical knowledge. Simple and clear graphs can highlight the key values and the ranges of assessment data, thus facilitating discussions. Using this technique, an economic assessment makes a substantial contribution to launching the discussion and arriving at a decision, thus fulfilling its mission.

The graph in Figure 19 shows an example of this technique with data drawn from the CBA presented above. In addition to the costs and benefits already assessed in the CBA, two scenarios are also compared.

Figure 19



The tipping point is where the lines representing the scenarios cross.

Discussions with stakeholders and joint analysis to manage uncertainty

In the example above, the use of ranges for the assessments (high and low values) can be of use in presenting the cost and benefit data. They indicate the areas where costs and benefits reach similar values, i.e. where there must be discussion and negotiation with and between the local stakeholders.

The CBA results are one factor among many in the process of making a decision and should not be the sole factor in determining whether a project is approved or not.

Experts and local stakeholders should be brought into the assessment process as early as possible because their participation is a pragmatic means to manage uncertainty while creating a common understanding of the issues. They can further contribute by providing very precise knowledge concerning the costs and benefits of measures for projects specific to a given site. The sharing of information on uncertainty is also a means to limit risks. Making different groups of people aware of uncertainties is in fact a collective means of managing uncertainty. It is a necessary step in the plan to manage uncertainty over the long term, which should also include a monitoring system and the creation of a database.

Summary of the principles and techniques proposed to manage uncertainty

During WFD implementation, economists must confront uncertainty when carrying out economic assessments and when presenting the results to decision-makers. Among other aspects, uncertainty stands out in that it entails difficulties in terms of both the methods employed and communicating the results. The purpose of an economic assessment is to inform the decision-making process.

There are no generic or "ready-made" solutions when dealing with uncertainty. However, there are a number of principles and techniques that, when used correctly and depending on the circumstances, can help in managing uncertainty.

- Encourage discussions and the participation of local experts and stakeholders to ensure that local knowledge is taken into account in the assessment in order to reduce uncertainty.
- Work on the water-body scale to reduce the economic and scientific uncertainty.
- Assess advantages qualitatively when quantification is too difficult, that will stimulate discussion.
- Provide assessment results in the form of value ranges to express the uncertainty concerning advantages, costs and the effectiveness of measures. Point out situations where the estimated values are equal in order to stimulate discussion.
- Use graphs showing the tipping points between various scenarios to draw the attention of decision-makers to zones of uncertainty that require further discussion.

Special cost-calculation techniques – cost-effectiveness, cost-benefit and cost-recovery analyses

When the costs of measures and consequently of the various scenarios and programmes have been determined, the data is generally used in different types of analyses. These analysis techniques are fairly well known, however expert knowledge is required to implement them correctly.

The three main analysis techniques used in the water and aquatic-environment fields are presented here. They are part of the WFD-implementation process and may be of use in preparing an SBMP.

Cost-effectiveness analysis

Cost-effectiveness analysis (CEA) is used to select the various options or measures required to attain a goal at the least possible cost. This type of analysis serves to rank the available projects or measures according to their effectiveness in reaching the set environmental objective.

The purpose of CEA is to ensure that the limited financial resources of the stakeholders and funding parties are put to the best possible use. Consequently, it is a means to reduce the cost required to achieve the set objective. Contrary to cost-benefit analysis (CBA), the point is not to determine the monetary value of the benefits produced by reaching the objective. Cost-effectiveness analysis cannot inform on the relevance or the utility of a project, nor can it serve to select the best project on the basis of the expected benefits. CEA can, however, assist in selecting the least expensive set of projects or measures capable of attaining the set goal.

WFD Annex III states:
"The economic analysis shall contain enough information in sufficient detail [...] in order to [...] make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures under Article 11 based on estimates of the potential costs of such measures."

For example, concerning the reduction of priority substances (Art. 16), the WFD recommends using cost-effectiveness criteria to determine the best combination of measures to reduce and progressively eliminate this type of pollution.

Cost-effectiveness analysis is also a valuable tool in preparing an SBMP. In this context, the difficulty lies in jointly selecting the technical means, i.e. the measures capable of reaching the environmental objectives, and setting the economic parameters, via the economic assessment of the measures which are not always precisely defined by the experts, either because their scope is too vast to the point that they represent a general direction or an overall objective to be reached, or because it is very difficult to size them (number of hectares, of population equivalents, of tons, etc.).

Example of a cost-effectiveness analysis

The water resources of the towns of Patay and Coinces, in the Beauce region, did not meet drinking-water standards due to high levels of nitrates and pesticides. The pollution was caused by intensive farming activities within the water-table perimeter.

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The situation could be improved by preventive measures (which have a cost) or by technical corrective measures. Three different solutions were proposed to the two towns.

- Project A proposed drawing water from a new resource via a connection to an abstraction created in the town of Coinces.
- Project B proposed drawing water from a new resource via a connection to an abstraction created in the neighbouring town of Villeneuve-sur-Cosnie.
- Project C consisted of a physical-chemical treatment of the available resource to reduce the level of nitrates and pesticides.

The planned duration of projects A and B, i.e. drawing on a new resource, was 30 years. Project C, which involved treating the polluted water, was designed to last 15 years. However, its total cost over 30 years will be calculated.

For each project, the investment costs and annual operating costs were determined.

	Projet A	Projet B	Projet C
Investment	730 000 €	370 600 €	890 000 €
Operations	18 000 €	12 000 €	17 000 €

For project C, the investment costs were doubled in order to compare the three projects over the 30-year period.

The projects were ranked according to their net present value (NPV). The NPV is equal to the total revenues (unit price x volume sold) minus the initial investment and minus the expenses (operation), all discounted at an annual rate of 8% over the life of the project (30 years).

$$NPVn = \frac{\text{Revenue - Investment - Operating costs}}{(1+8\%)^n}$$

The selected project is the one having the highest NPV.

In the water field, the "impact on the water price" criterion (project cost / distributed volume) is often a useful data point. It translates the impact of a project into the cost per cubic metre of water. Presented in this manner, the results are easier to present and to understand for public decision-makers and water users.

The total cost of the projects (investment + operation) was compared with the revenue derived from the sale of 150 000 cubic metres per year, i.e. the costs of each project were divided by the 150 000 cubic metres distributed to consumers.

For a discount rate of 8%, project B is more cost effective than projects A and C.

Discount rate	Projet A	Projet B	Projet C
8%	0.66 €/m^3	0.35 €/m^3	0.94 €/m^3

Study by the Loire-Bretagne water agency.

Cost-benefit analysis

Cost-benefit analysis (CBA) compares all the benefits to all the costs of a given project and its options, taking notably into account the impacts that are not calculated in monetary terms (which is often the case for the environment).

It is a very useful decision-aid tool that can compare the different versions of a project and assess their relevance. Depending on the cost-benefit ratio, it is possible to determine whether the project is profitable or not. For example, it is possible to calculate the costs of restoring the ecological quality of the Alsatian water table and to assess the corresponding benefits.

Practically speaking, CBA results differ depending on whether the assessed benefits are marketable or not, e.g. environmental improvements such as reducing water pollution, etc. In the latter case, the analysis will require the use of appropriate techniques to monetise the expected non-market benefits.

Consequently, this type of analysis requires:

- precise definition of the required measures;
- an estimate of the costs and benefits of the measures;
- the distribution of costs and benefits over time (for discounting purposes);
- an assessment of the measures taking into account the present value of the cost-benefit ratios and a sensitivity analysis.

CBA is not a means to calculate the financial profitability of a measure, but an assessment of its overall value and economic relevance for the local government. In other words, the results are not intended solely for the project promoter, but for all stakeholders.

In determining the costs and benefits, CBA goes beyond a calculation of the financial aspects. The objective is to take into account all social and environmental costs and benefits, including non-economic effects, goods and services, which by definition do not have a price. To express their value in monetary terms, it is therefore necessary to produce fictive prices calculated using hypothetical methods. The results are only as good as the underlying assumptions, which sets certain limits to this type of assessment.

The main weak point of CBA is that the assessment of costs is based on measures whereas that of benefits looks at human uses that are directly linked to the status of a hydrosystem. The problem is that hydrosystems provide services on very large scales. It is sometimes difficult to see these services as being of direct use, even though they are, of course, of value for water management in a river basin (protection of groundwater, supply during low-flow periods, flood control), but also for protection of biodiversity on smaller scales, e.g. a network of natural zones, etc. Because CBA has difficulties in determining the best scale for its application, it has certain limits as a decision-aid tool in formulating policy.

Cost-benefit analysis also has limits in terms of the method. Because it attempts to express all the consequences and impacts of a project in monetary terms, it must call on fictive economic situations, either by inventing a market where none exists or by simulating a change in the environment. Both the persons running the assessment and those using the results must be aware of these limitations. In almost all cases, they are accompanied by practical difficulties pertaining to the availability of data. This has to do with the fact that the data required for the CBA cannot always be obtained in the suitable format. For this reason, the analysis consists, to a large extent, in manipulating data that are incomplete, fragmented, lacking in detail or lacking in scope. Extrapolations, interpolations, simplifications and working assumptions are the inevitable ingredients of economic assessments in the environmental field in general and the water-management field in particular, even if sensitivity analysis of these parameters can be used to limit the uncertainty to a certain degree.

Consequently, even though the basic principle behind cost-benefit analysis is fairly simple (compare discounted costs over time to discounted benefits over the same time span), the actual analysis implies a large amount of work to simplify the parameters and correctly define the hypotheses. In the end result, the quality of an assessment depends on its capacity to inform and facilitate discussions. That requires a high level of transparency concerning the method and understandable terminology.

That also means that the calculations and results should not be seen as a decision in and of themselves, but as a basis for discussion, further reflection and negotiations.

■ Cost-benefit analysis in the WFD and SBMPs

CBA is one of the basic techniques used in preparing WFD programmes of measures, i.e. to estimate and compare the costs of measures with the corresponding environmental benefits, in order to justify possible exemptions concerning the deadline or the overall objective for a water body (see the chapter on disproportionate costs).

This type of analysis could also be used in preparing SBMPs, but they are expensive. Feedback on CBA use for SBMPs has shown that it can be implemented in a simplified form, for example by listing all the costs and benefits corresponding to different scenarios, without necessarily having to monetise all the data. In this case, CBA corresponds to a multi-criteria analysis.

CBA may be a means to mobilise stakeholders and to impulse the creation of scenarios for the SBMP. It can also show that the foreseen financial resources are not sufficient to meet the set objectives.

However, a negative cost-benefit value does not necessarily mean that the objectives are overly ambitious. It could simply be because the monetary value of some benefits is difficult to calculate. In addition, other criteria (environmental, sociological, etc.) may exist, even though it is difficult to assess them quantitatively.

The difficulties commonly observed and reported are the following:

- difficulty in identifying all the benefits. Some benefits are unknown or not easy to quantify (margin of error, no reference points);
- difficulty in fully distinguishing the link between water and the local area. In some cases, the link is too technical to enable easy identification;
- the scope of the analysis appears too vast and open-ended;
- difficulties arise for SBMPs in less populated and/or less touristic areas;
- some benefits depend on other measures that fall well outside the scope of the SBMP.

On the whole, CBA is not particularly well suited to the scale on which SBMPs are formulated, but it can be used in specific cases for certain subjects.

Consequently, it is not necessarily useful to carry out a complete cost-benefit analysis for an SBMP. On the other hand, it may be worthwhile to:

- implement CBA techniques, e.g. by collecting data on economic issues in the area (the study for the SBMP for the Gironde estuary to select the rivers in which fish-passability issues were the most pressing produced an estimate on the value of fishing activities in the estuary (45 million euros), which was of great use to the concerned stakeholders because their role in the local economy had never been mentioned previously;
- run precisely targeted cost-benefit analyses (specific topics in each area);
- run cost-effectiveness analyses because they can avoid the difficulties involved in assessing benefits and can serve to compare different versions of projects.

Cost-effectiveness analysis or cost-benefit analysis?

To reach the set objectives, a number of measures or projects are generally possible. These measures or projects may complement each other or they may be exclusive. They differ in terms of their costs (market and non-market), their benefits (market and non-market), their deadlines, geographic locations, contributions to reaching the set objectives and their redistributive effects.

Cost-effectiveness analysis implies comparing the costs of various measures or projects required to attain a given environmental objective, e.g. a reduction of a pollutant to a given level in a water resource. For an SBMP, this type of analysis is suitable when the goal is to compare the costs of several technical options or scenarios in view of a given objective. For WFD implementation, these analyses are carried out during the formulation of the programmes of measures in order to select the most cost-effective measures to achieve good status for a water body.

Cost-benefit analysis is a decision-aid tool designed to assess projects through comparison of their costs and benefits. If the project produces a net gain, it can be approved. Different projects can also be ranked according to the level of net gains that they produce. There are two possible cases. The purpose of CBA can be to compare:

- a base scenario, which extrapolates the current situation into the future, with an alternative scenario in order to judge the usefulness of implementing the latter;
- a number of scenarios in order to select the best one, without necessarily comparing them to a base scenario.

It is clear that CBA deals with general guidelines and, for an SBMP, serves in particular to analyse alternative measures having different effects on resource quality. For WFD implementation, CBA is used to justify exemptions in terms of deadlines or of the final status (see the chapter on the analysis of disproportionate costs).

Finally, CBA differs from CEA in that it requires that all costs and all project impacts (both positive and negative) be expressed in monetary terms in order to allow comparisons.

Cost-recovery analysis

Cost-recovery analysis, a concept explicitly mentioned in the WFD, must be carried out in the process of drafting the characterisation report for each river-basin district. The analysis must indicate the degree to which each category of water-service users in fact pays for the water it consumes and discharges. The WFD does not impose a specific level of cost recovery and leaves the Member States with a certain degree of leeway, notably by providing the possibility of taking into account the social, environmental and economic impacts of cost recovery.

This type of analysis is presented in detail in the chapter titled “Cost recovery or the water economic cycle”.

Assessment of the environmental impacts of a project or measure

Assessment of the environmental impacts of a project or measure

Once the costs of project implementation have been calculated, it is often necessary to estimate the environmental impacts of the project. But how should an economic assessment be carried out on the environmental benefits and damages, which are, by definition, difficult to estimate in monetary terms? What value can be assigned to environmental assets or to the services rendered by the environment? What methods are available to carry out these assessments? At what point during the WFD cycle or during SBMP implementation should they be run?

Defining and assessing the various impacts of a project

For an SBMP or the WFD, it may be necessary to assess the environmental impacts of a project or measure. This consists of identifying the environmental benefits and damages incurred by the project or measure. The point of the assessment of these impacts is to inform on the economic, social and environmental effects caused by the project or measure. For example, the ecological consequences of a project may be defined as the impact of the project on the balance or the functioning of the environment or the ecological system. The consequences are thus all the effects of the project on ecosystem services, on environmental regulation (climate, soil formation, water cycle), on services provided by species (pollination, balance between fauna and flora), and on biodiversity and the gene pool.

The social effects of an environmental project reflect the consequences of the project on cultural, recreational, scientific and educational habits, as well as the benefits for human health and quality of living provided by the environment.

To determine the economic impact of an environmental project, it is necessary to assess all the economic consequences of the project in terms of jobs, the production of market natural goods and, more generally, the effects of the project on local development.

The approach to the impacts of a project will differ depending on the type of benefits and damages that must be quantified. Depending on the specific analysis selected, the value assigned to the consequences of a project (and the final assessment of the project) may vary considerably. **This variation in the assessment of impacts is not a problem as long as the evaluation criteria are clearly presented with the results.**

Some of the impacts listed in Table 10 are easy to quantify and can be translated into monetary terms and financial totals. That is notably the case for the economic impacts. On the other hand, it is much more difficult to set a price for ecological impacts, e.g. the "value of flagship species".

Tableau 10 *An example of impact assessment on the Sainte-Victoire site (Source: Credoc, 2008).*

Type of impact	Notable elements	Quantification and valuation
Economic impacts	Jobs created by the local board and by its partners in the economic sectors stimulated by environmental protection. Creation of skills in forest management (prevention of forest fires) and sustainable management of natural areas. Economic benefits for: - the forestry industry - agrosylvopastoralism - hunting - the wine-growing sector - real estate Potential benefits via specific labels for tourism businesses. Benefits derived from cooperation with farmers and hunters.	Number of full-time equivalent jobs: direct jobs, indirect jobs, derived jobs. Number of work days (calculated using the average price for consulting businesses) put into creating a methods guide on fire-prevention projects, a guide on development work in natural areas, etc. Revenues from sale of wood from the site. Revenues of business units on the site. Average price for one hectare of a reference hunting ground, multiplied by the number of hectares set aside for hunting on the site. Change in revenues of the cooperative following granting of the Sainte-Victoire label. Calculation (hedonic-pricing method) of the impact of the "proximity to and/or view of the Sainte-Victoire mountain" criterion on real-estate prices. Increase in the average price of a rental in a rural vacation apartment benefiting from the "Grand Site" label. Subsidies received by hunting associations for the development of cover crops (for game animals). Territorial agro-environmental subsidies received by farmers.
Ecological impacts	Oxygen supply and carbon sequestering by biomass. Prevention of fires. Value of flagship species.	Market value per ton of carbon per hectare of forest on the site. Avoidance cost calculated using the average cost of fire per hectare on the site (using the 1989 fire as the reference value) or Replacement cost based on the cost of fighting a fire if one occurs. Average willingness to pay to preserve site flagship species (further information required).
Social impacts	Value of the Cézanne heritage. Value of the vernacular historical heritage, of the palaeontological heritage and of the site landscape. Value of recreational uses (climbing, paragliding, hiking). Value of the local living conditions. Creation of a collective transportation system around the site.	Approach via willingness to pay for all aspects of the social value of the site or Approach specifically targeting the Cézanne heritage (the value of the Cézanne paintings showing the Sainte-Victoire mountain). Approach via willingness to pay for all aspects of the social value of the site or Value of a set of dinosaur eggs (based on the market value of dinosaur eggs). Approach via willingness to pay for all aspects of the social value of the site or Average cost accepted by individuals to access the site (cost of travel). Approach via willingness to pay for all aspects of the social value of the site. Annual gas savings achieved by inhabitants using the shuttles.

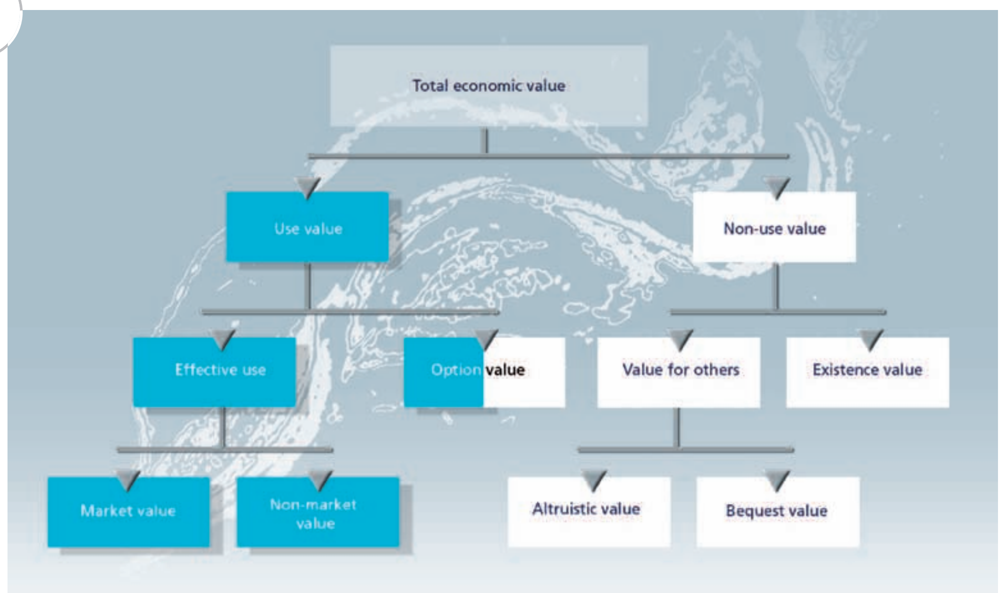
Total economic value (TEV)

How can the value of an environmental asset be assessed? What is meant by the value of an environmental good or service? To answer these questions, it is first necessary to define the notion of total economic value.

In environmental economics, the total economic value (TEV) is a theoretical concept used to define the value of an environmental good or service. TEV is made up, on the one hand, of the use value, and on the other, of the non-use value, as shown in Figure 20.

The use value of an environmental good corresponds to its effective and real use, e.g. a visit to a nature park,

Figure 20



The components of total economic value. Source: The theory of total economic value.

or to its planned and possible use, e.g. a planned visit to a nature park. The use value may or may not be set by an existing market. For example, use of water as drinking water has a price, i.e. the price paid by the user of the service. In this sense, the value of the water use is determined by a market. On the other hand, a walk in a wetland area to observe the fauna and flora is a use whose value is not set by a market (no market price).

In cases where a use is possible (option value), it is deemed to be offset to the future. The option value is therefore a type of use value, but postponed to a later time.

Non-use value corresponds to the value assigned by people to an environmental good or service that they do not effectively use, that they in fact cannot use or that it would be impossible to use. In most assessments, this value is declared by the persons questioned and is highly subjective.

The existence value represents the value a person assigns to an environmental good that the person does not use and does not intend for use, either by himself or herself or by other persons. This could be the case, for example, of the value assigned to saving a wetland even if the person has no intention of using the environmental good.

The altruistic value corresponds to the desire to preserve an environmental good for the present generation, whereas the bequest value represents the desire to preserve an environmental good for future generations.

It must be said, however, that these distinctions remain relatively theoretical. Practically speaking, it is difficult to distinguish the various types of values, particularly given that a single person may have many reasons to assign value to an environmental good or service.

Different economic methods may be used to roughly calculate one or more of the above values simultaneously. However, the methods must be correctly selected for the type of value to be determined.

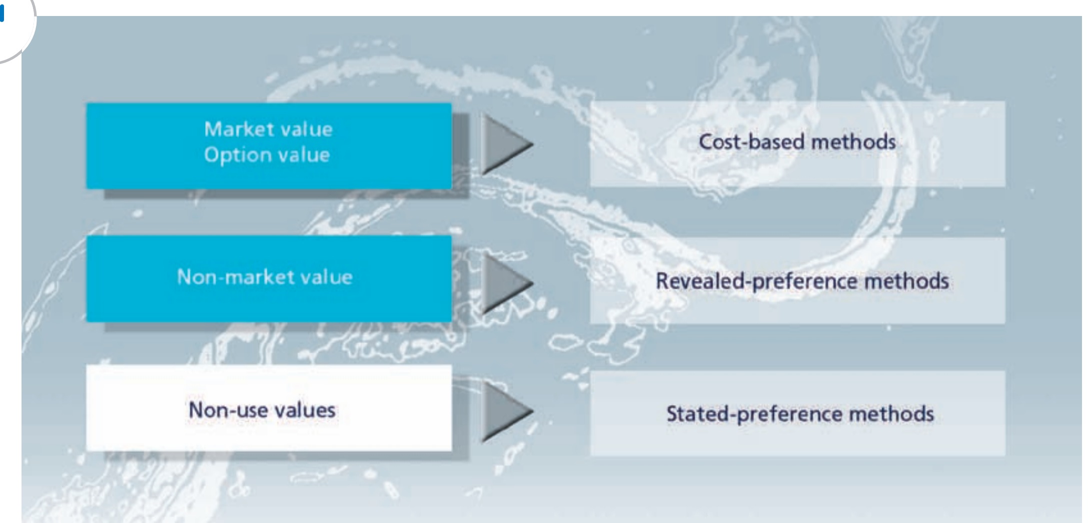
Methods to assess the impact of a project or measure

An economic assessment indicating the value of an environmental good is based primarily on methods **linking a value expressed in monetary terms** (euros, dollars, etc.) **with changes in the environmental status.** The process of monetising does not mean that the environmental good, the aquatic environment, becomes a marketable item that can be freely purchased or exploited. It **provides a quantified assessment that can then be compared to economic values** more commonly used in analysis such as costs and budgets.

Different methods for the economic assessment of environmental goods have been developed and are currently used. Each provides a particular type of information. Distinctions are generally made between three types of methods depending on the type of value to be determined.

For example, to determine market or option values, cost-based methods are employed. To calculate non market-related use values, revealed-preference methods are used. Finally, non-use values can be measured by stated-preference methods.

Figure 21



Assessment methods for the various values.

Cost-based methods

Market values and market-based option values are assessed using methods based on observed costs, e.g. the avoided-cost method, substitute-cost method, replacement-cost method. This type of method is relatively easy to use. In general, the objective is to determine the value of certain environmental goods or services by estimating the costs that would be incurred if the goods or services were no longer available or if their quality were damaged.

For example, the loss of a wetland or damage to it would lead to:

- an increase in flood risks, because wetlands absorb flood waters and thus avoid flood damage (avoided costs);
- a reduction in the self-cleansing of wastewater by the natural environment. The disappearance of the wetland would require the construction of additional wastewater-treatment plants or the resizing of existing plants, which would represent considerable additional costs (substitution costs);
- a reduction in biodiversity which would require, for example, the reintroduction of the species removed from the environment to "re-establish "the quality of the damaged ecosystem (replacement costs).

For a study on Alsatian groundwater during the preparation of the WFD programmes of measures, the avoided-cost method revealed that if the regulatory thresholds for sodium chloride (salt) were reached by 2015 in Alsatian groundwater bodies, investment and water-treatment costs of between 5.7 and 6.8 million euros could be avoided.

Table 11 presents the results of assessments using cost methods to determine the economic impacts of pollution in water resources for consumers of drinking water.

Tableau 11 *Use of cost-based methods to assess the economic impacts of water pollution.*

Treatment costs for water resources intended for drinking water	Minimum unit price	Maximum unit price	Study site	Sources
Treatment for eutrophication (abstraction from a river)	0.13 €/m3	0.21€/m3	Loire-Bretagne basin	Loire-Bretagne water agency
Treatment for nitrates (abstraction from a river)	0.22€/m3		Seine-Normandie basin	Seine-Normandie water agency
Treatment for pesticides (abstraction from a river)	0.06€/m3		Seine-Normandie basin	Seine-Normandie water agency
Treatment for nitrates	0.4€/m3	0.6€/m3		Ecology ministry (CGDD)
Treatment for pesticides	0.06€/m3	0.2€/m3		Ecology ministry (CGDD)

(Sources: Water agencies and CGDD, E&D no. 52, http://www.developpement-durable.gouv.fr/Couts-des-principales-pollutions.html).

Revealed-preference methods

To calculate non market-related use values, revealed-preference methods may be implemented. They consist of estimating the value of, for example, bathing by referring to an existing and relevant market, for example, the real-estate market.

The objective is to deduce the value of environmental goods and services on the basis of decisions effectively made by individuals. The basic technique used by these methods is to observe the behaviour of environmental users (fishermen, walkers, industrial companies using water as a raw material, etc.), on the assumption that their behaviour indicates their preferences and thus the value that they assign to the environment.

In other words, these methods "reveal" the value of the environmental good or service via an estimation using an existing market.

■ Method based on market prices

This method deduces the value of environmental goods and services on the basis of their market price. For example, if problems involving water pollution lead to the closing of a fish-canning factory, the loss of revenue caused by the closing and the possible impacts of increases in fish prices on markets for consumers may be used to calculate the benefits of a return to high-quality water.

■ Method based on productivity

This method is used when an environmental good (water, wood, etc.) enters into the production of another object sold on a market. For example, water quality influences the productivity of irrigated crops or the treatment costs of services providing drinking water. The economic benefits drawn from higher quality water may be roughly calculated by measuring the increase in revenue due to greater agricultural productivity or to a drop in costs to provide drinking water.

■ Hedonic-pricing method

This method assesses the value of an ecosystem or of an environmental service based on its direct influence on the price of certain objects. It is based on the idea that the price of some objects, e.g. housing, depends on many characteristics, some of which may be environmental. In general, economists study the variations in real-estate prices assumed to indicate an implicit value of the environmental component, for example, proximity to a nature park.

■ Travel-cost method

The travel-cost method estimates the economic value of a recreational site on the basis of the costs accepted by site users to travel to the site. The travel costs incurred by the visitors are interpreted as the expression of their willingness to pay to visit the site.

Stated-preference methods

Many of the services provided by an ecosystem, for example a walk in the woods or the pleasure of fishing, cannot be purchased or sold on a market. It is also impossible to roughly calculate their value based on existing market sales of other goods or services, as is the case for the revealed-preferences methods (travel-cost method, hedonic-pricing method). In order to determine the non-use value of an environmental good or service, stated-preference methods are used, e.g. the contingent-valuation and joint-evaluation methods.

■ Contingent-valuation method

This method uses **declarative questionnaires and surveys on the population concerned by a project to assess how much households would be willing to pay for a given improvement in the environment.** This willingness to pay for an improvement in environmental quality is then used to calculate the monetary value of the environment (see Figure 23).

Figure 23

AN EXAMPLE OF CONTINGENT VALUATION ON THE LOWER GARDON RIVER

METHOD

- Telephone survey
- Travel-cost method
- Contingent-valuation method to estimate the advantages of restoring the Gardon River to good status
- Cost-benefit analysis to determine the degree to which good status is reached

OBJECTIVES

- **Assess** the value of recreational activities on the lower Gardon River
- **Quantify** the benefits in order to compare them to the costs of measures required to reach good ecological status of the river
- The **analysis** serves as a decision-aid tool

RESULTS

- The value assigned to their recreational activity was estimated on the basis of the maximum entry fee that they would be willing to pay to continue that activity (travel-cost method):

  19.30 euros for walkers, 12.80 for fishermen, 12.60 for kayakers, 12.00 for bathers (values per visit and per person).

- The total amounted to 45 million euros per year.
- These data were then extrapolated to calculate the advantage derived from restoring good status in the lower Gardon River. The result was 2.8 million euros.
- This analysis showed that the benefits to be drawn from restoring the river were higher than the costs (net sum resulting from revenues minus the costs of measures).

Source: Espaces naturels, revue des professionnels de la nature, no. 30, April 2010.

In general, contingent-valuation analysis comprises three main steps.

First, it is necessary to structure the survey questionnaire. The elements that must be determined are the population to be surveyed and the type of questions (telephone survey, postal survey). It is necessary to define the hypothetical scenario studied during the survey and the payment systems targeted by the questionnaire (income taxes, sales taxes, entry fees, etc.). It is also necessary to select the social-economic parameters used to differentiate the surveyed population (age, income, profession, etc.).

The second step consists of selecting the method used to have people declare their preferences. There are a number of possibilities:

- using an auction system (the proposed values increase throughout the questionnaire);
- using an open question (no proposed values, answers are totally open);
- using a bank card (semi-open question with a proposed value);
- using a closed question (only one value proposed).

Finally, in the third step, the collected data is analysed. This step comprises a descriptive phase and an explicative phase:

- via statistical analysis, the descriptive phase indicates user willingness to pay;
- via econometric analysis, the explicative phase identifies the key variables determining user willingness to pay.

■ Joint-evaluation method

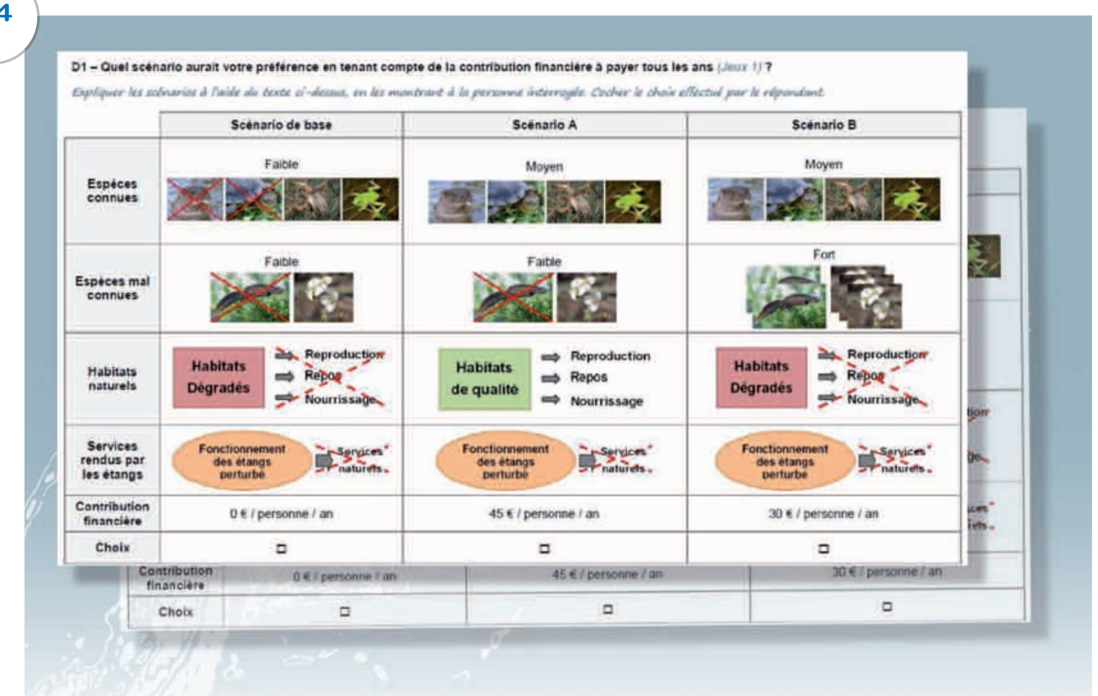
Similar to contingent valuation, joint evaluation is a stated-preference method used to estimate both use and non-use values assigned to an environmental good. The joint-evaluation method, also called the experimental-choice or the contingent-choice method, is used to determine the **value of an ecosystem or a service provided by the environment based on a choice between virtual situations.**

The persons interviewed must make choices and set priorities among different characteristics of the ecosystem and/or the services it provides. Each choice is linked to a cost or to other monetary/economic attributes. It is on the basis of the choices made by the interviewed persons that the value attributed to the ecosystem can be determined.

To encourage the interviewed persons to make choices between the various scenarios presented, the environmental good to be evaluated is geographically situated. The good is presented in its current and future (hypothetical) state and the restoration possibilities of the good are listed (following the hypothetical degradation).

An example of the joint-evaluation method used for the Brenne ponds is presented in Figure 24.

Figure 24



D1 – Quel scénario aurait votre préférence en tenant compte de la contribution financière à payer tous les ans (Jeux 1) ?

Expliquer les scénarios à l'aide du texte ci-dessus, en les montrant à la personne interrogée. Cocher le choix effectué par le répondant.

	Scénario de base	Scénario A	Scénario B
Espèces connues	Faible	Moyen	Moyen
Espèces mal connues	Faible	Faible	Fort
Habitats naturels	Habitats Dégradés → Reproduction, Repos, Nourrissage	Habitats de qualité → Reproduction, Repos, Nourrissage	Habitats Dégradés → Reproduction, Repos, Nourrissage
Services rendus par les étangs	Fonctionnement des étangs perturbé → Services naturels	Fonctionnement des étangs perturbé → Services naturels	Fonctionnement des étangs perturbé → Services naturels
Contribution financière	0 € / personne / an	45 € / personne / an	30 € / personne / an
Choix	☐	☐	☐

Joint-evaluation method used for the Brenne ponds. The available choices comprise three scenarios incorporating different biodiversity characteristics. Each scenario also includes different financial contributions.

Study on the "improvement of knowledge of wetlands on eight sites in the Loire-Bretagne basin", Actéon, 2010, page 67.

Operational implementation of the assessment on the environmental benefits and damages incurred by a project or measure

Implementation of an assessment method is not the only element in the procedure. Beforehand, it is necessary to determine whether it is a good idea to take existing values obtained from other studies and use them for the assessment.

After the assessment, the results must be extrapolated to the entire population concerned by the given ecosystem and the services it provides. The time factor must also be taken into account (using the discount rate) because the benefits drawn from the services provided by the environment are not limited to a single year. Implementation of economic-assessment methods for environmental goods therefore requires particular care in ensuring that the monetary values obtained are robust, relevant and can be used at some later time.

Benefit transfer and aggregation of data for entire areas

Benefit transfer means that the results of a prior study on a given site are transferred to another site. In this manner, the costs that would be incurred by launching a new study can be avoided. The transfer may also be the first step in a more extensive study on the new site.

To date, transfer methods remain fairly rudimentary. The simplest and most common method is to use unit values expressed per cubic metre of water, per household, per hectare, etc., drawn from previous studies. Consequently, a change in the status of an environment can be linked to a unit value corresponding to the non-market benefits that may be expected following the change.

Three types of transfer have been identified, in increasing order of precision and difficulty:
- **simple-value transfer.** The average unit value drawn from an existing study is taken without adjustment and used “as is” for the new site;
- **adjusted-value transfer.** The average unit value drawn from an existing study is adjusted taking into account the differences between the sites, e.g. the differences in income between inhabitants living on the two sites;
- **value-function transfer.** Some methods call on statistical models to describe the relationship between the unit value and explanatory variables such as the age of the population, income levels, etc. Value-function transfer consists of transferring the explanatory model linked to the unit value produced by the prior study to the new site.

To determine the total value of an environmental good, it is necessary to aggregate the transferred unit values. The precision of the unit-value aggregation is enhanced by clearly identifying and determining the population concerned by the study, i.e. the persons potentially affected by a change in the quality of the environment. It is then necessary to select the sample group that, given its social-economic characteristics and behaviour, is as representative as possible of the identified population.

Once the sample group has been selected, aggregation consists of extrapolating the value found for the sample to the population as a whole. The result is the estimated total value of the environmental good. In some cases, it may be necessary to modify the sample group in order to improve its representativeness.

Procedure to estimate the value of an environmental good or service

■ Determine the unit values

Most methods proceed by **first determining unit values corresponding to a marginal change in certain environmental goods or services,** e.g. the value of an environmental change calculated per cubic metre of water, per household, per protected hectare, etc.

Unit values may be calculated using a three-step process recommended by the Ecology ministry.

Figure 25

THREE-STEP PROCESS FOR UNIT VALUES

1

First, carry out a **qualitative assessment of the uses** concerned by a change in the natural environment (see chapter one of this book).

2

Secondly, **use unit values from prior studies** to roughly calculate financial volumes that are imprecise, but sufficient to provide a general idea of the amounts in play. Reference unit values are available on the economie.eaufrance.fr site for the water sector or on the EVRI database site (see box below) for environmental assessments in general. The database contains a number of environmental-valuation studies and may be consulted on-line.

3

Finally, to obtain reference unit values better suited to the actual case, **it may be necessary to use on site a method specifically adapted to the context** and to the environmental impact studied.

Unit values may be determined in three successive steps.

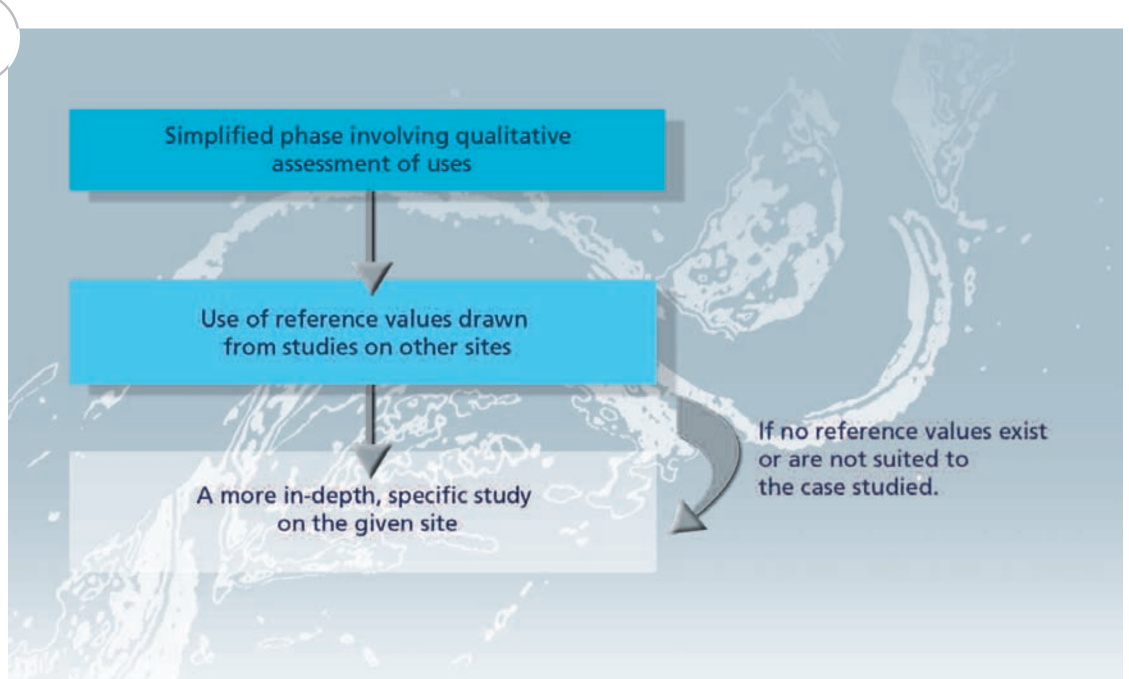
The EVRI database for the development of benefit transfer

The EVRI (Environmental Valuation Reference Inventory) database is a storehouse of environmental valuation studies.

It was developed in the beginning of the 1990s by the Canadian and U.S. environmental agencies (Environment Canada and the Environmental Protection Agency), primarily to identity alternate solutions for on-site environmental-assessment studies because the latter are often long and costly. The main goal of the EVRI database is to encourage benefit transfer. It has continued to be developed in the form of an internet site (www.evri.ca). In 2011, the site held almost 3 500 studies, including 50% from North America and 30% from Europe. Most of the studies stored in the database concern water or fauna. Since October 2002, France has been a member country with Canada, the United Kingdom, the United States and Australia.

The agreement signed between France and Environment Canada means that all French citizens may freely access the database. A registration is required prior to obtaining access.

Figure 26

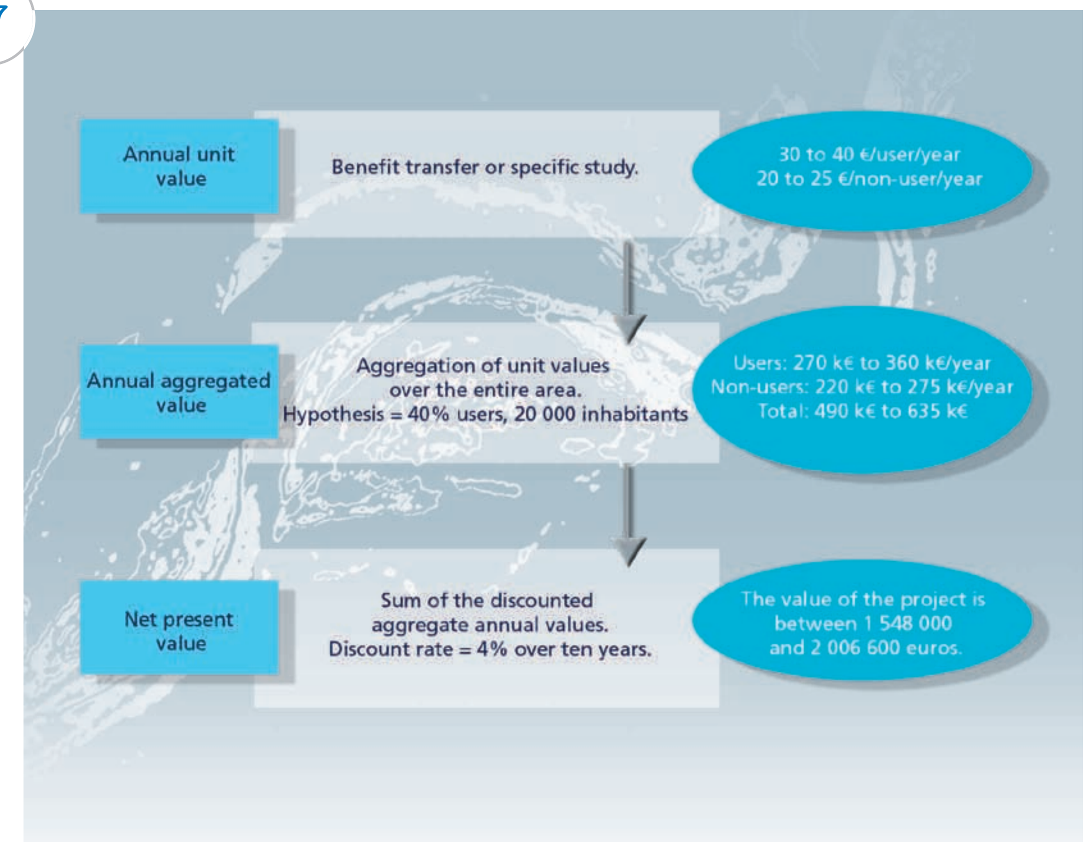


Position of on-site assessment in the overall procedure.
Source: the Water agencies.

Aggregation of the unit values

Once the **unit values have been determined,** it is necessary to proceed with their **aggregation** over the entire population to learn the total benefits produced by conserving or restoring environmental quality. **Calculation of the distribution of benefits over time** also requires particular care and the use of a discount rate. Figure 27 recapitulates the steps involved in the aggregation of unit values.

Figure 27



Steps leading to an estimate of the total value of an environmental good, based on unit values.
Source: the Water agencies.

Example of an assessment of the environmental services rendered by wetlands

An environmental economic assessment of wetlands is based on assigning a market value to the functions and services provided by these environments (see the Zones humides journal, no. 66, fourth quarter 2009). However, this type of valuation requires that the services rendered concern a use and/or are of use to users. For this reason, the assessment is anthropocentric, i.e. a service that does not concern a use and/or is not of use to users would have no value or a negligible value.

In French studies, a number of methods have been implemented to determine these values, notably direct market assessment based on prices, the avoided-cost method, the travel-cost method and contingent-valuation methods (see Table 12).

Tableau 12 *Value in euros2008/hectare/year of the main services provided by wetlands as indicated by the various methods.*

	Average economic value found by 15 French studies	Average economic value found by the meta-analysis by Brander *et al.* (2003) on the basis of 89 sites
Water purification	15 – 11300 (4)	272
Supply of water during low-flow periods	45 – 150 (3)	42
Flood control	37 – 617 (6)	438
Recreational activities		
Fishing	80 – 120 (2)	353
Hunting	230 – 330 (2)	116
Navigation / boating	15 (1)	not assessed
Canoeing/kayaking	28 (1)	not assessed
Social value	200 – 1600 (7)	392
Total services provided (€2008/ha/year)	650 – 1416 * 907 – 3132 **	1613

() The number in parentheses indicates the number of studies on which the data is based.
** These values represent the total services provided by the wetland.*
*** Given the great variability in the water-purification service, the value was replaced by the average (272 €) produced by the meta-analysis undertaken by Brander et al.*

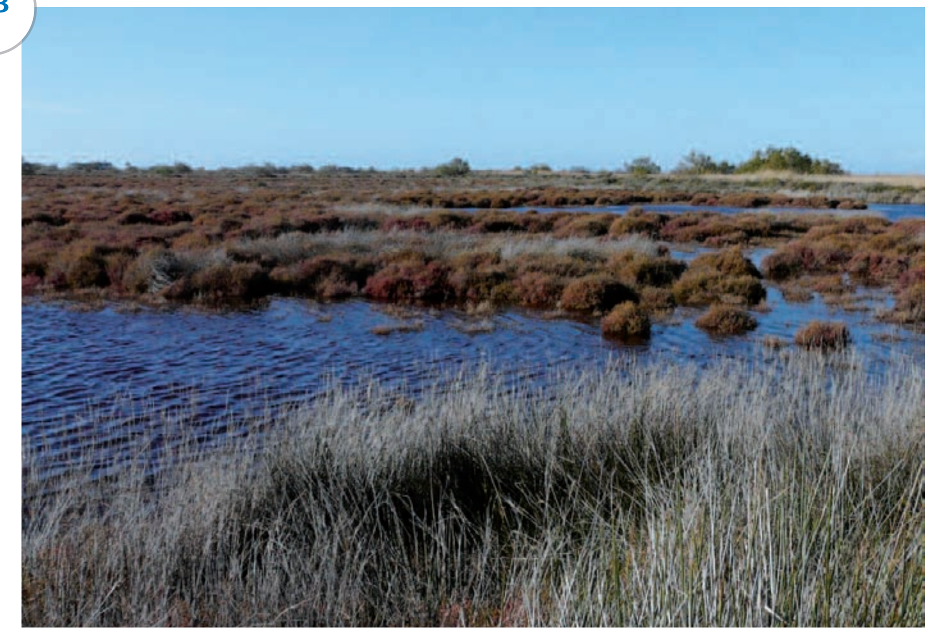
CGDD. E&D no. 23 (June 2010, http://www.developpement-durable.gouv.fr/Evaluation-economique-des-services.html) and LPS no. 62 (September 2010, http://www.developpement-durable.gouv.fr/L-evaluation-economique-des.html).

The report titled "Approche économique de la biodiversité et des services liés aux écosystèmes : contribution possible à la décision publique" (B. Chevassus-au-Louis, J.M. Salles and J.L. Pujol, 2009) analyses the methods used to assess the economic value of biodiversity and ecosystem services (see Figure 28). The authors also test the reference values used for social-economic assessments of public investment. In France, some work has used the willingness-to-pay approach. The results of the studies are presented in Tables 13 and 14.

Tableau 13 *Assessment of the willingness to pay to preserve wetlands.*

Site	Methods used	Willingness to pay per year x households (average willingness to pay)	Size of population concerned by measure	Surface area of the studied wetland	Willingness to pay / ha / year
Der Lake	Contingent valuation	30-33 €	117 000 inhabitants, i.e. 46 600 households	4 800 ha	291-320 €
Orne estuary	Contingent valuation	30-66 €	13 500 inhabitants, i.e. 5 400 households	900 ha	179-394 €
Erdre marshes	Choice experiments	34 €	56 000 inhabitants, i.e. 22 555 households	2 500 ha	307 €
Seine estuary	Choice experiments	18-46 €	1.17 million inhabitants, i.e. 500 000 households	14 000 ha	659-1 652 €

Figure 28



Example of a wetland.

© F. Weingertner - Onema

Tableau 14 *Assessment of the services rendered by wetlands.*

In euros	Cotentin and Bessin		Bassée		Oise	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Regulatory services						
Absorption of flood waters			210	3840	110	370
Groundwater recharging	190	370	35	70	35	35
Water purification	830	890	475	1420	315	560
Climate regulation	1800	1800	1800	1800		
Productive services						
Agriculture	585	750	285	305	285	305
Shell fishing	120	120				
Forestry			75	270	75	270
Cultural services						
Hunting	170	340	100	155	60	80
Recreational fishing	165	230	130	160	80	90
Educative and scientific value	10	15	490	540		
Aesthetic and recreational value	290	1170	Negligible	Negligible	Negligible	Negligible
Total use value	2100	3500	900	4300	700	1200
Biodiversity (non-use)	225	870	470	2360	440	2230
Total economic value	2400	4400	1300	6700	1200	3400

CGDD, Economic assessment of services rendered by wetlands, in Études & documents no. 49, September 2011.

Recommendations for studies to assess an environmental good or service

Figure 29 lists the steps for an assessment of an environmental good or service For each step, practical recommendations are provided.

Figure 29

Step	Recommendation
Set up a steering committee	Do not attempt to carry out an assessment alone. It is necessary to set up a steering committee including economists, organisations having already participated in this type of assessment and people who are intimately familiar with the area and with local activities.
List all items of value	Draw up a list of the potential economic effects of the environment to be restored (using the value typology), identify existing sources of information. This step may be filled out with in-depth studies.
Write up the technical specifications	For each item of value, draft a written plan for the study or survey intended to assess the item.
Select a competent study partner	Selection of the entity carrying out the study depends on the cost, but also on the quality of the proposal. Make sure that the subject and issues at hand are correctly understood, that the person/company is familiar with the field and can produce relevant references. Contingent-valuation analysis, for example, requires very particular skills.
Monitor and accompany the study	Study monitoring includes checks on the work done at certain key steps agreed upon with the study partner, notably the targets of the study (who, when and where), the type and content of questionnaires (telephone, face to face), etc., all of which must have first been tested. It is indispensable to visit the area with the persons who will carry out the study and to explain the issues involved. Finally, do not forget to inform beforehand the persons to be surveyed and to thank them for their time.
Inform on the study results	It is best to organise a meeting for the management organisation, the elected officials and economic participants. The results presented should be understandable and appropriate for a public of non-economists.

The steps for an assessment of an environmental good or service.
Source: the Water agencies.

In addition to the recommendations listed above, Table 15 recapitulates the various assessment methods that can be used, depending on the values and types of impacts to be assessed.

Tableau 15 *Methods to assess different values on a site.*

Type of value	Components of the value to be assessed	Available analysis methods
Economic value	Jobs Production Local development Skills	Budgetary analysis* Input/output analysis** Activity-systems analysis***
Ecological services	Environmental services Services provided by species Protection against hazards Biodiversity, genetic heritage	Avoided costs Replacement costs Opportunity costs
Social value	Value of heritage Scientific and educational uses Recreational uses Health and quality of life	Joint evaluation Contingent valuation Travel costs Hedonic pricing

** Budgetary analysis consists of an accounting examination of the revenue and expenses of the environmental-management organisation.*

*** Input/output analysis requires highly detailed territorial statistics. It attempts to model the economic functioning of the territory and particularly the flows of wealth transiting from one economic compartment to another.*

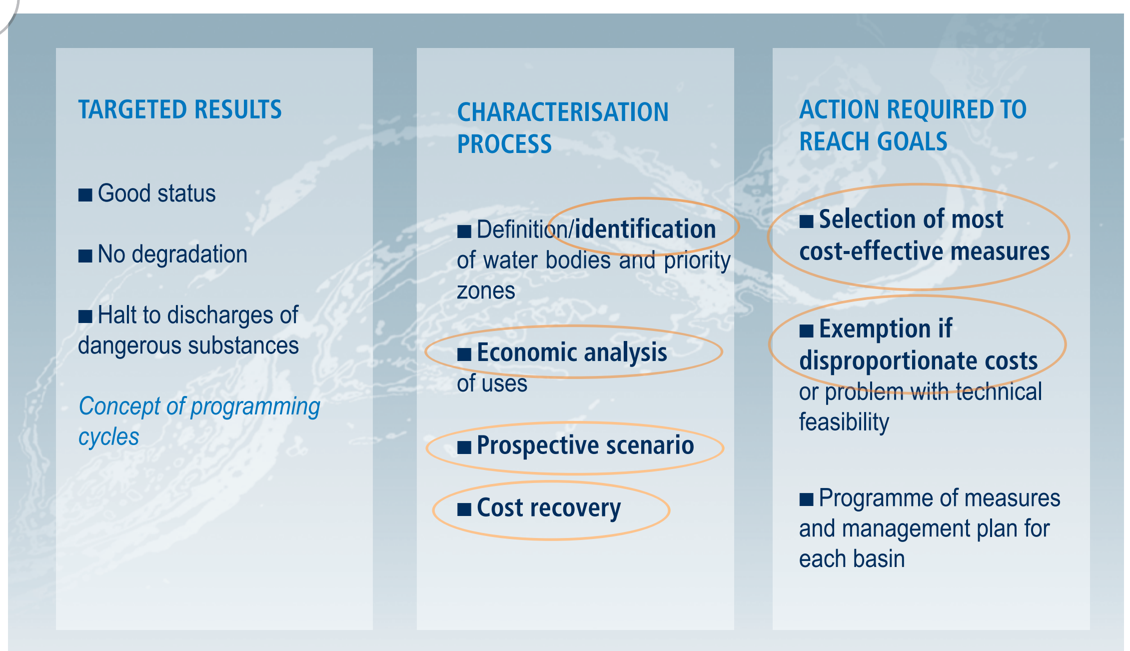
**** Activity-systems analysis measures the positive impact on the economy (improved productivity, quality) of the availability of goods produced by ecosystems (wood, fresh water, etc.).*

When should the environmental impacts of a project or measure be assessed?

Assessment of environmental impacts in the WFD programming cycle

In the process of implementing the WFD, economic analyses are carried out at a number of key steps during the preparatory cycle for the management plans of each river basin, as is shown in Figure 30.

Figure 30 *Economic analysis during the key phases of WFD implementation.*



Source: Maria Salvetti.

For the WFD characterisation process, the economics of water uses and cost recovery of water services must be analysed.

Economic analysis is also required during the process of identifying the heavily modified and artificial water bodies.

Finally, during formulation of the programmes of measures, cost-effectiveness and cost-benefit analyses should be carried out.

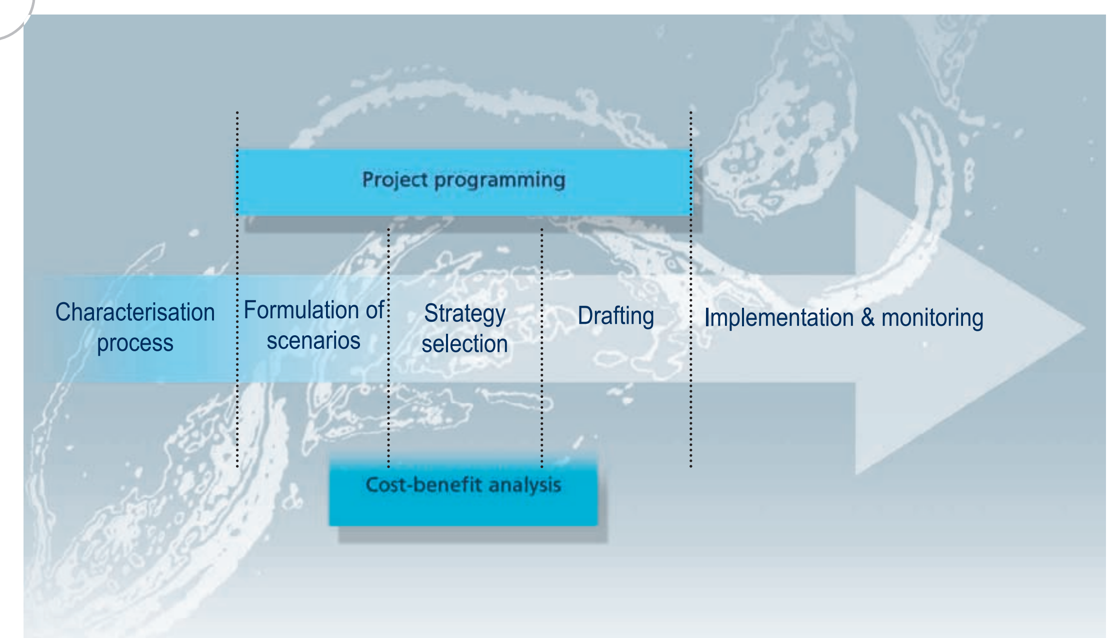
The assessment of environmental benefits and damage is carried out primarily during the phase in which the programmes of measures are drafted. This is because it is during this phase that the disproportionate-cost analyses are done (see the chapter titled “Disproportionate costs - a special type of assessment”) in view of justifying exemptions from WFD requirements. The disproportionate-cost analyses include cost-benefit analyses during which the benefits and damages incurred by the various measures are studied and quantified.

It should be noted, however, that the environmental benefit and damage assessments can also be carried out during the identification of the heavily modified and artificial water bodies.

Assessment of environmental impacts during SBMP preparation

For an SBMP, assessment of environmental impacts occurs essentially during the strategy-selection phase (see Figure 31). Collection and processing of the data required for this phase are however closely linked to the characterisation phase.

Figure 31 *Assessment of environmental impacts during SBMP preparation.*



Source: the Water agencies.

Tableau 16 *Experience feedback on environmental benefits and damage assessment during SBMP preparation (Source: the Water agencies).*

Issue	Difficulties to be avoided (negative feedback)	Needs expressed	Advantages expressed
Integration of analysis in SBMP procedure	Poor integration of analysis in overall SBMP planning. Economic analyses carried out separately, in parallel.	Need to simplify procedures (accelerate SBMP preparation). Run the analysis when project participants are ready (i.e. the political decisions concerning the project have been made).	
Data acquisition and processing	Benefits unknown or difficult to quantify (margin of error, no reference points). Difficulty in determining the effectiveness of measures and consequently in calculating the avoided costs. Links between water and the area as a whole may be too technical.	Improve access to data. Improve knowledge on effectiveness of measures. Improve links between perception of the territory and the issues.	
Analysis scale	Open-ended possible advantages (where does the analysis stop?). Less populated, less touristic SBMP area. Benefits depend on other measures that fall well outside the scope of the SBMP.	Focus analyses on issues and on each area. A "collectively ready" project, i.e. advantages identified for the area, beneficiaries identified, contributors identified, political guidelines set (plan for area).	Shed light on underlying economic issues. Highlight the economic value for the area.
Debates	Difficulty in perceiving the collective objective.	Need for a forward-looking debate with the local stakeholders. Support for political decisions. Enhance definition of projects in the economic analysis.	Provide an alternative to the existing debate. Clarify the advantages and the costs. Confirm or contradict the economic analyses presented by each stakeholder. Clarify the underlying economic issues, justify the option to be debated for the SBMP.
Objectives	Confusion between assessment and budget. Numerous misunderstandings and difficulty in grasping concepts.	Send a message to the local water commission.	Strengthen SBMP legitimacy.

Conclusion

As a conclusion, Table 17 recapitulates the resources required to implement the main methods used to assess environmental impacts, each with their specific advantages and disadvantages.

Tableau 17 *Methods to assess the environmental impacts of a project or measure (Source: the Water agencies).*

Method	Type of information used	Cost	Skills required	Advantages	Disadvantages
Avoided costs	Technical information	+	Economist Technical expert	Intuitive method, easy to understand.	Provides no information on non-use values.
Contingent valuation	Sample group of people must be interviewed (if postal or telephone survey)	+++	Ecologist Sociologist Statistician Economist	Provides information on non-use values. Can be used to assess all types of goods and services.	Based on answers and hypothetical situations. Higher cost than other methods.
Hedonic pricing	Data on real-estate sales	++	Economist Person with knowledge on real-estate sales Statistician	Suited to assessing changes in environmental quality. Based on choices and real situations.	Provides no information on non-use values. Difficulty in finding suitable real-estate data. Caution concerning effects of inflation.
Travel costs	Sample group of people must be interviewed (if postal or telephone survey) Data on frequency of visits to studied site, on travel costs (bus tickets, etc.)	+++	Statistician Economist	Suited to assessing the recreational value of a site. Based on choices and real situations.	Provides no information on non-use values. The existence of substitute sites and multiple-purpose visits complicates the assessment.

Cost recovery or the water economic cycle

Scope of cost-recovery analysis

The concept of cost recovery is explicitly mentioned in the WFD. Cost-recovery analysis must be carried out in the process of drafting the characterisation report for each river-basin district. A more simplified form of the analysis may also be carried out for an SBMP. The results can serve as true decision-aid tools in that they facilitate debate and inform on the economic issues in the area covered by the SBMP.

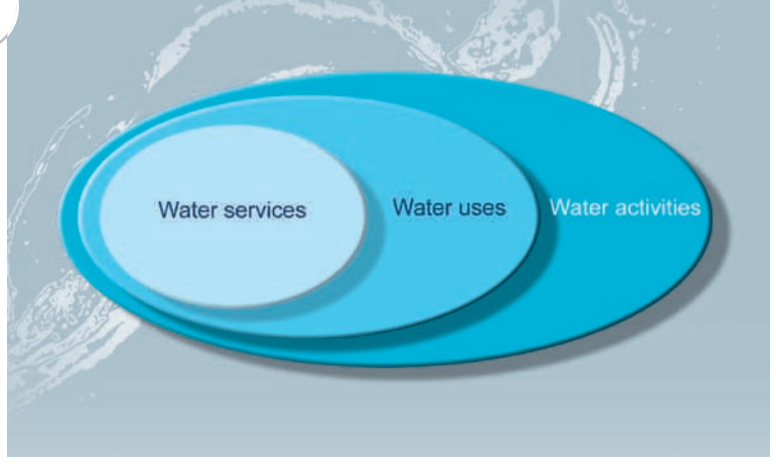
WFD article 9 requires that cost recovery be analysed in each river basin:
"Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle."

The objective being that water users cover as much as possible the costs incurred by their use of water, primarily through the price paid for that water,. The analysis must therefore indicate the degree to which each category of water-service users in fact pays for the water it consumes and discharges. The directive does not set a specific level of cost recovery. It provides the Member States with a certain degree of leeway, notably by providing the possibility of taking into account the social, environmental and economic impacts of cost recovery.

Definition of water services

The 22 April 2004 instructions concerning the analysis of water tariffs and cost recovery of services, in compliance with WFD article 9, provides in their Annex I definitions of the terms "water activities", "water uses" and "water services".
The three sets of items are nested, as shown in Figure 32.

Figure 32

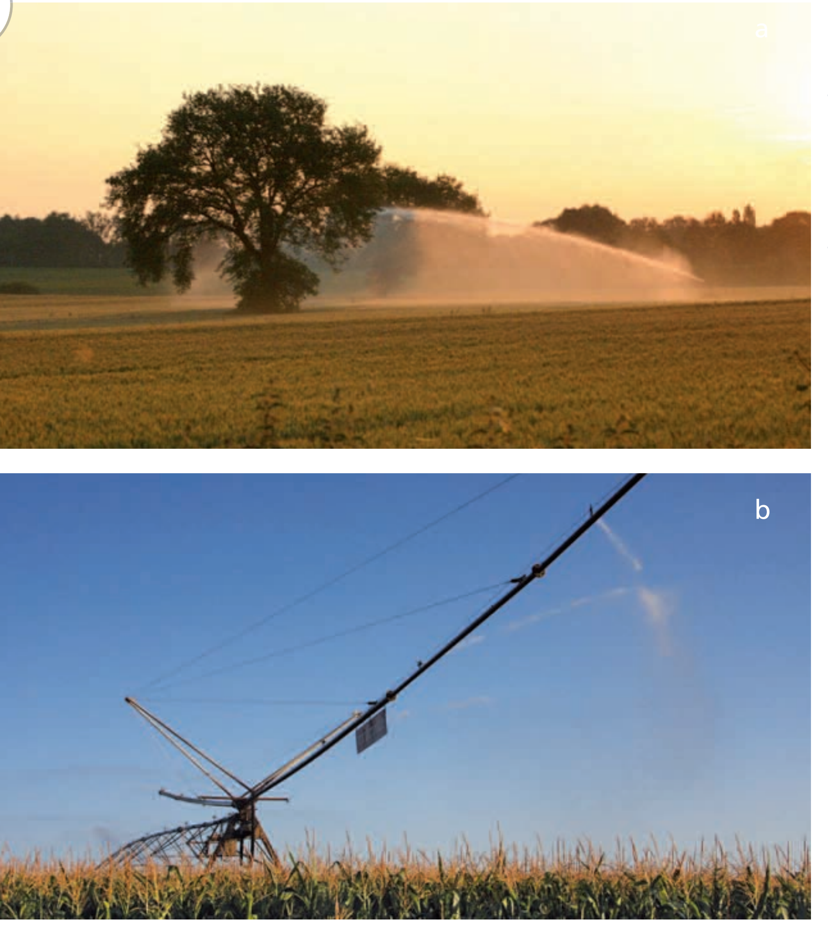


Water services. Source: Wateco guide, p.74.

■ Water activities

"The largest set is that of water activities." This may include, for example, bathing, irrigation (Figure 33), water distribution, fishing, etc.
By characterising water activities in a river-basin district, it is possible to determine their economic importance, as seen in the previous chapter.

Figure 33



a- b © M. Bramard - Onema

Irrigation is an example of a water activity.
(a) Sprinkler irrigation system for crops. (b) Irrigation via a central-pivot system with drop sprinklers.

■ Water uses

Water uses include *"services"* defined by WFD article 2-38 and other activities *"having a significant impact on the status of water"* (art. 2-39). They are identified in WFD Annex II (sections 1.4 and 2.1).

■ Water services

Water services are characterised by the existence of installations for water abstraction, storage, treatment and discharge (see Figure 34).

"The notion of "service" est extensive because it implicitly includes, absent any contrary indications in article 2-38, public and private services for third parties or for the provider itself, characterised by the presence of installations (abstraction, storage, discharge) and likely to influence significantly the status of water bodies."

WFD article 2-38

"Water services" means all services which provide, for households, public institutions or any economic activity:

- (a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater,
- (b) waste-water collection and treatment facilities which subsequently discharge into surface water.

The French position, presented in the 2004 instructions, was therefore to take into account in the analysis both public and private services for third parties or for the provider itself, likely to influence significantly the status of water bodies.

Figure 34

a © B. Gentil - Onema
b © C. Roussel - Onema

Wastewater-treatment plants and water towers are two infrastructure facilities included within the scope of cost-recovery analyses on the costs of water services.
(a) Wastewater-treatment plant.
(b) Water tower.

Definition of the economic sectors using water services

The WFD requires an assessment of cost recovery for water services whereby the data are "disaggregated into at least industry, households and agriculture".

In addition to these three user categories mentioned by the WFD, it was decided in France to more precisely distinguish within the industrial sector by adding the "quasi-domestic production activities" category. This category includes small shops, services and SMEs whose consumption is fairly similar to that of households. Practically speaking, however, this economic sector is closer to industry than to households.

Taking environmental impacts into account

Finally, the WFD requires that environmental benefits and damages be taken into account:

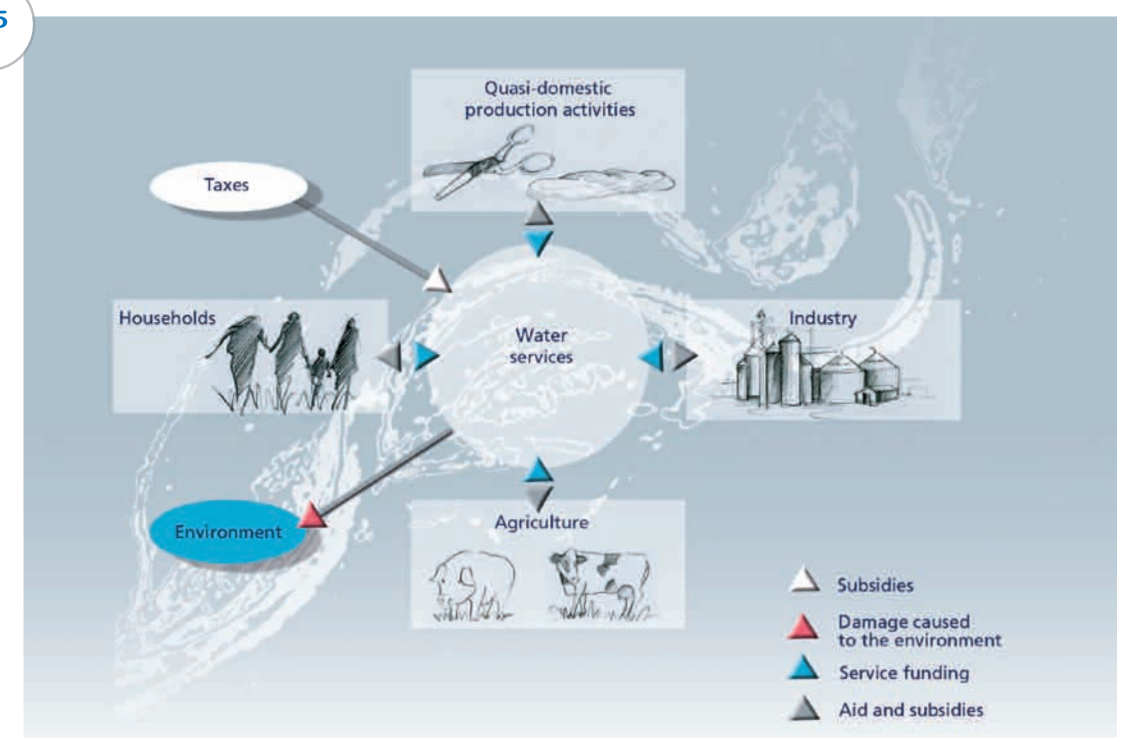
*"Member States shall take account of the principle of recovery of the costs of water services, **including environmental and resource costs,** having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle."*

For this reason, the environment must also be included in the cost-recovery analysis.

Service funding provided by taxes must also be listed.

Cost-recovery efforts therefore consist of identifying and assessing the economic flows between six stakeholders, as shown in Figure 35.

Figure 35



Drawings by Béatrice Saurel

Economic flows between water stakeholders. Source: Maria Salvetti, using work produced by the Forecasting and assessment department of the Seine-Normandie water agency.

Relevant costs for the analysis

The costs that must be assessed and taken into account for cost-recovery calculations are the following:

- capital costs, themselves made up of depreciation (the funds required to rebuild installations), new investment and opportunity costs, i.e. the benefits that could have been drawn from using the capital for another purpose;
- maintenance and operating costs;
- environmental costs which correspond to the market and non-market damage incurred by environmental degradation caused by the services;
- resource costs, i.e. a quantification of the costs borne by other services due to the over-use of the resource by the service in question.

Capital costs may be estimated fairly easily. It should be noted, however, that due to significant difficulties concerning the methods employed, capital opportunity costs are not included in calculations for cost recovery for the time being.

Assessment of the environmental costs also raises problems in terms of the methods. In general, they are roughly calculated using the compensatory costs, which however constitute only a part of the environmental costs.

An example of calculating the compensatory costs of a water service

Included in the maintenance and operating costs, as well as in the depreciation, are "compensatory" costs which correspond to the expenses assumed by the service for environmental degradation caused by other users. For a drinking-water service, these compensatory costs correspond, for example, to the installation of additional treatment processes made necessary by pollution of untreated water by other services and activities.

Purchase of bottled water by consumers confronted with poor-quality tap water caused by resource degradation must also be seen as compensatory expenses borne by households.

For a given service, the resource costs correspond to the expense incurred by the resource use exceeding the desirable level for the collectivity as a whole. In other words, it corresponds to the surplus that could have been achieved by the user making the best alternative use of the resource.

For example, the opportunity cost of an irrigation service compared to an industrial-water service may be roughly calculated by the losses in industrial production if the water is allocated for agricultural use. The opportunity cost of an irrigation service compared to a drinking-water service may be roughly calculated by the losses borne by the town or local government in acquiring water from a more distant location.
The opportunity cost of industry and towns compared to agriculture may be estimated on the basis of the lost agricultural income.

Given the difficulties in aggregating compensatory costs over an entire river basin, it was decided not to include them for the time being in calculations of the complete cost of services.

Calculating cost recovery

Once the scope of the analysis has been determined, cost-recovery calculations consist of identifying and estimating all the economic flows involved in water services. The overriding purpose is to provide economic information on water-management issues identified by the characterisation report for the river basin.

With that in mind, the WFD does not require complete cost recovery, but transparency concerning costs must be ensured. To that end, Member States must:

- take into account the principle of cost recovery (art. 9.1.);
- ensure by 2010 "adequate contribution of the different water uses, (...) to the recovery of the costs of water services, based on the economic analysis conducted according to Annex III and taking account of the polluter pays principle";
- assess "the contribution made by the various water uses to the recovery of the costs of water services" (art. 9.2.).

Practically speaking, the objective is to report on:

- the value of investments and how they are funded for each type of service;
- operating, depreciation and maintenance costs and how they are funded for each type of service;
- the contributions of the various economic sectors to funding of services and the subsidies granted.

Following the calculations, the ratios and economic flows listed below must be estimated:

- percentage of service costs (operating, maintenance and depreciation costs) covered by water prices;
- origin of water-sector funding (public subsidies and/or subsidies from the various economic sectors);
- cost recovery for the environment and water resources in application of the polluter-pays principle.

Assessment of service investments and how they are funded

For each type of service, the volume of investments and subsidies must be determined, taking care to distinguish subsidies funded by environmental fees and those by taxes. It is also necessary to assess any "compensatory" investments, i.e. investments undertaken due to the degradation in the quality or quantity of water resources. This may be the case, for example, of network interconnections, of reinforced treatment of drinking water due to eutrophication, to the presence of nitrates, pesticides, of changes in the position of abstractions, etc.
Table 18 presents a selection of the main compensatory costs and indicates whether they are curative, palliative, preventive, administrative (borne by the State and local governments) or for health purposes.

Tableau 18 *Type of compensatory costs.*
Source: Onema study, "Analysis of compensatory costs", 2011.

	Type of cost				
	Curative	Palliative	Preventive	Admin.	Health
Consequences following discharge of maritime waste (cleaning, health costs, etc.)	X				X
Increased pumping due to drops in groundwater levels	X				
Cleansing of shellfish following microbiological contamination	X				
Treatment of shellfish following chemical contamination	X				
Shellfish protection and detoxification following algal bloom	X				
Additional treatment of polluted water (mainly for the food industry)	X				
Maintenance of waterways and facilities	X				
Treatment of stored water if eutrophication (DWSS - drinking-water supply and sanitation)	X				
Additional treatment of eutrophication in water (DWSS)	X				
Additional treatment of water polluted by nitrates (DWSS)	X				
Additional treatment of water polluted by pesticides (DWSS)	X				
Mixed waters (DWSS)	X				
Restoration of treatment facilities following accidental pollution	X				
Restoration of wetlands and aquatic zones for recreational fishing	X				
Restocking for recreational fishing in fresh waters	X				
Management of oil spills	X				
Management of sediment contaminated by PCBs	X				
Relocation of shellfish farms		X			
Replacement of water resources to water livestock		X			
Purchase of spat		X			
Relocation of freshwater commercial fishing activities		X			
Replacement resources from reservoirs and dams		X			
Replacement resources from new abstractions		X			
Replacement resources (drinking water used by food industry)		X			
Creation of network interconnections (DWSS)		X			
Deeper wells and related treatments (DWSS)		X			
Replacement resources through desalination of seawater		X			
Replacement sources (tanks and bottles) following anthropogenic degradation		X			
Relocation of recreational activities to another, non-degraded site		X			
Rescue fishing when rivers run dry or following modification of hydraulic conditions in rivers		X			
Reinforced monitoring of water quality when thresholds are overrun (DWSS)			X	X	
Subsidies to change farming practices in abstraction supply zones (ASZ)			X		
Subsidies to change plant-protection practices by public or economic stakeholders in ASZs			X		
Incentives to change plant-protection practices by households in ASZs			X		
Protection of abstractions (land purchases outside of well-protection perimeters)			X		
Reinforced monitoring of water quality when thresholds are overrun (resources used by food industry)				X	
Administrative costs incurred for management of accidental pollution (DWSS)				X	
Administrative costs incurred by "green tides"				X	
Administrative costs incurred by oil spills				X	
Decisions to forbid harvesting and sale of seafood and freshwater products if contaminated				X	
Decisions on water use during dry periods and monitoring (central government)				X	
Reinforced monitoring of water quality when thresholds are overrun (recreation and consumption)				X	
Administrative costs incurred in managing PCB pollution				X	

Figure 36

a- b © C. Roussel - Onema

(a) and (b). Protection of a drinking-water abstraction.

Assessment of current expenditure for services and how it is funded

Current expenditure of services consists of operating expenses and depreciation. For each type of service, current expenditure and revenues must be assessed not including VAT and environmental fees, the latter being accounted for in the expenses of the various economic sectors.

The cost-recovery ratio is then calculated by comparing:

- expenses incurred by services (operating expenses and depreciation);
- revenues (billing volumes and operating subsidies).

Autonomous services that do not receive operating subsidies may produce a 100% cost-recovery rate.

For collective water and sanitation services (see Figure 37), it is also necessary to distinguish between subsidies financed by water prices, e.g. water-treatment fees collected by the Water agencies, and those financed by taxes, e.g. balancing subsidies.

In addition, the study must assess the costs incurred by the construction of facilities made necessary by resource degradation. It should be noted that the current expenditure in conjunction with the compensatory investments are already accounted for in the operating expenses of the service.

Figure 37

a- b © M. Carrouee - Onema

Cost-recovery analysis targets primarily public water and sanitation services.

The expenses of public sanitation services also include expenses for rainwater management, a responsibility of towns. This means that it is necessary to calculate the economic flows for rainwater management between service users and taxpayers.

Rainwater expenses
Description of economic flows between service users and taxpayers

Management of rainwater is the responsibility of towns and must be assumed by their budgets. In general, however, rainwater management is taken over by the collective sanitation service and booked in its subsidiary budget.

Local governments having a combined sewerage system must then contribute to recovery of the expenses booked in the sanitation-service subsidiary budget (for those having a subsidiary budget), on the basis of a percentage set by the local government, in compliance with ministerial instruction dated 12 December 1978. This contribution is booked to account 7 063 "contribution of local governments", an account created specifically for this purpose.
However, the amount booked to account 7 063 is rarely indicative of the actual costs incurred by rainwater management because local governments do not necessarily reimburse sanitation services in full for the outlays.

The difficulty for local governments having separate collection systems lies in identifying and distinguishing the expenses pertaining to rainwater management. These expenses must be booked in the municipal accounts and assumed by the general budget.

In the 2012 cost-recovery analysis using 2009 data, the cost for management of combined sewerage systems was estimated on the basis of the revenue listed in the subsidiary budgets (account 7 063 mentioned in the M49 accounting instructions), i.e. 192 million euros.

This amount corresponds to the minimum value reimbursed by local governments to sanitation services to cover the costs of rainwater management. This calculation serves to estimate the economic transfer between taxpayers and users of sanitation services.

Source: Cost-recovery analysis, 2009, Ernst and Young for IOWater.

a © M. Carrouee - Onema
b © O. Leroyer - Onema

Gutters serve to collect rainwater and catch basins retain excess water.
(a) Gutter. (b) Catch basin.

Assessment of the contributions of the economic sectors using the services

After assessing the outlays of services and how they are funded, it is necessary to calculate the contributions of the various economic sectors. This step in the analysis answers the question of "Who pays what" (see Table 19).

At this point, it is necessary to take into account:
- the contributions of the different categories of users to the funding of collective water and sanitation services;
- the contributions of the various economic sectors to funding of subsidies for water services, taking care to distinguish funding from taxes and funding via environmental fees;
- environmental and water-resource costs borne by the economic sectors.

Table 19 shows an example of the breakdown of the contributions from the various sectors to service funding.

The work consists of noting the total amounts (represented here by letters) of expenses, of subsidies and of the environmental costs borne by each category of user.

Tableau 19 *Example of a table summing up the cost-recovery data.*

	 Households	 Productive activities	 Industry	 Agriculture
Contribution to service funding, in euros	A	D	G	J
Contribution to funding of subsidies for services, in euros	B	E	H	K
Environmental and water-resource costs, in euros	C	F	I	L

Disproportionate costs – a special type of assessment

Introduction

The European water framework directive, voted in December 2000, requires that the Member States reach ambitious environmental objectives for all water bodies in all the major river basins (river-basin districts as per the WFD).

The directive set four essential objectives:
- no further deterioration of water resources;
- reaching good status or good potential of water bodies by 2015;
- reducing or eliminating pollution by priority substances;
- complete compliance with all standards in protected zones by 2015.

To reach these objectives in each river-basin district, it is necessary to characterise the pressures and impacts, run economic analysis of water uses (article 5), draft a water-management plan (article 13) and set up a programme of measures (article 11). In addition, participation by the public is mandatory (article 14).

Economic analysis plays a major role in WFD implementation. It serves as a decision-aid tool throughout the planning process because it can be used to:
- assess and contrast the economic value of water uses and the related issues;
- estimate the degree of cost recovery and the incentive value of price levels;
- determine the most cost-effective combinations of measures to achieve environmental objectives;
- **justify exemptions for deadlines and/or objectives on the basis of disproportionate cost.**

There are two types of exemptions for WFD requirements.

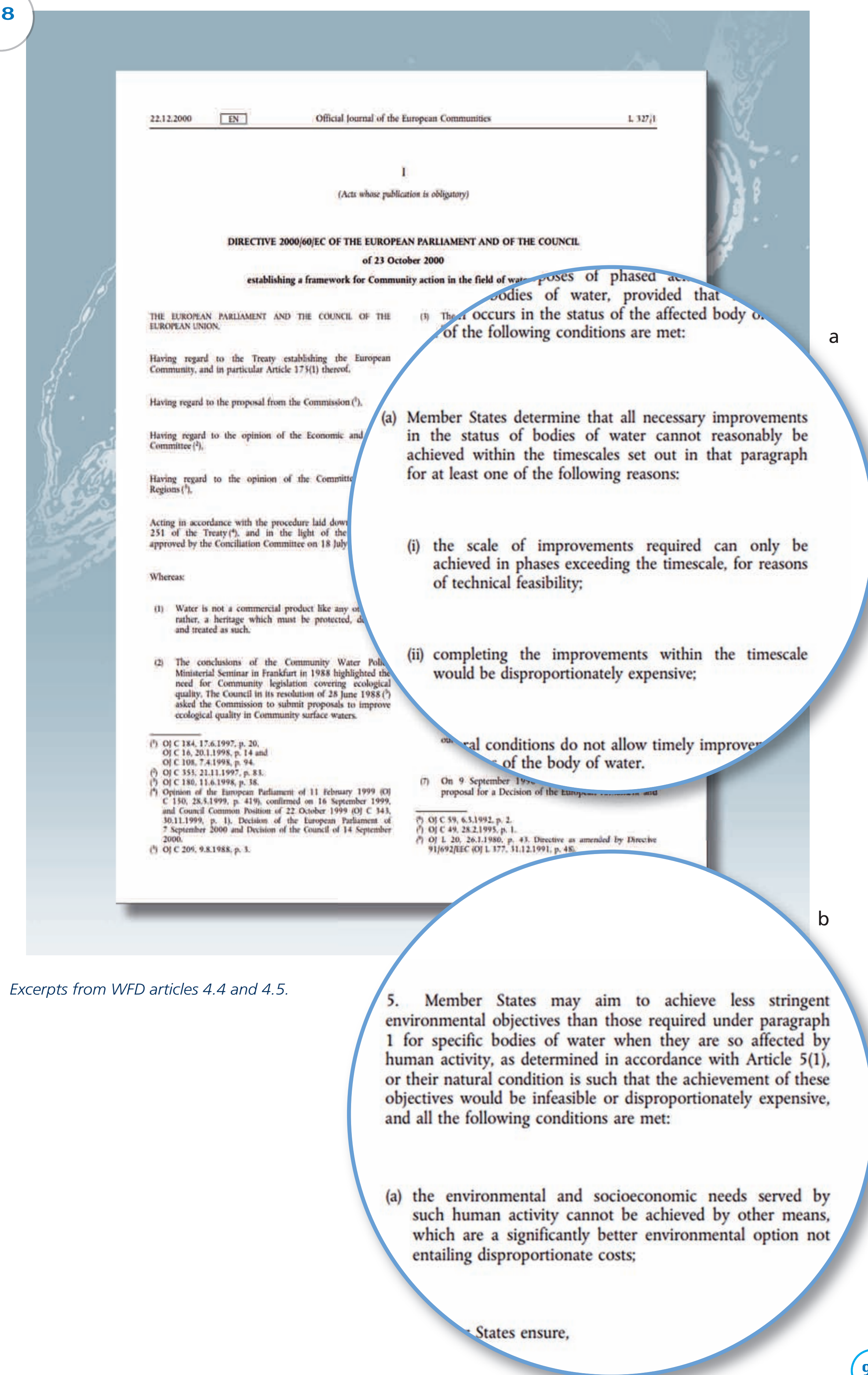
Exemptions for deadlines are mentioned in article 4.4 (see Figure 38a).
Reaching good status or good potential of water bodies may be postponed until 2021 or 2027 at the latest. This type of exemption must be justified using one of the three arguments below:
- for technical reasons, the necessary improvements can be made only in a series of steps running beyond the deadlines set for the programme;
- the cost of the necessary improvements within the set deadlines would be disproportionately expensive;
- the existing natural conditions make it impossible to carry out the improvements in the water bodies within the set deadlines.

Exemptions for objectives are mentioned in article 4.5 (see Figure 38b).

Similar to the above arguments, the WFD accepts that the Member States set less rigorous environmental objectives for certain water bodies that have been so modified by human activities or where the natural conditions are such that it would be impossible to reach the set objectives or the cost would be disproportionate even if spread over several WFD management cycles.

The concept of disproportionate cost can thus be used to justify exemptions in terms of both deadlines and the final status. It is therefore an important component in the formulation and planning of programmes of measures. In both France and the U.K., it was deemed better to strictly limit exemptions for objectives and to opt instead, whenever possible, for deadline exemptions.

Figure 38



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I

(Acts whose publication is obligatory)

DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 October 2000

establishing a framework for Community action in the field of water policy

a

... poses of phased ... bodies of water, provided that ... occurs in the status of the affected body ... of the following conditions are met:

(a) Member States determine that all necessary improvements in the status of bodies of water cannot reasonably be achieved within the timescales set out in that paragraph for at least one of the following reasons:

(i) the scale of improvements required can only be achieved in phases exceeding the timescale, for reasons of technical feasibility;

(ii) completing the improvements within the timescale would be disproportionately expensive;

... natural conditions do not allow timely improvement ... of the body of water.

b

5. Member States may aim to achieve less stringent environmental objectives than those required under paragraph 1 for specific bodies of water when they are so affected by human activity, as determined in accordance with Article 5(1), or their natural condition is such that the achievement of these objectives would be infeasible or disproportionately expensive, and all the following conditions are met:

(a) the environmental and socioeconomic needs served by such human activity cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs;

... States ensure,

Excerpts from WFD articles 4.4 and 4.5.

Basic measures and supplementary measures

It is important to note that the WFD, article 11, stipulates that programmes of measures shall include:

- basic measures, i.e. those pertaining to existing national and European legislation, notably concerning the directives for nitrates, urban wastewater treatment, bathing, shellfish and untreated water intended for drinking water;
- supplementary measures that must be implemented to achieve good status if the basic measures are found to be insufficient.

The basic measures are the minimum requirements, which explains why exemptions may be granted exclusively for supplementary measures. However, the total cost of all the measures will be taken into account when analysing the economic impact of programmes of measures on the stakeholders who must pay for them.

However, beyond those few guidelines, the WFD did not indicate precisely just what the concept of disproportionate costs means and covers. The required methods to justify exemptions are not explicitly laid out. A number of work groups, notably the *WATECO* (WATer ECOnomics) group, subsequently produced guidelines to facilitate day-to-day WFD implementation.

A document was drafted on how to justify exemptions. It explains that:

- judgement on the disproportionate cost of a measure is a political decision based on economic information;
- the disproportion threshold is not situated where costs exceed the quantifiable benefits;
- the assessment of costs and benefits must include quantitative, but also qualitative elements;
- the proportion by which costs exceed benefits must be both ascertainable and relatively certain, and decision-makers may take into account the ability to pay of the stakeholders concerned by the measures.

However, the document does not go beyond the above recommendations and is relatively brief.

Each Member State was thus obliged to make an effort to better understand and more precisely define the notion of disproportionate cost. What exactly does it mean and what is its scope? Which economic methods and analyses must be used to show that a set of measures for a water body or group of water bodies would lead to disproportionate costs? For example, which methods have been implemented in France and in the U.K.? To what extent do the methods employed differ from one country to the other?

In France, national guidelines with local adaptations

The national method to justify exemptions for economic reasons

The WFD 2006/17 ministerial instructions on the preparation, contents and scope of programmes of measures propose a method to justify extended deadlines and exemptions for objectives. This method was subsequently developed and presented in greater detail in the methods guide on justifying WFD exemptions, published in October 2009.

As a first step, it is necessary to determine the **relevant scale** for analyses in view of justifying exemptions. Even though WFD environmental objectives are formulated for water bodies, the correct scale for an analysis depends on the problem at hand.

The cost-benefit analysis should be carried out on the appropriate hydrographic scale to take into account, among other aspects, the fact that costs incurred for one water body may produce benefits in a downstream water body. Analysis can therefore be carried out on the level of:

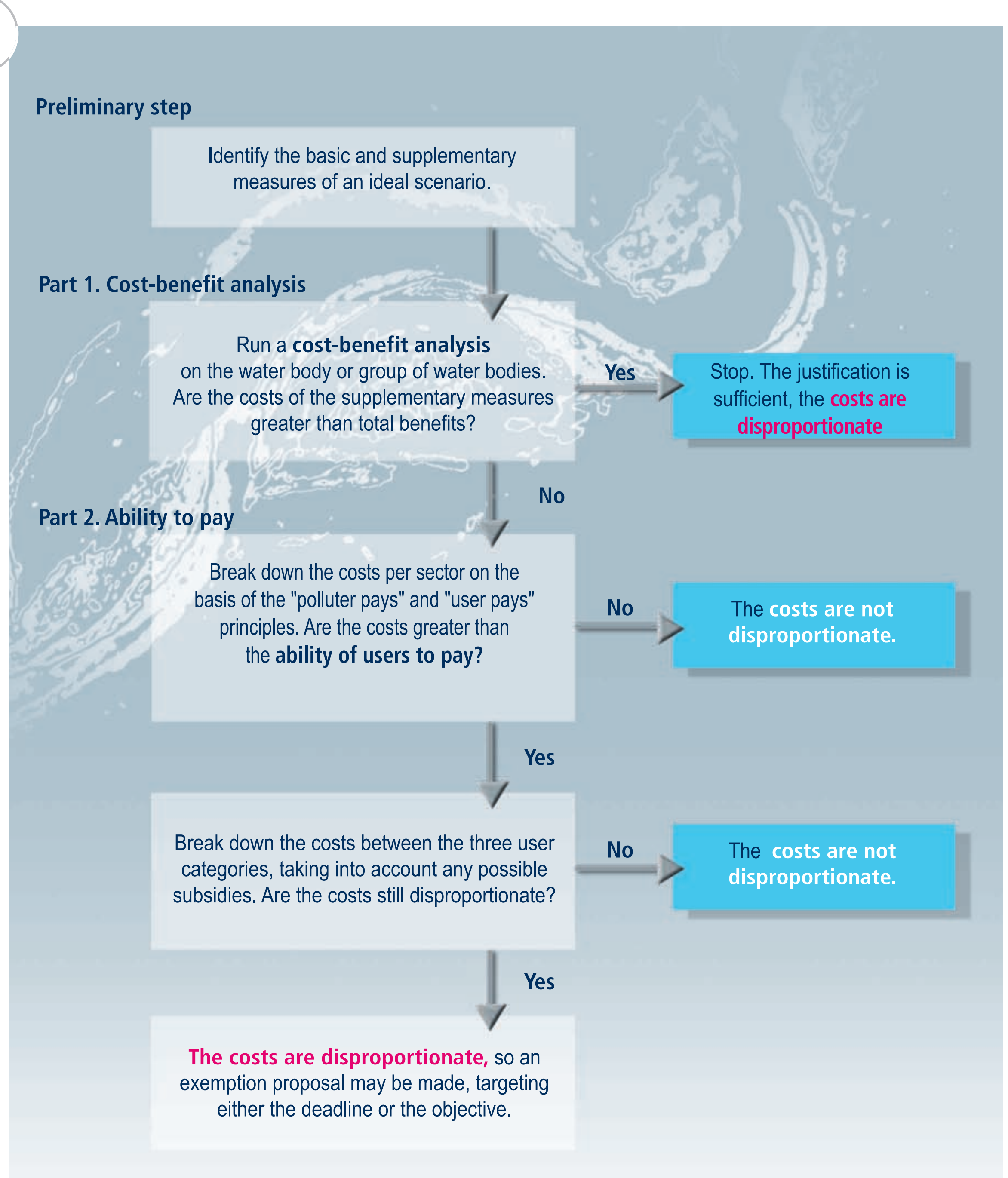
- a water body when good status is not reached because of pollution discharged to the water body or because of hydrological modifications caused by an installation;
- a group of water bodies making up a river basin when the detected problem concerns the entire basin.

As a second step, the method suggests examining whether any **technical reasons and the natural conditions** do not, in and of themselves, justify extending the deadline after 2015. It is only when the objectives for 2015 appear technically feasible taking into account the natural conditions that an extension of the deadline for disproportionate cost becomes a possibility. It follows that **analysis to provide economic justification for an extension should be carried out only after having tested the technical feasibility and studied the natural conditions.**

Once the appropriate scale has been selected and the technical feasibility / natural conditions have been confirmed, the procedure to justify an exemption for economic reasons may be launched, as shown in Figure 39.

The method consists of identifying the basic and supplementary measures of an ideal scenario in order to determine the costs, where an ideal scenario is one in which good status of the water body (or group of water bodies) is reached by 2015.

Figure 39



Flow chart to determine whether an exemption based on disproportionate cost is justified in France.
Source: Maria Salvetti based on the WFD 2006/17 ministerial instructions concerning the preparation, contents and scope of programmes of measures.

■ Cost-benefit analysis

The first part of the method consists of a cost-benefit analysis (CBA) on the water body or group of water bodies and addressing the transition from the current status to good status in 2015.

It was decided on the European level that the cost-benefit analyses would take into account only the costs of the supplementary measures. This is because exemptions are available only for the supplementary measures, i.e. those not related to the implementation of the other directives mentioned above. However, for practical reasons, it was decided to calculate the potential benefits of both the basic and supplementary measures. It should be noted that this simplification results in an overestimation of the benefits with respect to the costs (because the latter are calculated only for the supplementary measures).

If the cost of the supplementary measures is greater than the potential benefits, it is considered disproportionate. On the other hand, if the benefits are greater than the cost, it is necessary to proceed with the second part of the analysis.

Costs, benefits and present value

CBA takes into account not only the investment costs, but also the recurring costs (maintenance, operation) of the supplementary measures foreseen in the ideal scenario of the programme of measures. Costs are calculated starting in 2010 whereas benefits are calculated only from 2015 onward.

The main difficulty in estimating costs lies in sizing the measures and in translating that information into cost data. This is because it is fairly easy to calculate the unit cost of a measure, however it is more difficult to quantify the number of metres of river that must be renaturalised or the pollution that must be treated to reach good status, and consequently to determine the total cost of a measure given the uncertainty concerning the probable impacts of the considered measures. It is therefore necessary to deal with the uncertainty and propose sizing solutions taking care to explain the selected assumptions.

The benefits assessed and taken into account include:

- market benefits, i.e. those having a market value that can be estimated on the basis of existing economic circuits. These may include economic profits made by certain local activities, e.g. increased added value for recreational activities, or avoided costs, e.g. lower treatment costs for drinking water or reduced water consumption for industries, etc. These benefits may be quantified;
- non-market benefits, i.e. those not having a market value that can be estimated on the basis of existing economic circuits. Examples may be the satisfaction of consumers following an improvement in water quality or the interest shown by inhabitants (whether or not consumers) for an improvement in the natural heritage (more fish species, improvements for bathing and in biodiversity, enhanced ecosystems, etc.). These benefits are more difficult to assess and are often estimated qualitatively. They are, however, of the utmost importance for environmental assessments.

Other aspects of more or less importance on the local level may also be examined, e.g. the impacts on health, flooding, etc.

In the absence of consensus among the concerned local stakeholders (owners of installations and users) on the estimates for these values, more precise assessments of the uses (local surveys) and the potential benefits may be carried out.

The estimated costs and benefits are then discounted at a rate of 4% per year over a 30-year period. These recommendations concerning the discount rate and duration were set by the Prime minister on the basis of a report drafted by the General planning commission.

Present value and discount rate

The General planning commission defines present value as "*the mathematical operation used to compare economic values spread over long periods. The purpose is to convert the future value of an item or a future expense to its present value. The discount rate is the conversion percentage between the future and the present. It represents the value of time for a company or a local government and may even be called the price of time*". Calculation of the present value serves to convert future expenses and benefits so that they may be taken into account in the analysis. The decision concerning the level of the discount rate is in fact a decision assigning a relative value to the future compared to current issues and values. The higher the percentage, the greater the preference for the present and the less importance accorded to the future.

Practically speaking, the calculation consists of applying a coefficient to reduce the value of future costs and benefits compared to present values. The level of the discount rate influences the results of a cost-benefit analysis.

The General planning commission has recommended that there be a single public discount rate and that it be used for all public investment projects in all sectors of activity. In 2005, the commission proposed a revision to the rate which is now 4% in France for 30-year periods. For comparison purposes, the discount rate is 4% in Sweden and 3.5% in the U.K.

Leeway in appraising the cost-benefit ratio

Given the uncertainty affecting CBA calculations, the Ecology ministry has recommended applying a 20% margin when comparing costs and benefits. For example, the cost-benefit ratio must be less than 0.8 before drawing the conclusion that the cost of supplementary measures is disproportionate to the potential total benefits. Otherwise, if the total benefits represent 80% or more of the costs for the supplementary measures, it is necessary to proceed with an analysis of the ability of stakeholders to pay.

A tool to assess benefits

In order to ensure consistency and facilitate the vast amount of work required for the many water bodies likely to receive an economic exemption, the department for economic studies and environmental evaluation at the Ecology ministry developed a spreadsheet tool to accelerate execution of large numbers of cost-benefit analyses. The tool uses a database containing unit costs and unit willingness-to-pay data in a predetermined list. This makes it possible to calculate the key ratios of the cost-benefit analysis rapidly (http://www.economie.eaufrance.fr/spip.php?rubrique65&id_mot=78).

The tool also facilitates the calculation of benefits through the use of average "unit guide values" based on data drawn from approximately 40 studies on the topic in France, for example the value of a day of fishing, the purification value of a hectare of wetland, the average annual value of bathing in a river, etc. The result is, in essence, an intermediate approach between a rough qualitative study and an in-depth on-site study. The figures produced should not be seen as unquestionable values, but rather as an initial step in the assessment process. The tool can also calculate totals for discounted costs and benefits using the discount rate proposed by the General planning commission.

A user's guide is also provided with the tool (see Figure 40).

Figure 40

Cover of the guide on benefit assessment drafted by the department for economic studies and environmental evaluation at the Ecology ministry.

■ Analysis of the ability to pay by the categories of water users

Breakdown of costs per economic sector on the basis of the "polluter pays" principle

The second part of the method consists of comparing the financial capacities of water users to the total costs required to reach good status. To that end, the costs of measures are broken down and assigned to the various economic sectors on the basis of the polluter-pays and user-pays (i.e. the beneficiaries) principles. All costs are distributed among the polluters in the given area (water body, group of water bodies, sub-basin).

When a polluter does not exist or cannot be identified, the costs are assigned to the local beneficiaries. For measures addressing hydromorphological and rainwater issues, if a polluter and a beneficiary cannot be identified, the costs are assigned uniformly to the taxpayers in the given area.

The polluters and beneficiaries are divided into three main economic sectors as stipulated by the WFD (i.e. agriculture, households and industry), to which taxpayers must be added, who pay for measures funded via local or national taxes. All costs are fully transferred to the three categories of stakeholders, without taking into account at this point in the analysis any subsidies or alternative funding (Water agencies, departmental councils, State, etc.).

The total costs of measures (both basic and supplementary) are divided among the categories of users and compared to a set of financial indicators specific to each category (added value, taxable income, water prices, etc.) in order to determine whether the costs are disproportionate. Thresholds must be set for each of the selected indicators.

Indicators for each category of water user

Sheet number 5 in the WFD 2006/17 ministerial instructions suggested a number of indicators for each category of water user. Below is the list.

Households

- Cost of techniques commonly implemented by local governments of the same size.
- Cost of specific work required to achieve objectives. This cost must be compared to the cost of the investment programme carried out in past years or planned by the local government to continue its development and the creation of facilities.
- Price of water and observed average prices.
- Average income of households compared to observed average incomes.

Industry

- Cost of the best technologies available and commonly used by the industrial sector in question.
- Cost of procedures and systems going beyond the basic measures.

Agriculture

- Cost of the best environmental practices commonly used by the agricultural sector in question.
- Cost of procedures and systems going beyond the basic measures.

In the methods guide mentioned above, it is advised to determine whether costs for farmers and industry are disproportionate by looking at the potential impact of the measures on their gross operating margins. However, the applicable thresholds for gross operating margins must be set for each river basin. For households, the guide recommends determining whether costs are disproportionate by examining the potential impact of the measures on water prices. If the measures are projected to increase water bills to a level between 2% and 3% of taxable income of the households (based on INSÉÉ statistical data), the costs may be considered disproportionate prior to taking into account alternative funding sources.

If this step determines that the costs are disproportionate, it is necessary to go on to the last step in the analysis, which again consists of distributing the costs among the user categories, but taking into account any possible subsidies and alternative funding sources.

If, on the other hand, the costs are not considered disproportionate, the measures are deemed affordable by the local stakeholders, though it may be advisable to have the Water agencies or other funding organisations intervene to reduce somewhat the impact of the measures on the concerned sectors.

The ability to pay and alternative funding sources

This phase takes any alternative funding sources into account in the analysis in order to reduce the financial impact on the various sectors and to determine whether the available subsidies are sufficient to make the costs acceptable.

Once the alternative funding sources have been presented in detail, all costs are divided among the three categories of stakeholders taking into account, i.e. subtracting, the available subsidies (Water agencies, departmental and regional councils, EU funds, etc.). The analysis then proceeds as in the previous step for each of the three categories of users, using the same ratios and the same reference values.
If the costs are still disproportionate in spite of the subsidies, it is necessary to propose extensions of deadlines. If in 2027 the distributed costs taking into account the subsidies were still disproportionate, it would then be necessary to select less rigorous environmental objectives for the concerned water bodies (or at least for the parameters in question).

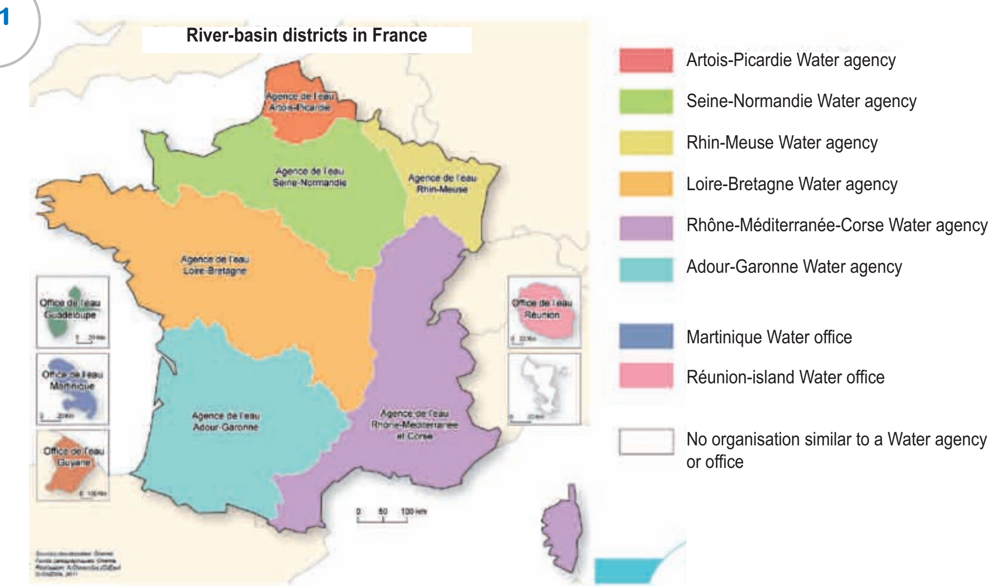
Local adaptations of the national guidelines

The Water agencies had to justify extended deadlines and exemptions to objectives for a certain number of water bodies in their respective basins (see Figure 41). Tables 20 and 21 present a rapid quantitative summary of the various objectives targeted for water bodies in France.

Tableau 20 *Distribution of water bodies in the river-basin districts (source: Water agencies, regional environmental directorates, BRGM, Onema, IOWater, Water offices, Ecology ministry (2011), Processing by SOeS, 2011).*

River-basin district	Total water bodies	Total surface water bodies	Including heavily modified water bodies	Total groundwater bodies
Seine Normandie	1 803	1 750	120	53
Artois Picardie	98	80	28	18
Adour Garonne	2 913	2 808	174	105
Rhin Meuse	669	643	88	26
Loire Bretagne	2 293	2 150	227	143
Rhône Méditerranée Corse	3 195	3 006	232	189
Guadeloupe	64	58	0	6
Martinique	50	44	2	6
Guyane	956	944	1	12
Réunion	56	40	1	17
Mayotte		46	2	6
TOTAL	12 150	11 569	875	581

Figure 41



Water agencies and offices in France.

Tableau 21 *Number of exemptions due to disproportionate costs compared to other exemptions. (Source: http://www.rapportage.eaufrance.fr/dce/2010/valorisation/tableaux)*

	Articles 4.4 and 4.5 Technical feasibility	Articles 4.4 and 4.5 Disproportionate costs	Articles 4.4 Natural conditions
Exemptions due to the ecological status/potential			
Moderate ecological status in 2009	2 324	808	1 006
Poor ecological status in 2009	703	446	337
Bad ecological status in 2009	167	79	127
Ecological status unknown in 2009 (natural water bodies)	3	0	6
Moderate ecological potential in 2009	103	25	31
Poor ecological potential in 2009	89	50	54
Bad ecological potential in 2009	112	38	41
Ecological potential unknown in 2009 (artificial and heavily modified water bodies)	51	6	45
TOTAL	3 552	1 452	1 647
Exemptions due to the chemical status of surface waters			
Bad chemical status in 2009 (natural water bodies)	1 521	435	107
Chemical status unknown in 2009 (natural water bodies)	484	366	73
Bad chemical status in 2009 (artificial and heavily modified water bodies)	178	39	44
Chemical status unknown in 2009 (artificial and heavily modified water bodies)	43	3	35
TOTAL	2225	843	259
Exemptions due to the chemical status of groundwater			
Bad chemical status in 2009	49	31	153
Chemical status unknown in 2009	0	0	0
TOTAL	49	31	153
Exemptions due to the quantitative status of groundwater			
Bad quantitative status in 2009	3	3	5
Quantitative status unknown in 2009	0	0	0
TOTAL	3	3	5

To justify these exemptions, the Water agencies started with the national method presented in the WFD 2006/17 ministerial instructions and the methods guide on justifying exemptions, and adapted them to their local context and needs. Certain elements of the local adaptations of the national method are presented in detail below.

■ Order of analyses on cost-benefits and ability to pay

The national method recommends starting with the cost-benefit analysis and then proceeding, if necessary, with an analysis of the ability of stakeholders to pay.

However, it has been noted that the Loire-Bretagne, Rhin-Meuse and Seine-Normandie Water agencies reversed the order of the two types of analysis. In these three river basins, the analysis of the ability to pay was carried out first as an initial filter to limit subsequent analysis to the water bodies effectively likely to receive an extended deadline due to disproportionate cost. Then, cost-benefit analyses were run on the resulting geographic sectors in order to terminate the work.

To illustrate this point, the box on the next page presents the economic justification for an extended deadline in the southern Morbihan region (Loire-Bretagne basin).

■ Presentation of benefits in cost-benefit analyses

In carrying out cost-benefit analyses, the national method recommends taking into account both market and non-market benefits. All Water agencies followed this advice.

However, the Rhin-Meuse Water agency decided to characterise the benefits expected from the implementation of the measures using different terminology in a different presentation. In its analysis, the agency distinguished between benefits related to use of water and aquatic environments, and non-use benefits.

Use benefits include boating recreation, fishing, walks and reduced treatment costs.

Non-use benefits take into account the bequest value and the enhanced value of ecosystems.

In addition, it should be noted that the benefit-transfer method was used to assess certain benefits.

The tables shown in the Annex recapitulate the cost-benefit analyses carried out in the Rhin-Meuse basin and propose a presentation of the costs and benefits taken into account.

Justification of deadline extensions in the southern Morbihan region

■ **Part 0. Presentation of the procedure**

The first step consisted of an analysis, covering the entire basin, on the ability to pay. It was carried out as an initial filter to limit subsequent analysis to the water bodies effectively likely to receive an extension due to disproportionate cost. Then in the second step, cost-benefit analyses were run on the geographic sectors of the river basin in order to finish the assessment work.

■ **Part 1 (a). Results of the initial filter (ability-to-pay analysis)**

The analysis of the ability to pay in the Loire-Bretagne basin produced two major conclusions:

- the first, concerning treatment of urban wastewater. Sizing of the programmes of measures is consistent with the objectives. The degradation targeted by the work (organic and oxydisable matter, or macropollutants not including nitrates and phosphorous) should be sufficiently eliminated to meet WFD objectives by 2015 and, with some exceptions, exemptions may not be justified by disproportionate costs;
- the second, concerning nonpoint-source pollution from farms and river morphology. The programme of measures required to attain good status by 2015 is more ambitious than the currently planned policies. The management committees for certain projects may be insufficiently robust or reticent to launch the projects. In addition, technical lead times for the implementation of projects and the inertia of the environment mean that the time required to reach the objectives would be very long.

Under these conditions and in compliance with the decisions of the planning commission, extensions of deadlines and even reduced objectives have been accepted for water bodies affected by certain types of degradation (nitrates, particulate phosphorous, river morphology) and requiring the most work to achieve good status.

■ **Part 1 (b). Application to the Côtier Breton Nord Manche sector**

The geographic commission is broken down into four sectors, namely the Vilaine River basin, the Côtier Breton Nord Manche river basins (including both the Couesnon and Douron basins), the coastal basins in the Finistère department (including the Laïta basin) and the Côtier Breton Sud Morbihan basins (including the Scorff basin to the Golfe du Morbihan). The total amounts for the territory of the commission mask major local differences caused notably by poor quality criteria in certain basins with respect to good status. The highest investment and operating costs for supplementary measures are noted in the Vilaine River basin. The Côtier Breton Sud Morbihan sector, the smallest, has the lowest costs. The supplementary measures deal primarily with nonpoint-source pollution and river morphology. The investment and operating costs for supplementary measures target essentially rural areas (local rural development).

Morphology is the main disqualifying parameter in terms of the numbers of water bodies affected. For very small rivers, given the lack of knowledge on their physical-chemical situation, morphology is virtually the only disqualifying characteristic. **Nitrates** affect all categories of water bodies. The **trophic nature** of lakes is illustrated by the importance of phosphorous as a parameter to justify extensions of deadlines. The programme also includes measures on **micropolluants** in estuarine and coastal waters.

Implementation of the supplementary measures, the high level of implication on the part of the funding parties and the often positive changes in water quality in the areas managed by the geographic commission over the past few years have made it possible to upgrade the objectives for good status of water bodies.

The supplementary measures would appear to produce significant results in rivers, however other types of water bodies are less reactive. This may justify extended deadlines for lakes, coastal and transitional waters, and groundwater. Finally, it should be noted that in the area managed by the geographic commission, there are major benefits arising from seashore tourism, as well as from the supply of drinking water and the development of shellfish farming.

The Côtier Breton Sud Morbihan sector in particular stands out for the supplementary measures to manage micropollutants, phosphorous and macropollutants.

During the first analysis (ability to pay), this observation resulted in extended deadlines on the basis of disproportionate costs.

It should be noted that this sector is characterised by highly divergent problems which may cause difficulties in implementing a consistent and uniform cost-benefit analysis over the sector as a whole.

Finally, the seashore and tourism in the area managed by the geographic commission suggest that there are also significant environmental benefits. These elements justify further analysis in the attempt to determine whether costs are effectively disproportionate (see Part 2).

The results of the first filter (ability to pay) indicate that of 61 rivers, 21 were granted extended deadlines on the basis of disproportionate costs. Of four lakes, 1 was granted an extended deadline on the basis of disproportionate costs. No extensions were granted for groundwater and coastal waters . Cost-benefit analysis must be carried out on the rivers and lakes to confirm these decisions.

■ **Part 2 (a). Cost-benefit analysis**

In terms of the method employed, in order to avoid double counts of benefits and remain consistent with the analysis of the programme of measures in each sector, the CBAs were initially carried out on each geographic sector, distinguishing between the surface water bodies (rivers, lakes, coastal waters) and groundwater.

When the overall analysis of each sector did not justify exemptions based on disproportionate cost, **analyses on each type of issue** (morphology, quantitative aspects, eutrophication, etc.) were carried out, again distinguishing the types of water body (lakes, rivers, etc.) in the sector. When the necessary data was available, **analyses on sub-sectors** (zones for work to achieve good status) were carried out. Finally, in the cases where the above analyses were insufficient, additional analyses were run on water bodies.

■ **Part 2 (b). Application to the Côtier Breton Nord Manche sector**

The CBA run on the entire geographic sector did not produce relevant results given the very divergent issues at hand in the sector.

In light of the types of measures and their distribution in the sector, three types of CBA are proposed:

- a cost-benefit analysis on lakes in view of managing the phosphorous problem;
- a cost-benefit analysis on morphology issues (on the entire sector and for each water body).

Lakes were the topic of an additional CBA on the issues surrounding phosphorous. For each lake, the costs of restoration measures and the value of benefits were distinguished. The CBA on the lakes, in particular the Moulin Neuf and Saint-Michel lakes, produced a ratio of 0.6, i.e. a largely negative value confirming the initial deadline-extension decision based on disproportionate costs for these water bodies.

The second CBA addressed **morphology issues as well as micropollutants and macropollutants.** The result was a ratio of less than 0.8 for the water bodies taken as a whole. Additional analysis on each water body was proposed to fill out the results. The results of the additional analysis were highly divergent, depending on the water body.

Type of cost-benefit analysis implemented

The CBA on the entire sector compared the measures for the sector as a whole with the benefits expected from good status. The CBAs on individual water bodies compared the cost of measures addressing morphology issues with the benefits expected from the measures.

The CBA on lakes compared the set of measures addressing phosphorous issues with the benefits expected from good status.

Concerning the **results of the second filter (CBA),** the analyses on specific issues and categories of water body confirmed the disproportionate cost of measures for most of the water bodies initially selected for extended deadlines. Nine water bodies were put back on track for 2015 (in spite of the CBAs) thanks to the Grenelle environmental agreements. Seven water bodies subsequently lost their extensions on the basis of disproportionate cost, but nonetheless continued to benefit from extended deadlines for other reasons.

Source: Loire-Bretagne Water agency.

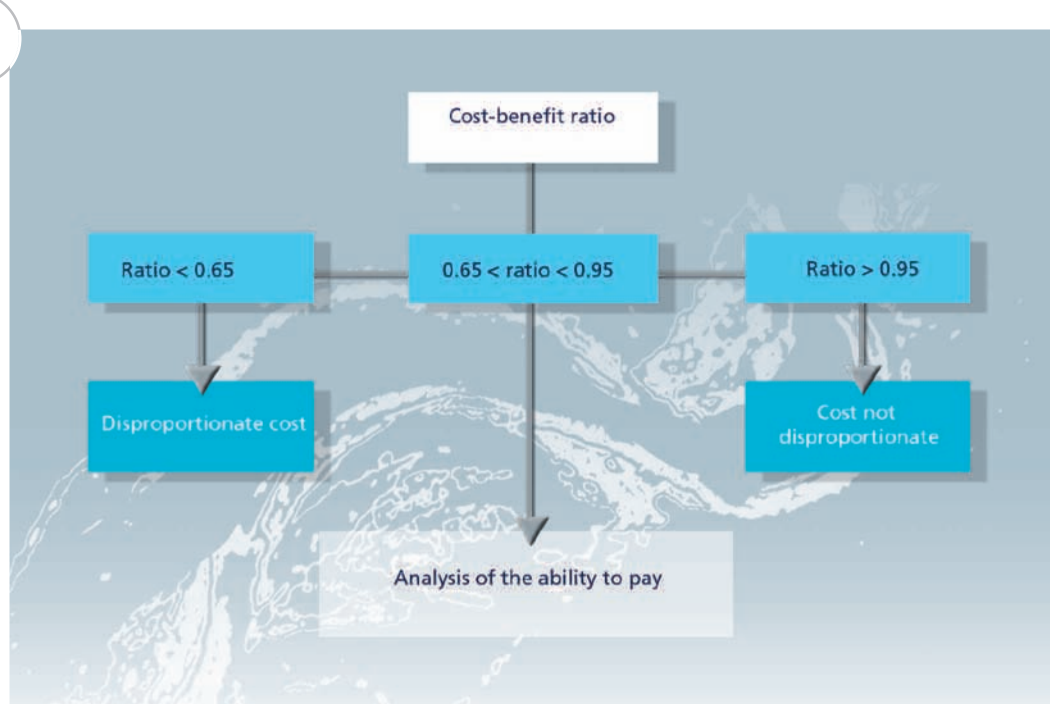
■ Cost-benefit ratio and disproportionate costs

The cost-benefit ratio produced by the CBAs is used to determine whether the costs of measures are disproportionate. Given the uncertainty affecting CBA calculations, the Ecology ministry has recommended applying a 20% margin when comparing costs and benefits. For example, the cost-benefit ratio must be less than 0.8 before drawing the conclusion that the cost of supplementary measures is disproportionate with respect to the potential total benefits.

The Rhône-Méditerranée-Corse water agency refined this approach by testing a method using different value ranges. Costs are considered disproportionate if the cost-benefit ratio is less than 0.65. However, sensitivity tests are carried out on all values between 0.5 and 0.8. Costs are not considered disproportionate if the cost-benefit ratio is greater than 0.95. In this case, sensitivity tests are carried out on all values between 0.8 and 1.1.

If the cost-benefit ratio is between 0.65 and 0.95, analysis of the ability to pay is undertaken. Figure 42 illustrates this method.

Figure 42



Analysis method for cost-benefit ratios, version 1.
Source: Rhône-Méditerranée-Corse Water agency.

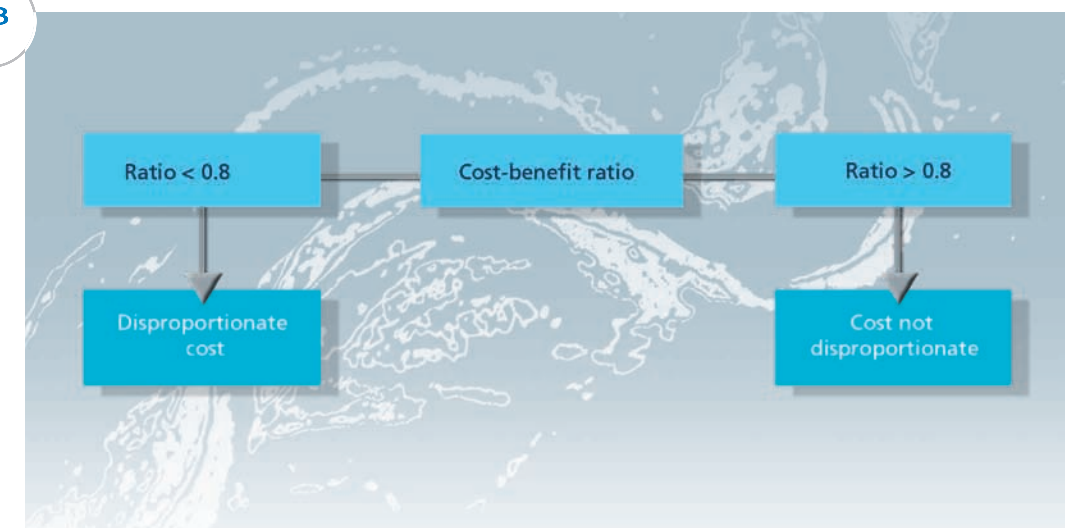
A large part of the work consisted of setting the threshold values of the cost-benefit ratio within which an analysis on the ability to pay must be carried out.

The decision on these values in effect determines a cost level considered acceptable whatever the expected benefits. A number of tests on costs (ranging from 1 to 15 million euros) showed that, even though the level significantly impacts the number of sub-basins concerned (approximately 40 to 80), it has little impact on the number of water bodies likely to benefit from an exemption (approximately 400 to 500). In addition, it has very little impact on the total costs likely to affect subsequent management plans (600 million to 1 billion euros).

Following discussions, it was decided to select a high threshold in order to ensure a degree of flexibility for negotiations with stakeholders. For this reason, a threshold of 10 million euros was selected. Under this threshold, costs are considered acceptable given the economic indicators and the different levels of cost analysis. This means that when costs exceed 10 million euros, an analysis on the ability to pay is required before it may be concluded that the cost of a programme of measures is disproportionate.
It is on the basis of this threshold (10 million euros) that the threshold values for cost-benefit ratios were set.

However, it is interesting to note that after running tests on the method using value ranges (0.65 to 0.95) and on the method using the pivot value recommended by the Ecology ministry (0.8), no notable differences were observed in the conclusions of the cost-benefit analyses (see Figure 43). It was therefore decided to opt for the method using the pivot value in order to determine whether costs are disproportionate.

Figure 43



Analysis method for cost-benefit ratios, version 2.
Source: Rhône-Méditerranée-Corse Water agency.

■ Selection of key indicators and threshold values for ability-to-pay analysis

The second part of the analysis on disproportionate costs consists of comparing the financial capacities of water users to the total costs of the measures required to reach good status. The total costs of measures (both basic and supplementary) are divided among the categories of users and compared to a set of financial indicators specific to each category (added value, taxable income, water prices, etc.) in order to determine whether the costs are disproportionate. Thresholds must be set for each of the selected indicators.

The indicators, threshold values and assessment methods for the ability to pay developed by the Rhin-Meuse Water agency to determine whether costs are disproportionate constitute an original approach presented in Table 22.

Tableau 22 *The indicators selected by the Rhin-Meuse Water agency (Source: Rhin-Meuse Water agency).*

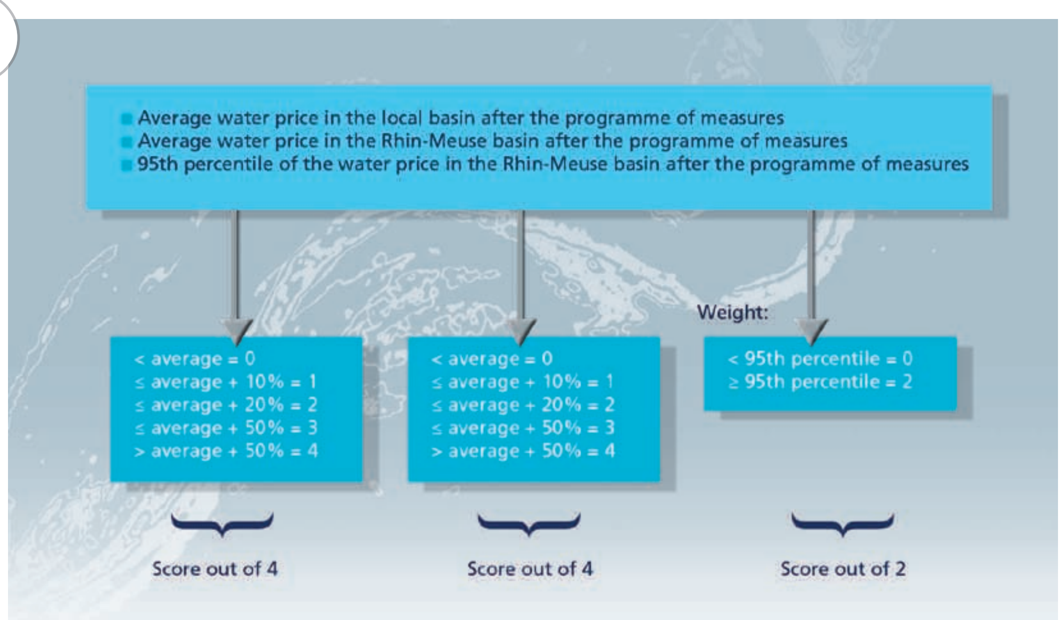
Field of application for measures	Economic indicators
Sanitation	Sanitation prices Percentage of household income spent on sanitation
Industry Main facilities, facilities not including GEREP (polluting emissions) and crafts/trade companies	Added value Gross operating margin Cash flow Annual investment Profit rate
Crafts/trade companies	Sales Added value
Agriculture	Added value Gross operating margin EBIT Cash flow
Hydromorphology	Local taxes (housing tax, property tax)

Using these indicators, threshold values were set to determine whether the costs of measures are disproportionate.

Taking the "price of water" indicator as an example, water prices before and after implementation of the programme of measures are compared. To avoid taking outliers into consideration, the comparison uses the 95th percentile of the average water price in the Rhin-Meuse basin, which excludes the 5% highest prices.

Depending on the differential between the "price of water" indicators, a score is assigned. For example, if the new water price exceeds by over 50% the average in the local river basin in which the water body is located, a score of four points is given, as indicated in Figure 44.

Figure 44

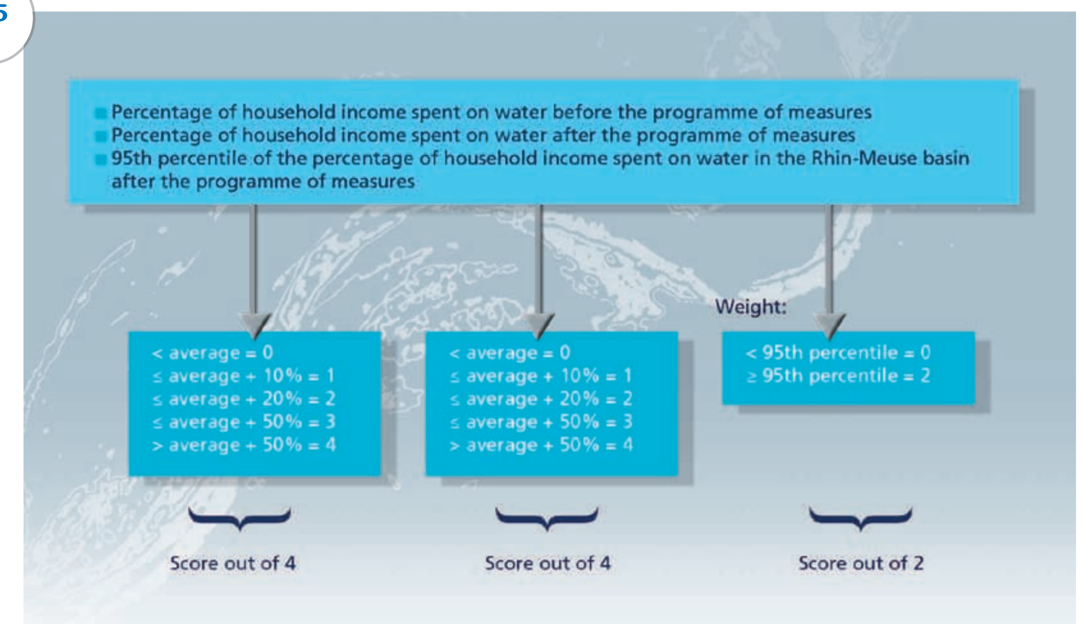


Threshold values for the "price of water" indicator.
Source: Rhin-Meuse Water agency).

For the "percentage of household income spent on water" indicator, the method is the same. The "percentage of household income spent on water" before and after the programme of measures is compared. To avoid taking outliers into consideration, the comparison uses the 95th percentile of the average percentage in the Rhin-Meuse basin, which excludes the 5% highest percentages.

A different weight is assigned to the indicator, depending on how it compares with the reference 95th percentile. For example, if the new percentage is less than 120% of the average in the local river basin, a score of two points is given, as indicated in Figure 45.

Figure 45



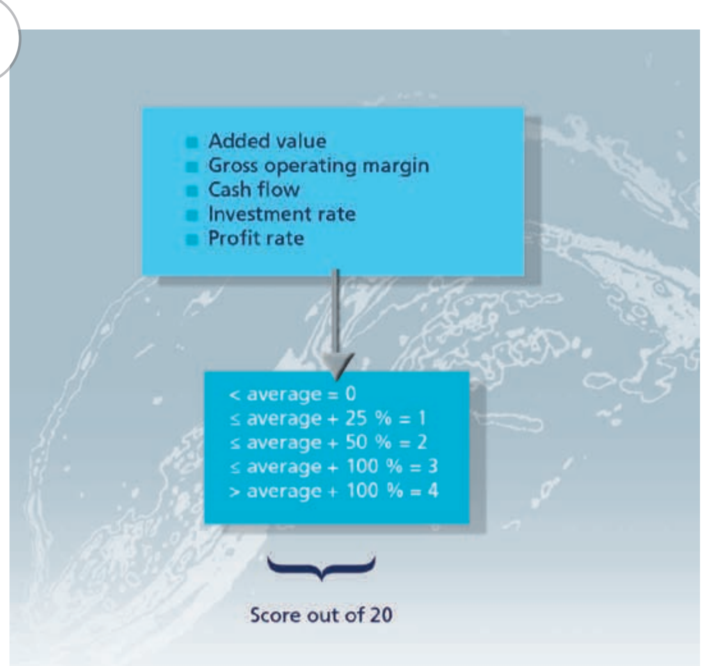
Threshold values for the "percentage of household income spent on water" indicator.
Source: Rhin-Meuse Water agency).

Calculation of the indicators for the price of water and the percentage of household income spent on water results in a maximum score of 20 points.

Following the Rhin-Meuse RBMP commission meeting on 15 June 2007, it was decided that when a water body receives a score of 12 or more, the cost of the programme of measures for that water body may be disproportionate.

For the five industrial indicators, the local value for each indicator is compared with the average value of that indicator for the entire Rhin-Meuse basin. Zero to four points are attributed depending on the degree to which the average is exceeded. Practically speaking, this system of points indicates the deviation from the mean (average). Figure 46 shows how points are attributed for each indicator.

Figure 46



Scoring system for the industrial indicators.
Source: Rhin-Meuse Water agency).

Calculation of the indicators for added value, gross operating margin, cash flow, investment rate and profit rate results in a maximum score of 20 points. Following the Rhin-Meuse RBMP commission meeting on 15 June 2007, it was decided that when a water body receives a score of 12 or more, the cost of the programme of measures for that water body may be disproportionate.

For crafts/trade companies, the maximum score for the two indicators is eight points. If a water body receives a score of 5 or more, the cost of the programme of measures for that water body may be disproportionate.

For each agricultural indicator, the threshold was set at 3%.

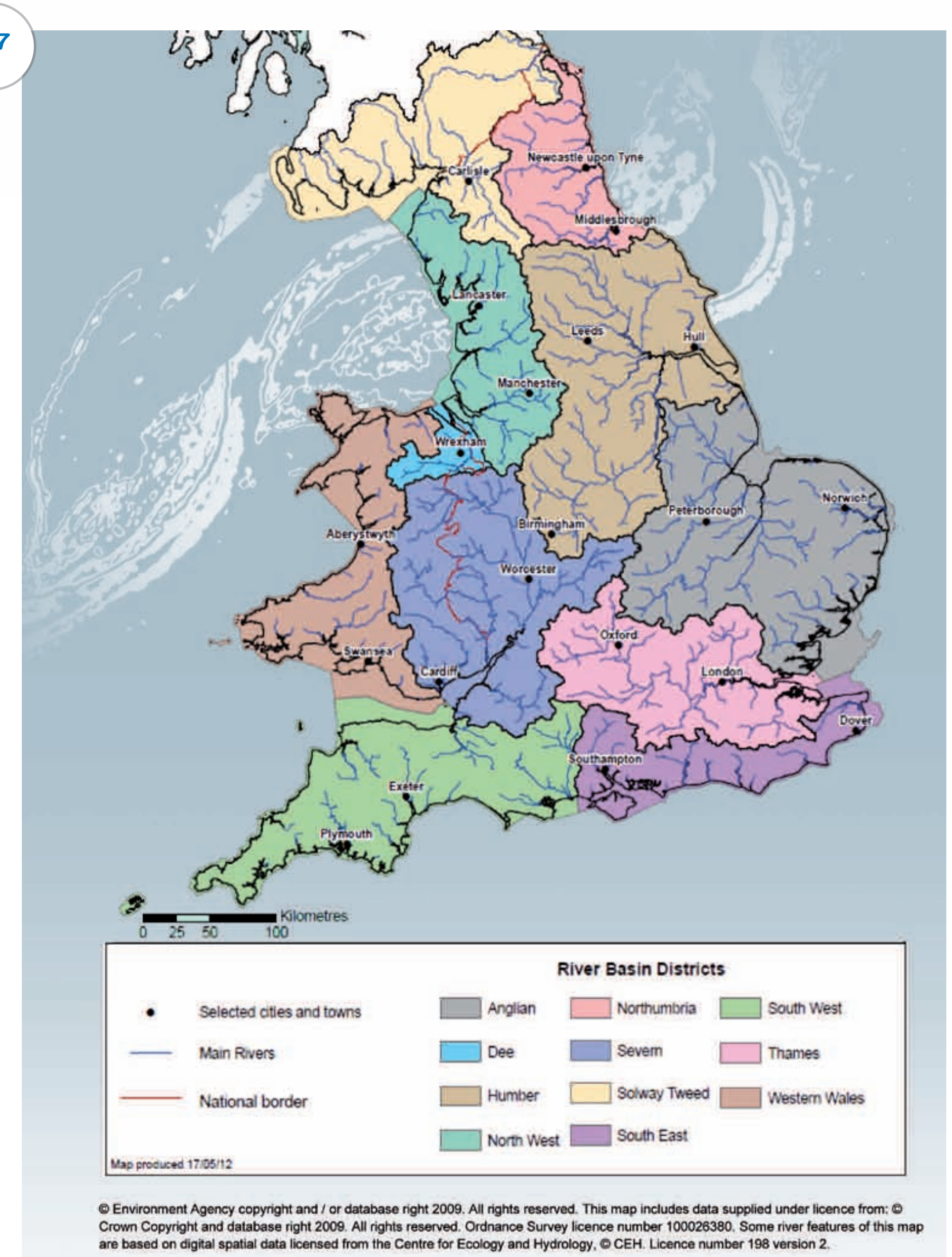
The three indicators for hydromorphological measures (housing tax and two property taxes) are calculated together and produce a maximum score of four points. If a water body receives a score of 3 or more, the cost of the programme of measures for that water body may be disproportionate.

For comparison purposes, the Rhône-Méditerranée-Corse water agency recommends a threshold value of 3% for the indicators selected for households, agriculture and industry. This means that for ability-to-pay analyses in the RMC basin, the costs of programmes of measures are considered disproportionate when they exceed 3% of the gross operating margin of farms or industrial companies, or when water bills exceed 3% of the taxable income of households.

In the U.K., a top-down approach

In the eleven river-basin districts of England and Wales (not including Scotland), basic and supplementary measures are divided into the M1, M2, M3 and M4 categories.

Figure 47



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The eleven river-basin districts of England and Wales.

Definitions and general recommendations

■ M1, M2, M3 and M4, basic and supplementary measures on the national and local levels

The basic measures are divided into M1 (currently implemented on the national level) and M2 (new statutory measures on the national level). For M1 and M2 measures, exemptions due to disproportionate cost are not possible.

Supplementary measures are divided into M3 (new measures on the national level) and M4 (new measures on the local level). M3 measures may be statutory or voluntary. They are decided on the national level. M4 measures are voluntary and decisions are taken on the river-basin level by the Liaison Panel (equivalent of the territorial commission in France).

Table 23 presents briefly the various categories of measures and highlights the top-down nature of the system.

Tableau 23 *Nomenclature of WFD measures (Source: Maria Salvetti using data from the Environment Agency River Basin Management Plan, Annex E: Actions appraisal and justifying objectives, December 2009, pages 11 and 12).*

	Types of measures	Examples
M1	**Measures already implemented** Measures already agreed and funded that may contribute to meeting WFD objectives	Nitrates Directive, Price Review, Coal authority mine-water restoration programme, etc.
M2	**New statutory measures** Measures that will be implemented (generally under other directives) and that may contribute to meeting WFD objectives	Directives on Freshwater fish, Urban wastewater treatment, Habitats, Nitrates, Bathing waters, Priority substances, etc.
M3(a)	**New national measures** New WFD measures requiring only a national decision	Controls on chemicals, fertilisers and the formulation of other products (e.g. detergents), as well as national rules and codes of practice applying to specific activities
M3(b)	**New national measures with local adaptations** National measures adapted to specific conditions in water bodies and river basins	Catchment sensitive farming, new catchments, catchment-scale protection zones, etc.
M4	**New local measures (decision on the river-basin level)** New measures for the WFD requiring only a local decision	Greener Futures initiatives, local partnerships, etc.

Only M3 and M4 measures may receive an exemption and consequently undergo analysis for disproportionate cost.

■ General recommendations for analysis of disproportionate cost

On the basis of the advice contained in the River Basin Planning Guidance drafted by DEFRA (Department for Environment, Food and Rural Affairs) and in the Common Implementation Strategy (CIS) document no. 20, a few general recommendations on how to carry out disproportionate-cost analysis (DCA) are listed below.

- The objective of DCA is to identify and collect data to determine whether an exemption to WFD requirements is justified.
- The analysis must be carried out on a quantity of data sufficient to make a decision within acceptable limits of uncertainty concerning risks.
- The analysis must be carried out on the largest possible geographic scale to determine whether costs are disproportionate.
- Initially, it is advised to proceed simply with collecting already available information.
- Certain non-market benefits should be assessed on a qualitative basis rather than as a benefit transfer.
- Disproportionate costs should be assessed on the basis of the marginal WFD effects, i.e. only the costs of supplementary measures should be taken into account.

■ Measures and delivery mechanisms, two distinct notions

For the economic analyses required by the WFD, DEFRA and the Environmental agency (EA) decided to distinguish between measures themselves and the delivery mechanism used to implement them.

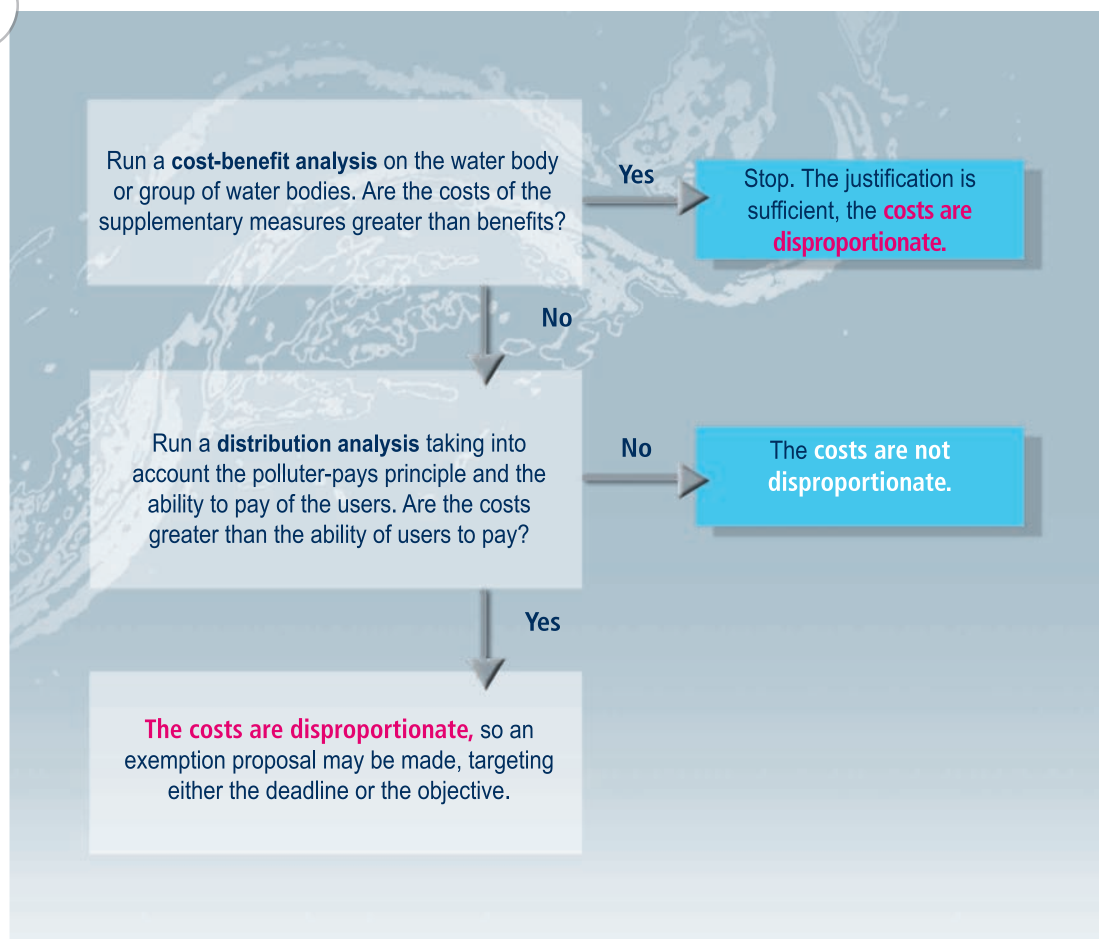
Measures are defined as concrete activities in view of achieving good status of water bodies. Delivery mechanisms are the modifications required for the actual and effective implementation of the measures. The mechanisms must be sufficiently realistic and incentive if they are to succeed in measure implementation. There are many different types of mechanisms, e.g. voluntary agreements, standard regulations, information campaigns, economic instruments, etc. The type of delivery mechanism selected for a given measure is in itself important. This is because its cost can vary and influence the cost-effectiveness and cost-benefit ratios of the measure.

The analysis on the disproportionate cost of a measure takes into account the type of delivery mechanism for the measure (or combination of measures). In other words, the cost of the delivery mechanism is included in the cost-benefit analysis.

DCA method

In addition to the general recommendations listed above, the method for disproportionate-cost analysis is presented in detail by DEFRA and EA. DCA is a process used to determine whether the cost of the planned measures is proportionate to the expected benefits. Proportionality is assessed by undertaking two successive analyses, i.e. first a cost-benefit analysis, followed by a distribution analysis (see Figure 49).

Figure 49



Flow chart to determine whether an exemption based on disproportionate cost is justified in the U.K. Source: Maria Salvetti using data from DEFRA/Wag, River basin planning guidance).

■ Analysis of economic efficiency

Analysis of economic efficiency is used to determine whether the total costs of a measure are proportionate to the total benefits of the measure. In other words, the goal is to assess whether implementation of the measure would be an efficient use of resources.

It is essentially a cost-benefit analysis that includes the economic, social and environmental costs and benefits. It should be noted that the analysis is carried out on the national level. The discount rate set by the HM Treasury Green Book is 3.5%.

CBA takes into account not only the investment costs, but also the recurring costs (maintenance, operation) of the supplementary measures. Benefits must be assessed both quantitatively and qualitatively. The costs and benefits taken into account are not limited to those directly linked to water and aquatic environments. The analysis includes non-market benefits as well as market costs and benefits indirectly linked to water. The scope of the analysis thus covers economic, social and environmental costs and benefits linked directly and indirectly to improvements in the aquatic environment.

Table 24 below lists a number of examples of benefits directly and indirectly linked to improvements in the aquatic environment.

Tableau 24 *List of direct and indirect benefits.*

Direct benefits	Indirect benefits
Water resources, water quality, aquatic habitats, migration of fish	Biodiversity, fauna and flora
Regulation of water levels in water bodies	Landscape (nature park, aesthetic value, etc.)
Nutrient cycles	Cultural and historic monuments (preservation)
Preservation of wetlands	Remarkable geological sites (preservation)
Spawning grounds	Soil and land (erosion, contaminated soil, creation of parks, etc.)
Storm and flood protection	Air quality
Product of commercial fishing	Climatic factors (emission of greenhouse gases, carbon sequestration, renewable energy, etc.)
Product of recreational fishing	Waste (waste management, waste reduction, etc.)
Commercial navigation	Population
Energy production (hydroelectricity)	Human health and safety
Recreation (walks along banks, etc.)	Non-use value, existence value
Water sports (canoeing, skiing, etc.)	
Fishing	
Bathing	

National study on benefits

A national benefits survey was carried out in the U.K. to assess in monetary terms the value assigned by households to improvements in the aquatic environment thanks to WFD implementation.

In July 2007, 1 487 interviews were carried out in approximately 50 different places throughout England and Wales. The results of this contingent-valuation method informed on the willingness to pay depending on the expected benefits. The results were subsequently used as factors in cost-benefit analyses and were completed as needed by local assessments of other environmental benefits expected following implementation of measures.

Leeway in drawing conclusions

Generally speaking, costs are considered disproportionate when the negative impacts of a measure (or combination of measures) exceed the positive. There is no "room for judgement" when comparing costs and benefits. However, attention is paid to the fact that greater certainty exists concerning costs than benefits. As a result, costs are not necessarily disproportionate if they exceed the quantified and monetised benefits alone. In addition, any uncertainty affecting the DCA must be clearly explained.

If the economic-efficiency analysis concludes that the costs are greater than the benefits, then the costs of the measure are considered disproportionate. An exemption on this basis may be justified.

On the other hand, if the economic-efficiency analysis concludes that the costs are less than the benefits, then a distribution analysis is carried out.

■ Distribution analysis on the ability to pay and respect of the polluter-pays principle

The distribution analysis indicates how the costs and benefits of the measure are spread among the various local stakeholders. It identifies the economic flows and transfers between categories of users causing the pressures, funding the measures and benefiting from the measures. The analysis takes into account both the ability to pay of the different user categories and the polluter-pays principle.

In this context, costs are considered disproportionate if:

- implementation of the measures incurs excessive costs for one or more economic sectors, given its ability to pay. The ability is determined using the ratio between the annual costs for the measure assumed by the sector and the annual revenues of the sector. Depending on whether the result exceeds a threshold value for the ratio, that must be set on a case-by-case basis, the costs are deemed disproportionate. It is also recommended to analyse the profitability of the given sector both before and after implementation of the measures in order to judge whether the costs are disproportionate. This phase of the analysis should also take into account any alternative sources of funding for the measures;
- implementation of the measures results in non-observance of the polluter-pays principle. In this case, it is necessary to identify and compare the economic flows between categories of users causing the pressures, funding the measures and benefiting from the measures.

CRP Project 3 tool

In 2007, the Collaborative Research Programme (project 3) developed an Excel tool to collect and present in a consistent manner the data and conclusions of disproportionate-cost analyses. It is used to record data and information on cost-benefit analyses and distribution analyses carried out to determine whether exemptions are justified.

The Environment Agency justified extended deadlines and exemptions to objectives for a certain number of water bodies in the 11 river-basin districts in England and Wales (see Table 25). Table 26 provides a brief quantitative summary of exemptions granted for water bodies in England and Wales.

Tableau 25 *Number of water bodies in each district (Source: Maria Salvetti using data from the Environment Agency River Basin Management Plan, Main document, December 2009).*

River-basin district	Total water bodies	Total surface-water bodies	Total heavily modified water bodies	Total artificial water bodies	Total groundwater bodies
Anglian	867	251	431	154	31
Dee	115	60	48	1	6
Humber	1 165	508	430	177	50
Northumbria	476	285	130	52	9
North West	749	333	315	83	18
Severn	912	633	148	91	40
Solway Tweed	653	500	80		73
South East	441	212	159	40	30
South West	1 093	823	182	44	
Thames	617	312	169	90	46
Western Wales	814	657	122	10	25
TOTAL	7 902	4 574	2 214	742	328

Tableau 26 *A brief quantitative summary of exemption requests granted for water bodies in England and Wales. (Source : Maria Salvetti using DEFRA/Wag data, National impact assessment, Appendix 4, December 2009, page 28).*

		Number of exempted water bodies in England and Wales
Technical feasibility	No available technical solution	1 705
	Cause of negative impacts is unknown	1 911
	Practical constraints (technical nature)	0
	Number of water bodies for which technical feasibility was used to justify the exemption	**3 258**
Disproportionate cost	Unfavourable cost-benefit ratio	327
	Significant risk of unfavourable cost-benefit ratio	2 771
	Disproportionate costs for users	121
	Number of water bodies for which disproportionate cost was used to justify the exemption	**3 007**
Natural conditions	Long ecological response time	25
	Long response time of groundwater bodies	3
	Number of water bodies for which natural conditions were used to justify the exemption	**28**
	Total number of water bodies in England and Wales for which an exemption was requested	**5 059**

To illustrate this point, the box below presents the economic justification for extended deadlines for water bodies in the Anglian river basin.

Reference: P5c

Element predicted not to achieve good status by 2015 : phosphate or total phosphorous
Reason for failure : confirmed - point-source water industry sewage works
Alternative objective : extended deadline
Reason for alternative objective : disproportionately expensive, unfavourable balance of costs and benefits

Justification for alternative objective
The discharge causing the phosphorus failure is known and a site-specific appraisal has shown the improvement measure available to be currently disproportionately expensive.

Through our price review 2009 (PR09) planning work, we identified the sewage treatment works causing the phosphorus failure. We identified the costs of the required measure and identified potential benefits and other impacts that improving the discharges will deliver. This showed the measure to be currently disproportionately expensive.

These appraisals used :

- site-specific costs provided by Ofwat following submission of water company final business plans;
- site-specific information on embedded carbon and operating carbon emissions to calculate carbon costs;
- environmental outcomes recorded as length of river improved to meet WFD objectives;
- benefits based on the NERA National Benefits Survey (Collaborative Research Project 4b/c);
- additional local benefits identified after consultation with RBD liaison panels.

Our PR09 appraisal of the costs and benefits of phosphorus removal schemes assessed 51 cases, of which 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. The 36 schemes that were assessed as having a favourable balance of costs, benefits and other impacts will improve 25 water bodies and 268 kilometres of river.
Technological improvements may make the improvement needed less costly and/or the estimated benefits may change significantly with better information. An extended deadline for achieving good ecological status is therefore required.

Investigation type
Investigate proportionate measures.

Example of investigation
At these sites, the assessments will be reviewed as further information becomes available that might change the balance of costs, benefits and other impacts. This might come from :

- an improved understanding of the relative importance of other sources such that combined action becomes cost-beneficial;
- benefits may be valued more highly;
- benefits may increase if outcomes become more certain;
- advancements in treatment technology may reduce the cost of the measures and/or improve the outcome that can be realised.

If measures are shown to be proportionate, we will look to progress measures as soon as practicable. These future measures may need to be phased, particularly if they depend on action to address other sources.

Possible future measures
Possible future measures could include further phosphorus removal for sewage discharges as well as action on agricultural sources, depending on the relative significance of these (and other) sources. Development of new techniques and practices for both of these sources could also provide more effective measures which achieve a better balance of costs, benefits and other impacts.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to 6 billion pounds and result in benefits of approximately 2 billion pounds. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used, it is estimated that 16 to 1 426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It costs between 157 and 7 408 £/kg to remove phosphorus from these size works.

Reference: GC5a

Element predicted not to achieve good status by 2015 : surface water, general quality test
Reason for failure : confirmed – disused mines point and/or diffuse source; the failures were mainly caused by metals (e.g. iron)
Alternative objective : extended deadline
Reason for alternative objective : disproportionately expensive, disproportionate burdens

Justification for alternative objective
The costs of the measures are proportionate to the benefits, but would impose a disproportionate burden if implemented by 2015.

A phased Coal Authority scheme is being implemented in this groundwater body to restore the body to good status. Treasury has agreed that the funding for these schemes will be phased over three river basin management planning cycles to 2027 due to affordability issues. To bring forward the implementation date of all these mine-water remediation schemes would also cause considerable practical difficulties, for example gaining permission for, and undertaking the necessary works. This phased approach will allow time to investigate and implement the most cost effective solution in each case, and it will also allow learning to take place. Our PCEA study has shown that a phased approach is likely to significantly reduce the overall cost of the whole programme. It would therefore impose a disproportionately burden to meet good status by 2015. Achieving good status by 2027, with the highest priority sites tackled by 2015, is a proportionate and cost-effective response to the problem.

Affordability is one area where there is limited guidance available at a European level and hence additional care must be taken in justifying exemptions to ensure that they follow the spirit of the Directive and its objectives. Although the adoption of the WFD entails obligations for Member States to make available the necessary means for implementation, this needs to be moderated by the option available to Member States to phase the implementation (through extended deadlines) of measures to spread the costs of implementation (while taking clear and demonstrable action in the first cycle).

To apply a time extension on grounds of affordability, consideration should be given to the availability of alternative financing mechanisms, the consequences of non-action and steps taken to resolve affordability in the future. We have considered all of these factors as part of justifying this alternative objective.

Investigation type
Further investigate feasible measures and their applicability at individual sites.

Example of investigation
Investigation and prioritisation of mine-water remediation schemes to achieve maximum environmental benefit.

Possible future measures
Mine-water remediation schemes.
Measures required to achieve 100% good chemical status by 2027 that are likely to be technically infeasible or disproportionately expensive.
Immediate implementation of mine-water remediation schemes for all discharges.

Source: Environment Agency River-basin management plan, Anglian river basin district, Annex E, Actions appraisal and justifying objectives, December 2009.

Conclusion

There are a number of similarities, but also differences in the approaches to disproportionate cost developed in France and the U.K.

Similarities in the French and British approaches

The overall method for disproportionate-cost analysis is **fairly similar** in the two countries. A two-step process is used to determine whether costs are disproportionate. The first step is a **cost-benefit analysis,** followed by a **distribution analysis** taking into account the polluter-pays principle and any sources of alternative funding. In both countries, the overall method for disproportionate-cost analysis is a **top-down approach.**

And each country has developed an **Excel tool** to facilitate and make more consistent the recording of data for disproportionate-cost analysis. It should be noted, however, that the French tool is intended strictly for cost-benefit analysis, whereas the British tool can be used for both cost-benefit analysis and distribution analysis.

Differences in the French and British approaches

A few significant differences may be observed in the French and British approaches to disproportionate cost.

The **discount rate** is not the same in the two countries and this impacts the calculation of the present value of costs and benefits.

The **categories of measures** differ between France and the U.K. French categories are limited to the WFD requirements and simply distinguish between basic and supplementary measures. The British system distinguishes between basic and supplementary measures, but also introduces a notion of scale by distinguishing between national and local measures.

The Environment Agency and DEFRA also **distinguish between measures and their delivery mechanism.** The type of delivery mechanism and its cost can vary and thus influence the cost-effectiveness and cost-benefit ratios of the measure. In the British approach, the analysis on the disproportionate cost of a measure takes into account the type of delivery mechanism for the measure (or combination of measures).

For cost-benefit analyses, the **range of benefits taken into account** in the U.K. would appear to be less restrictive than in France. The British method includes an assessment of the economic, social and environmental benefits that are not directly linked to water.

The **leeway afforded in judging whether a measure is cost beneficial differs** between France and the U.K. In France, calculations determined that a cost-benefit ratio as low as 0.8 may still be cost beneficial. In the U.K., this issue is left to the decision-makers, but the uncertainty affecting the economic assessment of costs and benefits must be taken into account.

Annexes

Examples of representative data on economic issues in the Rhône-Méditerranée basin

Established uses	Economic characterisation
Farms and farm jobs	■ The number of annual work units fell between 28% in the Languedoc-Roussillon region and 35% in the PACA (Provence-Alpes-Côte d'Azur) region from 1988 to 2000. ■ The average size of farms increased between 8 hectares in the Rhône-Alpes region and 17 ha in the Franche-Comté region from 1988 to 2000. ■ In Bourgogne, large farms now represent almost half of the total in the region.
Usable farm area	■ Usable farm area represents between 28 and 58% of the land area of the regions in the river basin.
Livestock farming	■ In Bourgogne, cattle farms represent 29% of all farms, 34% of the usable farm area, 64% of meadows, 27% of all farm jobs and they are primarily oriented toward meat production. ■ Meadows cover two-thirds of the usable farm area in the Franche-Comté region. Over one-third of the farms in the Franche-Comté region raise dairy stock. The Franche-Comté region comprises 5% of the national livestock and produces 5% of the milk in France, 7% of the butter and 6% of the cow cheese. ■ In the Rhône-Alpes region, one half of the farms are specialised in the production of grazing animals. ■ In the PACA region, sheep farming, a traditional activity in the area with its transhumance seasons, remains strong with 886 000 head, of which 610 000 ewes. ■ In Languedoc-Roussillon, livestock farming is concentrated in the Lozère department, in the high sections of the coastal departments and in the west of the Aude department. Sheep and goat farming is the dominant activity with 2 540 farms.
Large-scale farming	■ In Bourgogne, farms specialised in cereals and large-scale farming represent 23% of all farms, 40% of the usable farm area and 21% of farm jobs. ■ In Rhône-Alpes, arable land represents 40% of the total usable farm area in the region. This percentage varies from 8% in the Savoie department to over 60% in the Ain department. In Savoie, permanent grassland covers over 90% of the usable farm area in the department. ■ The cereals-oilseeds-protein crops sector is the third largest in Languedoc-Roussillon with 14% of the usable farm area in the region.
Mixed crops	■ Fruit growing in the Rhône valley is concentrated in the Drôme department and in the lower section of the Isère valley, and represents one-fifth of the land devoted to fruit growing in France. ■ 50% of the flowers produced in France are grown between Toulon and Nice. ■ The Rhône valley and the Mediterranean coast represent two-thirds of total French fruit production, including (virtually) all of some types of fruit (apricots, peaches, nectarines, cherries, almonds).
Wine growing	■ The basin represents over 60% of the land devoted to vineyards in France. ■ One-third of all vineyards are located in Languedoc-Roussillon.
Vegetables	■ The PACA region is one of the primary producers of vegetables, however surface areas have dropped 40% over the past 12 years. ■ In Languedoc-Roussillon, 3 170 farms work 11 660 ha (hectares) producing fresh vegetables, including 950 ha in greenhouses.
Forests	■ The Franche-Comté and Rhône-Alpes regions alone supply 15% of hardwood produced in France. ■ Franche-Comté is the second region in France in terms of its percentage of forest cover.

Irrigation	■ The RM basin has the highest percentage of crop irrigation. The basin represents 16% of the usable farm area in France, but 20% of the irrigated land with approximately 375 000 hectares (i.e. 8 % of the usable farm land in the basin). ■ Irrigation is extensively used. The basin comprises 22% of French farms, but 35% of the farms using irrigation. A total of 25% of farms (one in four) in the basin use irrigation, compared to 15% nationally.
Industrial jobs	■ Rhône-Alpes is the second industrial region in France, after the Paris region.
Geographic distribution of industry	■ The Gard and Hérault departments represent 75% of the industrial jobs in the Languedoc-Roussillon region. ■ Of the 15 000 industrial sites in PACA, over two-thirds are located in the Bouches-du-Rhône department (Marseille) and the Alpes-Maritimes department (Grasse, Nice, Sophia-Antipolis). ■ Half of the industrial activity in Rhône-Alpes is concentrated in three urban areas, Lyon, Grenoble and Saint-Étienne. ■ In Franche-Comté, the Belfort-Montbéliard urban area comprises almost 40% of the industrial jobs in the regions, with Besançon representing another 15%.
Large firms	■ In Rhône-Alpes, 35 companies each have over 1 000 employees in the region. In Bourgogne, over two-thirds of industrial employees work on sites having over 100 employees.
Agri-food industry	■ In PACA, the agri-food industry is the second largest industrial employer in the region (31 000 employees). ■ It is the foremost industrial sector in Languedoc-Roussillon with almost 14 000 employees. ■ Companies with over 20 employees represent 10% of the national total, placing Rhône-Alpes in second place among French regions, behind Bretagne.
Energy and petrochemical industries	■ The Rhône-Alpes region is the source of 21% of the primary energy in France and a quarter of the electricity. ■ In terms of nuclear power, the Rhône-Alpes region is the foremost French region with 30% of the total nuclear capacity and 24% of the electricity produced in nuclear plants. ■ PACA is home to 30% of French oil-refining capacity.
Specialised industrial sectors	■ Metallurgy and metal working are the leading industrial sector in Rhône-Alpes with 77 300 employees. ■ Over half of all industrial jobs in Languedoc-Roussillon are in the capital-goods sector.
Transport of untreated water	■ Three large, local-development companies contribute to economic growth by providing untreated water, essentially from two main sources, namely the Rhône River (Compagnie Nationale du Rhône (CNR) and Compagnie nationale d'aménagement de la région du Bas-Rhône et du Languedoc (BRL)) and the Verdon River (Société du Canal de Provence (SCP)). ■ The volumes abstracted annually amount to approximately 142 billion cubic metres for BRL and 167 billion for SCP (data based on fees for 2000-2002). These volumes serve mainly for public distribution (18% for BRL, 48% for SCP), irrigation (74% for BRL, 41% for SCP) and industry (8% for BRL, 11% for SCP).
Water resources	■ Agriculture represents the second largest user in the river basin with 2.8 billion cubic metres abstracted in 2001 from surface waters and 196 billion cubic metres from groundwater (IFEN study in 2004). ■ 80% of the volumes abstracted for agriculture are used for gravitational irrigation.
Drinking-water supply and sanitation (DWSS)	■ Percentage of the population whose water is directly managed by the local government: 28% ■ Percentage of the population for which water management is delegated by the local government: 72% ■ Number of customers for drinking water: 5 381 790 ■ Volume of drinking water billed: 1.148 billion cubic metres ■ Length of drinking-water networks approximately 150 000 km ■ Length of sanitation networks approximately 70 000 km ■ Drinking-water production units: 437 ■ Wastewater-treatment plants: 4 315 ■ Non-collective sanitation units: approximately 1 million ■ Jobs in the water sector: over 120 000 in France and approximately 30 000 in the basin
Sand and gravel mining	■ Over 106 million tons were produced in the basin in 2002 (27% of total French production), of which 40% from alluvial deposits. ■ In the river basin, 320 companies mining sand and gravel employ 2 500 persons.

Production of bottled drinking water	■ 3 700 million litres of bottled water were produced in 2002 in the river-basin district (40% of total French production). ■ The district represents 33% of the companies and 44% of the jobs in the table-water sector in France.
Water cures	■ Some 240 000 people took water cures in 2001 in the district, i.e. 45% of the French total. ■ There are 39 thermal spas in the district, i.e. 38% of the total in France (104).
Transportation infrastructure	■ With respect to its population, the communication networks in the Bourgogne region rank first among French regions for highways, second for railroads and fourth for national roads.
Commercial navigation on rivers	■ The network of navigable waterways in the Rhône-Méditerranée district spans 14 departments and five regions. ■ In 2003, river freight in the basin totalled over five million tons. ■ This total consisted of 85% exclusively river transport and 15% mixed river and maritime transport. ■ The basin has a stable fleet of 74 ships representing a total capacity of 125 000 metric tons.
Maritime transport	■ Approximately 100 million metric tons of freight and 3.5 million passengers transit each year via the six maritime ports on the Mediterranean coast. ■ Most of the freight (92%) goes through the port in Marseille (leading French port and third port in Europe for freight).
Energy	■ Two-thirds of French hydroelectric generation are located in the basin. A quarter of French nuclear generation is located in the basin.
Tourism	■ Almost 600 million nights were booked (including 240 million in PACA). ■ Total capacity is approximately 2.5 million beds, including 700 000 in PACA, but not including vacation homes. ■ The population during the tourist season has been estimated at 6.5 million, i.e. an increase of almost 50% compared to year-round inhabitants. ■ The average outlay per tourist and per day has been estimated at 50 euros. ■ Some 350 000 jobs are directly related to tourism. ■ There are almost six million vacation homes in the basin. ■ PACA represents 14.6% of the total French tourism market, followed by Rhône-Alpes (11.3%), the Paris region (10.7%) and Languedoc-Roussillon (9.2%).
River tourism	■ Some 35 companies rent a total of 900 houseboats (46% of the national total). ■ A total of 108 ships are available for cruises (28% of the national total).
Recreational activities	■ In the basin in 2003, 48 600 people were members of the national Canoe-Kayak federation and 37 350 people were members of the national Sailing federation. ■ Over 200 local clubs were part of the national Canoe-Kayak federation and 310 clubs part of the national Sailing federation. ■ A total of 145 marinas along the Mediterranean coast offer approximately 88 000 mooring points for sailboats and motorboats.
Bathing	■ 528 towns (6.5% of the total in the basin) have at least one beach or structured bathing area. ■ The cumulative seasonal (tourist) population in these towns is close to 2.5 million, i.e. approximately 38% of the total seasonal population in the basin (6.5 million).
Recreational fishing	■ Approximately 342 000 fishing enthusiasts in the basin paid their fishing fees in 2001 (one quarter of the national total). ■ The average outlay per person for fishing has been estimated at 250 euros per year and per person (including fees). ■ The Isère department has the most registered fishers, with almost 26 000. ■ Over 4% of the population in the Bourgogne and Franche-Comté regions paid the fishing fees.
Golf courses	■ Of the 531 courses in France in 2002, over 150 were located in the basin, including 57 in the Rhône-Alpes region and 53 in the PACA region, the two regions having the most courses in France. ■ A high-end, 18-hole golf course has an average consumption of 5 000 cubic metres per day, which corresponds to that of a town of 12 000 inhabitants. ■ The total water consumption for the irrigation of golf courses in 2002 amounted to 36 million cubic metres, equivalent to the annual consumption of a town of 500 000 inhabitants.

Skiing and snow cannons	■ For the 2002-2003 winter, revenues amounted to 930 million euros. ■ Passes representing 53.5 million days of skiing were sold in 2003. ■ 86% of Alpine ski resorts are now equipped with snow cannons. ■ Artificial snow requires approximately 4 000 cubic metres of water per hectare, a quantity much greater than that required for corn (1 700 cubic metres per hectare in the Isère department).
Salt production	■ Virtually all French sea salt (99% in 2002) is produced in the Mediterranean salt ponds. ■ There are nine production sites along the Mediterranean coast. ■ The seven salt ponds currently in production produce between 850 000 and 1 million tons of salt per year and employ approximately 540 people. ■ They cover some 26 000 hectares of wetlands.
Small commercial fisheries	■ 44 300 tons in 2002. ■ Only 7% of the national total, but over 85% of the national total for bluefin tuna and 45% of the national total for sardines and common anchovies. ■ Languedoc-Roussillon represents 80% of Mediterranean catches due to its 40 000 ha of lagoons and its continental shelf. ■ 3 500 fishermen and a fleet of 1 880 ships, of which 86% are smaller than 12 metres, are active in coastal and small-scale fishing.
Marine aquaculture and shellfishing	■ 25 600 tons of shellfish were produced in 2001 (14% of the national total sold under regulated sanitary conditions). ■ 700 shellfishing companies, generally family owned, employ over 2 000 people. ■ Over 80% of shellfish production in the basin is located in the Hérault department. ■ It represents the second agricultural activity for the department after wine growing.
River fishing (commercial and traditional)	■ 57 professional fishermen use special nets for an estimated average annual capture of 109 tons of fish in public rivers. ■ Some 60 professional fishermen produce approximately 500 tons of fish per year in the large Alpine lakes.
Continental fish farms	■ 9 000 tons of freshwater fish produced in 1997. ■ 65% in the Rhône-Alpes region. ■ In 1997, 160 salmon fish farms produced 5 500 tons of fish, generating revenues of 18.5 million euros and 300 full-time equivalent jobs. ■ In 1997, 3 600 tons of fish were produced in the 28 000 hectares of ponds in the northern section of the basin.

Linking economic uses and the natural environment

Activities - Uses	Mains uses of water	Main requirements weighing on water resources	Main pressures weighing on water resources and/or aquatic environments	Potential conflicts concerning water uses
Agriculture	Factor of production for irrigation and watering of livestock, cleaning of production sites and products (e.g. cheese).	Available quantities.	Direct pressure on water resources due to abstractions from surface and groundwater, organic and toxic pollutants, mainly nonpoint source (livestock effluents, fertilisers and plant-protection treatments, effluents from wine-growing installations, etc.). Physical pressure on the environment caused by irrigation canals, water transfers, upland reservoirs, draining, etc.	Resource sharing during periods of high demand with other uses, e.g. for drinking water, or industry, while taking into account the needs of aquatic species and environments.
Industry	Raw material or factor of production for hydraulic transport, rinsing, thermal exchanges, etc.	Depending on the situation, the water must be more or less pure (drinking water for the agri-food industry), available quantities.	Direct pressure on water resources due to abstractions from surface and groundwater, organic and toxic pollution.	Resource sharing during periods of high demand with other uses, e.g. for drinking water and agriculture, and taking into account the needs of aquatic environments and species.
Sanitation Supply of drinking water	Consumption for various household uses.	Physical-chemical and microbiological quality (suitability for drinking water), available quantities.	Direct pressure on water resources due to abstractions from surface and groundwater, primarily organic pollution (discharges from wastewater-treatment plants). Physical pressure on the environment caused by soil sealing (urbanisation, communication infrastructure, flood prevention, etc.).	Resource sharing during periods of high demand with other uses, e.g. for drinking water, agriculture and industry. Use for drinking water put into question by the pollution caused by other uses (leading to a halt in abstractions or to additional treatments).
Sand and gravel mining	Extraction of alluvial deposits created by river erosion and transport.	The resource is renewable due to hydro-geological cycles.	Physical pressure on the environment caused by extractions from river beds, impacts on hydrology, the vulnerability of the underlying water table, possible destruction of ecosystems, the creation of new environments (renovation of quarries as artificial lakes for recreational activities and as reservoirs, etc.), obstacles to flow, etc.	Competition for the use of the space required for correct river functioning (sediment transport, sustainable protection of groundwater, etc.), i.e. the space where the alluvial deposits and the water required to manage the incoming materials are located.
Production of bottled drinking water	Raw material.	Naturally drinkable, special physical-chemical composition that is stable over time, available quantities.	Direct pressure on water resources through abstractions of groundwater.	Except in exceptional cases of mineral water that participates significantly to the balances ensuring the functioning and good status of neighbouring environments, the potential is for indirect conflict with other sectors, e.g. competition with the drinking-water sector.
Water cures	Raw material.	Naturally drinkable, special physical-chemical composition (therapeutic properties) that is stable over time, available quantities.	Direct pressure on water resources through abstractions of groundwater.	Rare cases of massive abstractions producing significant imbalances in groundwater and/or in linked surface water bodies (very rare). Conflicts may concern the use of water resources or heat resources.
Commercial navigation on rivers	Water literally supports the activity and is used as a means of transport.	Navigable waterways, the size of rivers, development work, ports.	Direct pressure on water resources due to pollution (hydrocarbons, stirring of sediment with resulting release of pollutants). Physical pressure on the environment caused by man-made installations (locks, ports, loading zones, channelling, etc.).	Depending on layout of the project and the quantities of water shunted off, conflict may be minimal (e.g. for a new canal, draining water from a large river, there would be the standard land disputes due to the expropriation and the forced moving of existing activities) or may become major (e.g. the transformation of a sloping river bed into a stair-step format with deep pools would provoke severe conflicts with virtually all the other stakeholders in aquatic issues, concerning notably the restoration of large migratory fish, bank erosion, etc.).
Energy	Factor of production, the driving force for hydroelectricity. Thermal exchange, used for cooling nuclear power plants.	Sufficient hydrological regime (quantity and discharge).	Physical pressure on water resources through abstractions (reservoirs, dams, hydropeaking, etc.), discharges of warm water from power plants.	Breaks in hydraulic continuity and need to maintain sufficient discharge downstream of dams can lead to conflict with fishing groups, aquatic recreational activities, etc. Mortality of migratory fish during downstream migration when passing through turbines.
Tourism	In addition to the uses specific to tourism and water recreational activities (see below), the uses are the same as those for households, e.g. water consumption for various uses in homes.	The same as those for household uses, i.e. physical-chemical and microbiological quality (suitability for drinking water), available quantities.	Pollution and abstraction pressures are increased by the seasonal increase in population in highly attractive zones. This can create problems if resource volumes, the capacity of the environment to receive effluents or the capacity of wastewater-treatment plants are insufficient to handle the temporary increase of the population in the area.	The same as those for household uses or greater, i.e. resource sharing during periods of high demand with other uses, e.g. agriculture and industry. Use for drinking water put into question by the pollution caused by other uses (leading to a halt in abstractions or to additional treatments).

River tourism (boating)	Water literally supports the activity and is used as a means of transport.	Constant discharge, notably during the summer (low-flow period) when the level of activity is the highest. The quality of the landscape, the local heritage and the environment created by the aquatic conditions are important.	Direct pressure on water resources due to pollution caused by the wastewater discharged by the tourists. Physical pressure on the environment caused by man-made installations (locks, ports, channelling, etc.).	Hydraulic facilities constitute obstacles to the movement of fish and are a possible source of conflict with fishermen.
Water-related recreational activities	Water literally supports the activity and is used as a means of transport.	Discharge that is sufficient in terms of the volume or the regularity, depending on the activity. The quality of the landscape, the local heritage and the environment created by the aquatic conditions are important.	Direct pressure on water resources due to pollution caused by the wastewater discharged by the tourists, hydrocarbons and boat paints. Physical pressure on the environment caused by man-made installations (ports, loading zones, etc.).	Conflicts with uses resulting in breaks of river continuity, changes in hydrological regimes (hydroelectric generation, navigation), water pollution and rivers running dry during low-flow periods. Conflicts for use of lagoons and littoral areas.
Bathing	Water is required for the activity.	Water quality, notably bacteriological quality. The quality of the landscape, the local heritage and the environment created by the aquatic conditions are important.	Pressure on the environment caused by pollution of beaches and man-made installations in littoral zones.	Conflicts with fishermen and kayakers for use of littoral areas, lagoons, lakes and the river bed of some rivers.
Recreational fishing	Capture of fish, water serves as the living environment for the fish.	Biological richness of the aquatic environment. The quality of the landscape, the local heritage and the environment created by the aquatic conditions are important.	Direct pressure on fauna due to capture and the risk of overfishing, but also a contribution to maintaining fish populations.	Conflicts with uses resulting in obstacles to the movement of fish (hydroelectric generation, navigation), to their reproduction (damage to spawning grounds), in water pollution and rivers running dry during low-flow periods.
Golf courses	Factor of production used to water greens.	Available quantities.	Direct pressure on water resources through abstractions and pollution caused by fertilisers and plant-protection products.	Potential conflict with all users and uses requiring high-quality water. Conflict with other recipients of local water resources is possible if the volumes consumed (always high per surface unit) are significant compared to potential uses elsewhere. Tensions, during periods of restricted use, with uses for drinking water and irrigation.
Man-made snow	Raw material for the production of man-made snow.	Available quantities at a precise period during the year (winter and beginning of spring).	Direct pressure on water resources through abstractions.	Possible conflict with the local supply of drinking water and nearby downstream sections. Local environmental needs (low but not non-existent, even in winter).
Salt ponds and marshes	Production of salt from seawater.	Water quality (no pollution). Availability of land along the coast.	Direct pressure on water resources through abstractions. Pressure on the environment due to increased salinity levels in soil, blocking off of land, creation of wetlands and specific ecosystems.	Conflicts for use of land along the coast is possible with farmers, tourists, hunters, etc.

Small commercial fisheries	Capture of fish, water serves as the living environment for the fish.	Biological richness of the aquatic environment.	Direct pressure on water resources through pollution (hydrocarbons, boat paints). Physical pressure on the environment caused by man-made installations (ports, moorings, etc.). Direct pressure on fauna due to capture and the risk of overfishing.	Conflicts for use of lagoons and the sea (tourism, aquaculture, etc.).
Marine aquaculture and shellfishing	Water is the natural environment in which fish and shellfish grow.	Water quality (purity, no pollution, biological richness of the environment, temperature, oxygen level, salinity, etc.).	Direct pressure on water resources due to possible filling of lagoons (shell fragments, sediment) and eutrophication, pollution caused by fermentable organic matter.	Conflicts for use of lagoons and the sea (tourism, fishing, etc.). Conflicts if the environment is polluted by other uses (pollution of lagoons by organic matter and toxic substances produced by urban activities in the river basin).
River commercial fishing	Capture of fish, water serves as the living environment for the fish.	Biological richness of the aquatic environment.	Direct pressure on water resources due to pollution (hydrocarbons, boat paints). Physical pressure on the environment caused by man-made installations (ports, moorings, etc.). Direct pressure on fauna due to capture and the risk of overfishing, but also a contribution to maintaining fish populations.	Conflicts with uses resulting in obstacles to the movement of fish (hydroelectric generation, navigation), in water pollution and rivers running dry during low-flow periods.
Continental fish farming	Water is the natural environment in which fish grow.	Water quality (purity, no pollution, biological richness of the environment, temperature, oxygen level, etc.).	Direct pressure on water resources due to bypasses, abstractions for the growing ponds, pollution caused by fermentable organic matter (high numbers of fish in limited areas, use of concentrated feed from outside the ecosystem). But also a contribution to maintaining fish populations.	Conflicts with people downstream of the fish farm (water quality) and with local users (of the environment as well) if the quantities of water drawn off are relatively high.

Data extracted from the files of the Sustainable-development division of the Ecology ministry

Recreational activities - Bathing

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Non-market benefits for current bathers	Low-land river, category 2, shifting from RNRGS (risk of not reaching good status), due to nitrates, pesticides, river morphology, doubts concerning hydrology, to good status.	€/bather/year		32.10 €		River	Gardon
Non-market benefits for additional bathers		€/visit/bather		12 €		River	Gardon
		€/person/year	(apply to the number of persons visiting the recreational sites of the river)	16 €	21 €	River	Erdre
Non-market benefits for current bathers	Improvement in the quality of water (ranging from moderate (occasionally unclean) to good quality) in the harbour of a major city.	€/household/year	(apply to the number of households participating in at least one activity on the studied site)	33 €		Coastal and transitional waters	Brest harbour
		€/person/year	(apply to the number of persons living within 30 kilometres of a site on the studied harbour)	21 €		Coastal and transitional waters	Brest harbour
Non-market benefits for current bathers	Large quantities of green algae, bad ecological status, problems concerning unsightly conditions, odours and public health. Transition to good status thanks to a reduction in nitrates in rivers and better management of abstractions and discharges.	€/bather/year		25 €		Coastal and transitional waters	Lannion bay St-Michel shore
Non-market benefits for current bathers	Lake maintained at a constant level in the spring and during emptying.	€/household/year	(apply to the number of households participating in at least one activity on the studied site)	4 €	7 €	Lake	Lake in Orient forest
	Reduction in the frequency of eutrophication in a Mediterranean pond often visited by tourists, due to sanitation work.	€/household/year	(apply to the number of households participating in at least one activity on the studied site)	30 €	33 €	Lake	Thau pond

Recreational activities

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Non-market benefits for users (current recreational fishers and participants in water sports)	Large quantities of green algae, bad ecological status, problems concerning unsightly conditions, odours and public health. Transition to good status thanks to a reduction in nitrates in rivers and better management of abstractions and discharges.	€/fisher and/or participant in a water sport, per year		43.10 €		Coastal and transitional waters	Lannion bay St-Michel shore

Recreational activities - Water sports

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Non-market benefits of current kayakers who are occasional users (day passes)	Low-land river, category 2, shifting from RNRGS (risk of not reaching good status), due to nitrates, pesticides, river morphology, doubts concerning hydrology, to good status.	€/household/year		7.80 €		River	Gardon
Non-market benefits of current kayakers who are regular users	Low-land river, category 2, shifting from RNRGS (risk of not reaching good status), due to nitrates, pesticides, river morphology, doubts concerning hydrology, to good status.	€/kayaker/year		36 €		River	Loir
Non-market benefits for additional kayakers	Calm waters (low-land river).	€/visit/kayaker/year		8.40 €		River	Loir
		€/visit/kayaker/year		12.60 €		River	Gardon
	White waters (small mountain river).	€/visit/kayaker/year		15 to 21 €		River	Sioule
Non-market benefits for current windsurfers	Lake maintained at a constant level in the spring and during emptying.	€/household/year	(apply to the number of households participating in at least one activity on the studied site)	4 €	7 €	Lake	Lake in Orient forest
	Reduction in the frequency of eutrophication in a Mediterranean pond often visited by tourists, due to sanitation work.	€/household/year	(apply to the number of households participating in at least one activity on the studied site)	30 €	33 €	Lake	Thau pond
Non-market benefits for current windsurfers (all participants in water sports in the study by AELB (Loire-Bretagne Water agency))	Degradation of rivers, canals and meadows. Loss of role as buffer. Measures to attenuate the phenomenon include better management of abstractions and water levels, restoration of rivers and aquatic habitats, reduction of rural pollution.	€/participant water sports/year		27.20 €		Marsh	Marais Poitevin area
Recreational activities - canoeing and kayaking	Average economic value found by 15 French studies.	€/hectare		28 €		Wetland	All of France
Recreational activities - canoeing and kayaking	Average economic value calculated by the meta-analysis by Brander *et al.* (2003) on the basis of 89 sites.	€/hectare				Wetland	International

Recreational activities - Walking

Type of benefit	Details/information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Lieu de l'étude
Non-market benefits for current walkers	Low-land river, category 2, shifting from RNRGS (risk of not reaching good status), due to nitrates, pesticides, river morphology, doubts concerning hydrology, to good status.	€/household/ year		34.80 €		River	Loir
	Visible hydromorphological and/or hydraulic modifications. Transition from capture of sedentary salmonids to sports fishing of wild, sedentary salmonids, through stocking. Reduction in algae.	€/person/year		6 €	14 €	River	Indre and Hérault departments
	Programme to restore (10-15 km/year) and to maintain (10-15 km/year) rivers using manual techniques. Small river basin (main river 19 km long) in a rural area.	€/household/year	(apply to households in towns along the river to be restored)	16 €	19 €	River	Arbas
Non-market benefits for additional walkers		€/visit/walker		15.60 €		River	Loir
		€/visit/walker		14 €		River	Lignon du Velay
		€/visit/walker		19.30 €		River	Gardon
		€/visit/walker		2.40 €		River	Erdre
Non-market benefits for current walkers (and nature watchers)	Improvement in the quality of water (ranging from moderate (occasionally unclean) to good quality for users) in the harbour of a major city.	€/household/ year	(apply to the number of households participating in at least one activity on the studied site)	33 €		Coastal and transitional waters	Brest harbour
		€/person/year	(apply to the number of persons living within 30 kilometres of a site on the studied harbour)	21 €		Coastal and transitional waters	Brest harbour
	Maintenance and protection of an estuary with rich fauna and flora.	€/household/ year	(apply to the number of households participating in this activity)	30 €		Coastal and transitional waters	Orne estuary
Non-market benefits for additional walkers (and nature watchers)	Informal recreational uses (walking, nature watching).	€/visit/user	(apply to the number of additional visits by new users)	41 €	48 €	Coastal and transitional waters	Orne estuary
Non-market benefits for current walkers	Large quantities of green algae, bad ecological status, problems concerning unsightly conditions, odours and public health. Transition to good status thanks to a reduction in nitrates in rivers and better management of abstractions and discharges.	€/walker/year		23 €		Coastal and transitional waters	Lannion bay St-Michel shore
Non-market benefits for current walkers	Existence of a turbidity plume, impact on fish, shift from moderate status to good status due to an attenuation of the phenomena, i.e. rising of the river bed, recreation of mud flats, restoring biological quality along the banks of the estuary.	€/walker/year		46 €		Coastal and transitional waters	Loire estuary
	Maintenance and protection of a reservoir lake receiving many visitors for recreational activities and bird watching.	€/household/ year	(apply to the number of households participating in this activity on the studied site)	30 €	33 €	Lake	Der Lake

Recreational activities - Fishing

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Non-market benefits for current recreational fishers	Low-land river, category 2, shifting from RNRGS (risk of not reaching good status), due to nitrates, pesticides, river morphology, doubts concerning hydrology, to good status.	€/fisher/year	(apply to the fishers on the site)	36 €		River	Loir
	Wild fish (pike, trout) can now live and reproduce in the aquatic environment, whereas they were initially absent or present in low numbers.	€/fisher/year	(apply to the fishers on the site)	7 €	14 €	River	Indre and Hérault departments
	Visible hydromorphological and/or hydraulic modifications. Transition from capture of sedentary salmonids to sports fishing of wild, sedentary salmonids, through stocking. Reduction in algae.	€/fisher/year	(apply to the fishers on the site)	7 €	20 €	River	Lignon du Velay
Non-market benefits for current recreational fishers - fishers from the department not visiting the site	Visible hydromorphological and/or hydraulic modifications. Transition from capture of sedentary salmonids to sports fishing of wild, sedentary salmonids, through stocking. Reduction in algae.	€/fisher/year	(apply to the recreational fishers in the department that do not visit the site)	3.80 €		River	Lignon du Velay
Non-market benefits for additional fishers	Concerning fishing of sea trout.	€/day of fishing		24 €		River	Touques
	Concerning fishing of salmon.	€/day of fishing	(for less than 32 000 total visits to the studied site)	42 €	61 €	River	Sée et Sélune
		€/fisher/year	(for less than 32 000 total visits to the studied site)	7 €		River	Sée et Sélune
	Concerning fishing of sedentary salmonids (trout).	€/visit/fisher		25 €		River	Lignon du Velay
	Concerning standard fishing (fish with white flesh).	€/visit/fisher		12.20 €		River	Loir
		€/visit/fisher		12.80 €		River	
		€/visit/household		2.40 €		River	Gardon
Non-market benefits for current recreational fishers on foot	Improvement in the quality of water (ranging from moderate (occasionally unclean) to good quality for users) in the harbour of a major city.	€/household/year	(apply to the number of households participating in at least one activity on the studied site)	33 €		Coastal and transitional waters	Erdre
		€/person/year	(apply to the number of persons living within 30 kilometres of a site on the studied harbour)	21 €		Coastal and transitional waters	Brest harbour
							Brest harbour
	Zones rated B (low health risk from consumption of shellfish) and C (high risk) shift to A (no risk).	€/visit/fisher	(apply to the number of visits related to this activity on the studied site)	11 €	14 €	Coastal and transitional waters	Breton coast
Non-market benefits for fishers on foot		€/fisher/year	(apply to the number of visits related to this activity on the studied site)	24 €		Coastal and transitional waters	Rhuys peninsula
		€/visit/fisher	(apply to the number of additional visits by new users)	55 €		Coastal and transitional waters	Breton coast

Hunting

Type of benefit	Details / information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Hunting	Average economic value found by 15 French studies.	€/hectare		230 €	330 €	Wetland	All of France
Hunting	Average economic value calculated by the meta-analysis by Brander *et al.* (2003) on the basis of 89 sites.	€/hectare		116 €		Wetland	International
Hunting	Existence of a turbidity plume, shift from moderate status to good status due to an attenuation of the phenomena, i.e. rising of the river bed, recreation of mud flats, restoring biological quality along the banks of the estuary.	€/hunter		48 €		Wetland	Loire estuary

Navigation

Type de bénéficiaire	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Non-market benefits for an increase in "recreational boating"	If the number of navigable days in the week is 3.5.	€/week of boat rental		64 €		River	Lot
	If the number of navigable days in the week is greater than 5.	€/week of boat rental		444 €		River	Lot
Recreational activities	Average economic value found by 15 French studies.	€/hectare		15 €		Wetland	All of France International
Recreational activities	Average economic value calculated by the meta-analysis by Brander *et al.* (2003) on the basis of 89 sites.	€/hectare				Wetland	

Supply of drinking water (DWSS)

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Supply of drinking water from surface waters	City whose drinking water comes from a large, threatened abstraction. The quality of water from a river shifts from insufficient for drinking water to sufficient.	€/household/year	(apply to households of the city whose drinking water comes from the large abstraction)	36 €		River	Erdre

Water treatment

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Lower treatment costs for the DWSS system	Treatment for eutrophication	€/ m^3		0.13 €	0,21 €	River	Loire-Bretagne water agency
Lower treatment costs for the DWSS system	Treatment for nitrates	€/ m^3		0.22 €		River	Seine-Normandie water agency
Lower treatment costs for the DWSS system	Treatment for pesticides	€/ m^3		0.06 €		River	Seine-Normandie water agency
Lower treatment costs for the DWSS system	Treatment for eutrophication	€/ m^3		0.13 €	0,21 €	Coastal and transitional waters	Loire-Bretagne water agency
Lower treatment costs for the DWSS system	Treatment for nitrates	€/ m^3		0.22 €		Coastal and transitional waters	Seine-Normandie water agency
Lower treatment costs for the DWSS system	Treatment for nitrates and pesticides	€/ m^3		0.06 €		Coastal and transitional waters	Seine-Normandie water agency
Lower treatment costs for the DWSS system	Treatment for eutrophication	€/ m^3		0.13 €	0,21 €	Groundwater	Loire-Bretagne water agency
Lower treatment costs for the DWSS system	Treatment for nitrates	€/ m^3		0.22 €		Groundwater	Seine-Normandie water agency
Lower treatment costs for the DWSS system	Treatment for pesticides	€/ m^3		0.06 €		Groundwater	Seine-Normandie water agency
Lower treatment costs for the DWSS system	Treatment for eutrophication	€/ m^3		0.13 €	0,21 €	Lake	Loire-Bretagne water agency
Lower treatment costs for the DWSS system	Treatment for nitrates			0.22 €		Lake	Seine-Normandie water agency
Lower treatment costs for the DWSS system	Treatment for pesticides	€/ m^3		0.06 €		Lake	Seine-Normandie water agency
Water purification	Average economic value found by 15 French studies.	€/ha		15 €	11 300 €	Wetland	All of France
Water purification	Average economic value calculated by the meta-analysis by Brander *et al.* (2003) on the basis of 89 sites.	€/ha		272 €		Wetland	International

Bequest value

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Bequest value (non-use)	Low-land river, category 2, shifting from RNRGS (risk of not reaching good status), due to nitrates, pesticides, river morphology, doubts concerning hydrology, to good status.	€/household/year	(apply to non-user households in towns along the river)	24 €		River	Loir
	Visible hydromorphological and/or hydraulic modifications Transition from capture of sedentary salmonids to sports fishing of wild, sedentary salmonids, through stocking. Reduction in algae.	€/household/year	(apply to non-user inhabitants of the river basin)	5 €	8.50 €	River	Lignon du Velay
	Programme to restore (10-15km/year) and to maintain (10-15 km/year) rivers using manual techniques. Small river basin (main river 19 km long) in a rural area.	€/household/year	(apply to households in towns along the river to be restored)	16 €	19 €	River	Arbas
Enhancement of ecosystems	Protection of forests along a river through the creation of nature reserves, use of less polluting farming techniques, restricted access to certain sites, restrictive zoning of land along the river, etc., for the users of the site (the people visiting the studied sites).	€/household/year	(apply to households living less than 15 kilometres from the river)	10 €	22 €	River	Garonne River
	Restoration of the hydrographic network of an island in the former bed of a river that has been channelised by reconnecting the side channels, restoring the alluvial forest, improving biodiversity, etc., for the users of the site (the people visiting the studied sites).	€/household/year	(apply to households in towns adjacent to the island)	18.70 €		River	Rhinau island in the Rhine River
		€/household/year	(apply to households in towns located less than 10 kilometres from the island (not including towns adjacent to the island))	14.10 €		River	Rhinau island in the Rhine River
Enhancement of ecosystems	Shift from clear eutrophication in the harbour of a large city to no visible eutrophication, for the users of the site (the people visiting the studied sites).	€/household/year	(apply to the number of households visiting the studied site)	24 €		Coastal and transitional waters	Brest harbour
Bequest value (non-use)	For the current status.	€/non user (household)/year		30 €		Coastal and transitional waters	Lannion bay St-Michel shore
Bequest value (non-use)	For the current status.	€/non user (household)/year		36 €		Coastal and transitional waters	Loire estuary
Bequest value assigned by households supplied with drinking water from groundwater	Shift of a body of groundwater with moderate characteristics to good status. Nitrates and pesticides are the reason for RNRGS (risk of not reaching good status). The outflow of the primarily sedimentary aquifer is generally free.	€/household/year	(apply to households supplied with drinking water from the studied water table)	25.40 €	27.20€	Groundwater	Water bodies in the Craie and Artois regions and in the Lys valley
	Creation of a programme to preserve a symbolic and very large aquifer that is polluted in some places.	€/household/year	(apply to households supplied with drinking water from the studied water table)	52 €	110 €	Groundwater	Alsatian water table

Flooding

Type of benefit	Details / Information	Unit	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Flood control	Average economic value found by 15 French studies.	€/hectare		37 €	617 €	Wetland	All of France
Flood control	Average economic value calculated by the meta-analysis by Brander *et al.* (2003) on the basis of 89 sites.	€/hectare		438 €		Wetland	International

Shellfishing

Type of benefit	Details / Information	Details / Information	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Lower treatment costs for oyster production	Oyster purification costs	€/kg of oysters	(apply to a quantity of oysters produced by a farm located in a B zone)	0.06 €		Coastal and transitional waters	Loire-Bretagne water agency

Mitigation of low flows

Type of benefit	Details / Information	Details / Information	Field of application	Min. unit price	Max. unit price	Environment / Category of water body	Study site
Supply of water during low-flow periods	Average economic value found by 15 French studies.	€/hectare		45 €	150 €	Wetland	All of France
Supply of water during low-flow periods	Average economic value calculated by the meta-analysis by Brander *et al.* (2003) on the basis of 89 sites.	€/hectare		42 €		Wetland	International

Investment costs of supplementary measures to reach good status

HYPOTHESES

Service life:
unlimited

Calculation period:
30 years

Reference year:
2010

Discount rate:
4%

Benefits calculated starting in:
2015

Water-body code	Population	Number of potentially available guide values (not including walkers and bequest value)	Sanitation		Industry					Agriculture	Hydromorphology		TOTAL costs of supplementary measures	
			Investment	Operations	Investment	Operation of polluting installations (GEREP)	Operation (PAH)	Operation (chlorinated solvents)	Operation (chloride)	Investment	Investment	Operations	Investment	Discounted operating costs
CR1	13 338	4	3 026 054	1 984 500	25 242 423	3 680 000	66 693	0	0		23 515 759	14 455	51 784 236	105 099 584
CR2	525	4	165 000	7 437	0	0	0	0	0		40 948 177	24 457	41 113 177	583 396
CR3	0	4	0	0	0	0	0	0	0		6 817 783	36 061	6 817 783	659 636
CR4	3 261	2	1 167 198	0	14 324	0	28 153	0	0		1 810 000	14 400	2 991 522	778 381
CR5	0	2	0	0	0	0	0	0	0		23 168 281	13 027	23 168 281	238 285
CR6	0	2	0	0	0	0	0	0	0		0	0	0	0
CR7	0	3	0	0	0	0	0	0	0		659 150	36 507	659 150	667 783
CR8	0	2	0	0	0	0	0	0	0		0	0	0	0
CR9	0	1	0	0	0	0	0	0	0		0	0	0	0
CR10	22 821	2	372 500	10 027	788 768	0	136 453	0	0		0	0	1 161 268	2 679 415
CR12	0	2	0	0	0	0	0	0	0		92 890	5 145	92 890	94 107
CR13	26 512	3	11 913 451	15 821 816	1 019 364	84 000	221 300	0	0		1 090 043	10 525	14 022 858	295 190 266
CR14	25 167	3	650 000	0	1 047 490	80 000	64 917	0	0		889 950	5 964	2 587 440	2 759 929
CR15	14 891	3	2 500 117	208 846	240 379	0	77 815	0	0		1 280 209	8 580	4 020 705	5 400 535
CR16	1 860	4	310 254	3 103	750	0	0	0	0		339 617	9 184	650 621	224 746
CR17	20 268	3	7 485 000	341 727	1 457 488	32 000	136 154	0	0		791 834	21 413	9 734 322	9 718 452
CR18	136 931	3	13 335 000	136 610	7 920 575	512 000	724 522	0	0		330 420	8 935	21 585 995	25 280 821
CR19	2 477	3	297 147	0	6 608	0	5 021	0	0		2 121 320	29 738	2 425 075	635 815
CR20	0	3	0	0	0	0	0	0	0		2 030 966	28 471	2 030 966	520 801
CR21	34 921	2	9 199 093	69 682	2 952 078	164 000	282 359	0	0		1 492 475	20 923	13 643 646	9 822 146
CR22	417 332	5	36 190 741	28 350 000	21 330 536	1 828 000	1 364 510	0	0		2 915 239	40 868	60 436 516	577 724 203
CR23	326	1	0	1 508	0	0	0	0	0		0	0	0	27 575
CR24	1 653	1	0	1 549	8 804	0	5 257	0	0		0	0	8 804	124 487
CR25	10 091	2	832 330	0	452 293	0	59 967	0	0		1 801 176	18 960	3 085 799	1 443 726
CR26	19 875	3	2 856 746	0	735 840	0	104 285	0	0		646 029	6 800	4 238 615	2 031 969
CR27	528	0	0	1 580	8 804	0	5 257	0	0		0	0	8 804	125 057
CR28	11 448	1	2 096 139	58 387	230 829	0	61 460	0	0		907 300	9 551	3 234 269	2 366 941
CR29	6 122	1	3 142 500	141 440	64 470	0	29 445	0	0		663 222	6 981	3 870 192	3 253 536
CR30	9 020	2	6 147 500	272 353	20 108	0	11 109	0	0		542 272	5 708	6 709 880	5 289 505
CR31	1 443	4	181 154	121 732	10 200	0	1 550	0	0		1 721 508	28 106	1 912 863	2 769 192
CR32	2 346	4	0	0	501 500	80 000	0	0	0		1 399 677	22 852	1 901 177	1 881 370
CR33	7 897	4	1 460 500	506 281	2 635 474	360 000	18 452	0	0		1 153 021	18 825	5 248 995	16 527 910
CR34	3 519	3	150 000	0	28 558	0	12 554	0	0		0	0	178 558	229 638
CR35	7 465	3	602 500	18 150	83 656	0	34 852	0	0		1 128 045	18 417	1 814 201	1 306 395
CR36	5 118	2	325 000	16 209	155 530	0	46 180	0	0		658 395	17 804	1 138 925	1 466 896
CR37	1 835	2	0	0	148 550	0	0	0	0		218 216	5 901	366 766	107 942
CR38	2 521	2	0	0	500	0	0	0	0		221 387	5 987	221 887	109 511
CR39	790	2	0	1 567	250	0	0	0	0		231 233	6 253	231 483	143 050

Water-body code	Results of stakeholder ability to pay (pre-screening)									TOTAL benefits (not including ecosystems)		TOTAL benefits for ecosystems alone		TOTAL costs	[Benefits] - [Costs]		[Benefits] - 80% [Costs]	
	Sanitation: supplementary measures	Industry: ecological pollution (GEREP)	Industry: chemical pollution (GEREP)	Industry: not including main polluters	Crafts/trade companies: PAHs	Industry: chlorinated solvents	Agriculture: abstraction supply zone for drinking water	Agriculture: nonpoint-source pollutants (nitrates and pesticides)	Hydromorphology	Min.	Max.	Min.	Max.	Costs of supplementary measures	Min.	Max.	If the minimum benefits are less than 80% of the costs for the supplementary measures, the costs are considered disproportionate	
CR1	ok 2015	ok 2015	ok 2027	ok 2015	ok 2015	0	0	0	cb 2027	2 328 359	16 400 674	1 481 573	6 242 748	156 883 820	-154 555 461	-140 483 146	-123 178 697	coût dispro *
CR2	ok 2015	0	0	0	0	0	0	0	ok 2015	1 369 552	2 643 490	29 981	36 175	41 696 573				
CR3	0	0	0	0	0	0	0	0	ok 2015	472 198	1 032 533	0	0	7 477 419				
CR4	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	481 164	77 580 847	224 698	641 438	3 769 903	-3 288 739	73 810 944	-2 534 758	coût dispro
CR5	0	0	0	0	0	0	0	0	cb 2027	0	0	0	0	23 406 566	-23 406 566	-23 406 566	-18 725 252	coût dispro
CR6	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR7	0	0	0	0	0	0	0	0	cb 2027	0	0	0	0	1 326 933	-1 326 933	-1 326 933	-1 061 546	coût dispro
CR8	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR9	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR10	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	0	3 298 416	30 274 704	2 534 937	8 709 175	3 840 683				
CR12	0	0	0	0	0	0	0	0	cb 2027	0	0	0	0	186 997	-186 997	-186 997	-149 598	coût dispro
CR13	ok 2021	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	3 928 788	25 501 143 094	2 944 930	34 268 870	309 213 124	-305 284 335	25 191 929 971	-243 441 711	coût dispro
CR14	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	3 982 507	27 432 777 735	2 795 528	35 801 163	5 347 369				
CR15	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	2 197 183	3 094 304 909	1 654 079	10 266 941	9 421 240				
CR16	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	320 550	2 372 119	206 607	803 446	875 367				
CR17	ok 2015	0	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	3 492 966	10 706 954 462	1 396 560	25 362 118	19 452 774	-15 959 808	10 687 501 688	-12 069 253	coût dispro
CR18	ok 2015	ok 2015	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	21 583 350	354 595 235	9 435 189	83 218 867	46 866 816	-25 283 466	307 728 419	-15 910 102	coût dispro
CR19	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	383 887	972 841	216 801	275 143	3 060 890				
CR20	0	0	0	0	0	0	0	0	ok 2015	0	671 921	0	0	2 551 767				
CR21	cb 2027	ok 2015	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	5 070 781	88 401 550	2 406 221	21 131 200	23 465 792	-18 395 010	64 935 758	-13 701 852	coût dispro
CR22	ok 2015	ok 2015	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	66 929 289	2 011 993 076	46 356 872	581 404 956	638 160 719	-571 231 430	1 373 832 358	-443 599 286	coût dispro
CR23	ok 2015	0	0	0	0	0	0	0	0	48 102	273 803	36 212	53 302	27 575				
CR24	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	243 902	5 875 503	183 614	552 064	133 291				
CR25	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	1 501 726	3 299 450 052	695 317	7 578 013	4 529 525	-3 027 800	3 294 920 527	-2 121 895	coût dispro
CR26	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	2 895 525	11 070 987	1 282 295	1 369 481	6 270 584				
CR27	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	77 907	819 662	0	0	133 861				
CR28	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 689 165	9 521 809 321	788 821	10 159 600	5 601 209				
CR29	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	903 308	1 401 476 318	421 835	3 850 005	7 123 728				
CR30	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 330 911	3 091 880 193	1 001 934	8 888 227	11 999 385				
CR31	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	265 599	1 165 423	160 287	322 767	4 682 055				
CR32	ok 2015	ok 2015	0	ok 2015	0	0	0	0	ok 2015	749 686	1 276 011	260 592	353 943	3 782 546				
CR33	ok 2015	0	ok 2021	ok 2027	ok 2015	0	0	0	ok 2015	1 706 340	8 433 789	877 192	4 006 533	21 776 905	-20 070 566	-13 343 116	-15 715 185	coût dispro
CR34	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	606 461	16 844 107	390 887	802 992	408 196				
CR35	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 446 848	5 816 434	829 206	2 841 450	3 120 595				
CR36	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	755 166	17 908 355	568 503	6 673 504	2 605 821				
CR37	ok 2015	0	0	ok 2027	0	0	0	0	ok 2015	270 756	9 116 666	203 830	725 750	474 708	-203 952	8 641 958	-109 010	coût dispro
CR38	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	371 976	60 476 778	280 030	731 612	331 398				
CR39	ok 2021	0	0	ok 2015	0	0	0	0	ok 2015	116 565	350 740	87 753	145 237	374 533	-257 967	-23 793	-183 061	coût dispro

*Dispro. cost

CR40	1 906	2	0	1 544	750	0	0	0	0		243 630	6 588	244 380	148 758	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	281 232	16 466 313	211 717	634 467	393 138				
CR41	1 249	2	402 500	18 141	8 650	0	1 490	0	0		174 769	4 726	585 919	445 533	ok 2015	0	0	ok 2021	ok 2021	0	0	0	ok 2015	158 980	1 480 834	96 290	138 738	1 031 452	-872 472	449 383	-666 181	coût dispro *
CR42	1 786	2	552 500	24 875	76 800	0	0	0	0		180 380	4 878	809 680	544 233	cb 2027	0	0	ok 2021	0	0	0	0	ok 2015	248 106	8 459 882	150 272	198 387	1 353 912	-1 105 806	7 105 970	-835 024	coût dispro
CR43	1 132	2	332 500	15 011	5 108	0	5 021	0	0		160 120	4 330	497 728	445 634	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	160 008	2 556 987	96 913	125 742	943 363	-783 355	1 613 625	-594 682	coût dispro
CR704	5 112	4	2 158 263	83 180	243 422	0	45 864	0	0		1 370 635	21 435	3 772 320	2 752 555	ok 2015	0	0	ok 2021	ok 2015	0	0	0	cb 2027	#N/A	#N/A	567 836	4 373 800	6 524 875	#N/A	#N/A	#N/A	coût dispro
CR703	1 399	4	1 265 731	56 907	13 462	0	3 969	0	0		688 937	10 274	1 968 130	1 301 484	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#N/A	#N/A	155 400	341 343	3 269 614				
CR705	6 016	2	2 606 218	107 805	27 674	0	14 483	0	0		1 633 332	27 847	4 267 224	2 746 265	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#N/A	#N/A	668 252	6 622 127	7 013 489				
CR47	1 792	2	0	1 548	1 000	0	0	0	0		329 487	4 593	330 487	112 329	ok 2021	0	0	ok 2015	0	0	0	0	cb 2027	0	11 818 149	0	199 054	442 816	-442 816	11 375 333	-354 253	coût dispro
CR48	1 970	2	2 432 050	90 989	9 950	0	1 550	0	0		555 805	7 748	2 997 805	1 834 454	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	290 676	24 293 099	218 826	1 151 825	4 832 260				
CR49	3 819	2	1 249 051	56 079	521 264	24 000	52 157	0	0		448 780	6 256	2 219 095	2 533 292	ok 2021	0	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	563 498	200 992 479	424 211	836 023	4 752 387	-4 188 890	196 240 092	-3 238 412	coût dispro
CR50	3 620	2	5 684 263	234 578	50 574	0	11 907	0	0		1 317 249	18 362	7 052 087	4 844 576	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	534 135	129 533 255	402 106	2 953 326	11 896 663	-11 362 528	117 636 593	-8 983 195	coût dispro
CR51	2 319	2	0	0	22 974	0	17 743	0	0		835 712	11 649	858 686	537 645	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	302 499	3 357 194	257 592	995 055	1 396 332				
CR52	767	2	50 000	0	7 400	0	1 490	0	0		390 063	5 437	447 463	126 713	ok 2015	0	0	ok 2021	ok 2021	0	0	0	ok 2015	113 172	174 453	71 628	85 198	574 176	-461 004	-399 723	-346 169	coût dispro
CR53	2 870	2	0	6 293	42 698	0	23 481	0	0		319 585	7 919	362 283	689 482	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	423 472	3 233 255	318 797	1 187 645	1 051 765				
CR54	5 688	1	50 000	0	334 561	0	32 516	0	0		177 901	4 408	562 462	675 414	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	839 271	505 056 250	391 930	1 014 544	1 237 876				
CR706	1 205	3	0	0	90 262	0	11 704	0	0		55 500	1 375	145 762	239 246	ok 2021	0	0	ok 2027	ok 2015	0	0	0	ok 2015	#N/A	#N/A	96 895	133 850	385 008	#N/A	#N/A	#N/A	
CR707	1 599	3	50 000	0	566 106	16 000	25 672	0	0		195 001	4 832	811 107	850 651	ok 2015	0	ok 2015	ok 2027	ok 2015	0	0	0	ok 2015	#N/A	#N/A	133 988	177 616	1 661 757	#N/A	#N/A	#N/A	coût dispro
CR57	0	3	0	0	0	0	0	0	0		252 887	6 266	252 887	114 622	0	0	0	0	0	0	0	0	ok 2015	234 102	436 062	0	0	367 509				
CR58	948	1	0	1 579	250	0	0	0	0		147 251	3 649	147 501	95 629	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	139 878	319 392	65 322	96 052	243 130				
CR59	1 246	2	92 500	4 188	347 102	16 000	13 296	0	0		185 389	4 594	624 991	696 521	ok 2015	0	ok 2015	cb 2027	cb 2027	0	0	0	ok 2015	183 849	3 641 142	138 405	307 211	1 321 511	-1 137 663	2 319 631	-873 361	coût dispro
CR60	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	53 527	0	0	0				
CR61	5 044	2	982 500	37 517	27 808	0	16 229	0	0		380 932	9 439	1 391 240	1 155 779	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	657 958	7 606 616	560 283	2 254 561	2 547 019				
CR62	4 434	3	100 000	0	118 358	8 000	6 944	0	0		308 043	7 633	526 401	412 978	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	1 039 338	2 032 892	492 525	840 325	939 379	99 959	1 093 513	287 835	coût
CR63	1 411	2	50 000	0	25 266	0	28 457	0	0		237 512	5 885	312 778	628 190	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	189 432	1 181 555	114 734	156 733	940 968				
CR64	68 389	3	19 696 171	630 495	4 320 259	160 000	365 889	0	0		680 000	24 000	24 696 430	21 591 625	ok 2015	ok 2015	cb 2027	ok 2021	ok 2015	0	0	0	ok 2015	9 888 013	139 937 038	7 596 590	40 006 562	46 288 054	-36 400 041	93 648 984	-27 142 430	coût dispro
CR65	15 015	4	50 000	0	986 837	0	109 189	0	0		787 758	5 279	1 824 595	2 093 852	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 923 758	5 088 546	995 004	1 667 853	3 918 446				
CR66	198	2	38 002	588	500	0	0	0	0		247 057	3 953	285 559	83 071	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	17 361	94 118	10 515	21 994	368 630	-351 269	-274 512	-277 543	coût dispro
CR708	6 914	2	1 236 630	19 183	564 942	80 000	52 232	0	0		0	0	1 801 572	2 769 688	cb 2027	0	ok 2015	ok 2015	ok 2015	0	0	0	0	#N/A	#N/A	768 001	2 359 178	4 571 260	#N/A	#N/A	#N/A	coût dispro
CR709	11 146	3	5 449 367	241 260	4 300 970	560 000	89 620	0	0		0	0	9 750 337	16 296 006	ok 2015	ok 2021	cb 2027	ok 2027	ok 2015	0	0	0	0	#N/A	#N/A	1 238 088	3 113 268	26 046 343	#N/A	#N/A	#N/A	coût dispro
CR69	10 163	2	6 350 420	230 096	2 446 181	296 000	143 051	0	0		1 088 819	17 421	9 885 421	12 558 725	ok 2015	cb 2027	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 526 066	630 766 810	700 278	3 443 734	22 444 145	-20 918 079	608 322 665	-16 429 250	coût dispro
CR70	735	1	128 796	1 996	0	0	0	0	0		368 547	5 897	497 343	144 381	ok 2015	0	0	0	0	0	0	0	ok 2015	108 450	306 706	50 645	83 063	641 724				
CR71	1 435	2	255 499	4 006	9 966	0	4 092	0	0		280 236	4 484	545 701	230 137	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	211 736	10 206 562	159 399	201 277	775 838	-564 103	9 430 723	-408 935	coût dispro
CR72	858	2	165 430	2 605	12 508	0	12 881	0	0		271 069	4 337	449 007	362 614	cb 2027	0	0	ok 2015	ok 2015	0	0	0	cb 2027	96 881	388 170	58 679	95 306	811 621	-714 740	-423 451	-552 416	coût dispro
CR73	1 785	2	1 579 689	777 026	701 000	112 000	0	0	0		252 569	4 041	2 533 258	16 336 008	cb 2027	0	ok 2027	ok 2015	0	0	0	0	ok 2015	187 326	12 453 162	113 459	198 276	18 869 267	-18 681 940	-6 416 105	-14 908 087	coût dispro
CR74	2 222	2	975 000	45 453	13 008	0	19 496	0	0		365 987	5 856	1 353 995	1 295 172	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	327 859	13 661 439	246 818	324 991	2 649 166	-2 321 308	11 012 273	-1 791 475	coût dispro
CR75	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	4 627	0	0	0				
CR76	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR77	1 640	1	228 329	0	500	0	0	0	0		154 066	8 149	382 895	149 061	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	241 984	776 876	113 004	194 769	531 955				
CR78	87 849	2	13 892 473	147 636	3 681 387	24 000	492 553	0	0		579 712	30 662	18 153 572	12 710 246	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	12 653 534	349 489 612	6 053 209	83 642 839	30 863 818				
CR79	19 921	2	1 866 402	0	803 348	24 000	101 684	0	0		195 777	10 355	2 865 527	2 488 429	ok 2015	0	ok 2027	ok 2015	ok 2015	0	0	0	ok 2015	2 817 361	24 674 091	2 212 807	7 313 272	5 353 956	-2 536 595	19 320 135	-1 465 804	coût dispro
CR80	16 949	2	4 113 527	193 812	1 585 335	32 000	113 977	0	0		730 343	38 630	6 429 205	6 922 061	ok 2015	0	ok 2021	ok 2015	ok 2021	0	0	0	ok 2015	2 500 843	13 116 145 259	1 882 680	13 663 134	13 351 266	-10 850 422	13 102 793 993	-8 180 169	coût dispro
CR81	8 268	2	2 955 000	126 275	376 117	0	44 094	0	0		498 594	26 372	3 829 711	3 598 786	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 219 952	1 017 252 436	918 402	3 926 672	7 428 497				
CR82	6 419	2	814 079	0	266 176	16 000	41 969	0	0		261 508	13 832	1 341 763	1 313 389	ok 2015	0	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	947 130	405 395 130	713 017	3 250 905	2 655 152	-1 708 022	402 739 977	-1 176 992	coût dispro
CR83	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR84	4 273	1	300 000	0	258 808	0	18 331	0	0		0	0	558 808	335 311	ok 2015	0	0	ok 2027	ok 2015	0	0	0	0	630 486	14 240 775	474 641	1 726 097	894 119	-263 633	13 346 656	-84 810	coût dispro
CR85	8 784	2	250 000	0	3 188 626	480 000	119 367	0	0		187 525	6 251	3 626 151	11 077 975	ok 2015	cb 2027	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 296 089	2 049 409 629	975 719	3 553 890	14 704 126	-13 408 037	2 034 705 503	-10 467 212	coût dispro
CR86	10 240	1	250 000	0	10 238 245	1 600 000	77 016	0	0		226 074	7 536	10 714 319	30 813 881	ok 2015	cb 2027	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 510 923	4 269 289 310	705 584	4 218 379	41 528 200	-40 017 277	4 227 761 111	-31 711 637	coût dispro
CR87	6 396	1	250 000	0	89 224	0	32 192	0	0		257 986	8 600	597 210	746 160	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	943 737	420 783 137	440 714	2 710 057	1 343 370				
CR88	7 640	1	1 614 315	53 981	1 872 876	0	50 708	0	0		1 416 290	34 386	4 903 481	2 543 979	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	1 127 290	22 657 436	526 432	7 130 149	7 447 460	-6 320 170	15 209 976	-4 830 678	coût dispro
CR89	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	14 489	0	0	0				
CR90	25 384	3	500 000	1 589	2 082 508	48 000	108 644	0	0		665 758	16 164	3 248 266	3 190 063	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	3 823 994	15 922 055 007	2 819 632	23 886 037	6 438 328				
CR91	22 436	4	3 519 306	471 135	3 118 378	352 000	142 764	0	0		619 745	15 047	7 257 429	17 943 485	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	4 567 463	82 905 664	2 492 171	22 669 291	25 200 914				
CR92	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR93	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	59 987	0	0	0				
CR94	647	1	50 000	0	0	0	0	0	0		0	0	50 000	0	ok 2015	0	0	0	0	0	0	0	0	69 377	221 793	42 020	71 868	50 000				
CR95	2 884	1	150 000	0	18 754	0	6 807	0	0		384 125	12 804	552 879	358 728	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	425 537	1 502 702	198 721	494 444	911 607				
CR96	1 135	2	50 000	1 575	9 950	0	1 550	0	0		193 155	6 439	253 105	174 927	ok 2015	0	0	ok 2027	ok 2021	0	0	0	ok 2015	167 470	665 644	126 075	170 452	428 032	-260 562	237 612	-174 955	coût dispro
CR97	0	2	0	0	0	0	0	0	0		238 663	7 955	238 663	145 521	0	0	0	0	0	0	0	0	ok 2015	0	83 260	0	0	384 184				
CR98	8 294	4	4 132 500	179 260	5 335 140	800 000	81 090	0	0		392 251	13 075	9 859 891	19 635 120	ok 2015	cb 2027	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	10 063 851	14 518 239	921 290	2 697 444	29 495 011	-19 431 160	-14 976 771	-13 532 158	coût dispro
CR99	0	2	0	0	0	0	0	0	0		116 696	3 890	116 696	71 153	0	0	0	0	0	0	0	0	ok 2015	0	60 585	0	0	187 849				
CR100	2 893	1	3 543 736	626 907	100 274	0	23 098	0	0		236 772	7 892	3 880 783	12 034 282	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	426 865	9 766 614	199 341	328 201	15 915 064				
CR101	1 385	2	1 450 000	65 272	1 250	0	0	0	0		0	0	1 451 250	1 193 952	ok 2015	0	0	ok 2015	0	0	0	0	0	8 836 892	8 935 866	0	0	2 645 202				

*Dispro. cost

CR102	4 050	1	860 410	842 826	222 512	0	13 986	0	0		178 143	5 938	1 261 065	15 781 453	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	597 582	202 846 571	279 064	615 529	17 042 518	-16 444 937	185 804 053	-13 036 433	coût dispro *
CR103	2 058	1	100 000	0	52 352	0	12 276	0	0		224 871	7 496	377 223	361 670	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	303 660	28 144 555	141 806	277 885	738 894				
CR104	5 380	3	50 000	0	275 864	0	31 982	0	0		366 591	12 220	692 455	808 537	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	9 561 655	10 281 980	370 707	618 338	1 500 993				
CR710	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	#N/A	#N/A	0	0	0				
CR106	5 436	4	250 000	0	254 866	0	8 822	0	0		978 045	15 968	1 482 911	453 461	ok 2015	0	ok 2015	ok 2027	ok 2015	0	0	0	ok 2015	995 855	7 854 971	603 826	3 025 723	1 936 372	-940 517	5 918 599	-553 243	coût dispro
CR107	6 007	1	489 625	0	256 328	0	63 649	0	0		0	0	745 953	1 164 266	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	886 339	355 083 062	667 252	3 476 414	1 910 219				
CR108	1 676	3	100 000	0	77 800	0	0	0	0		770 858	12 585	948 658	230 213	ok 2015	0	0	ok 2021	0	0	0	0	ok 2015	265 216	1 556 628	186 169	300 784	1 178 871	-913 656	377 757	-677 881	coût dispro
CR109	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 026	0	0	0				
CR110	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	7 927	0	0	0				
CR111	1 308	2	1 098 775	31 174	1 000	0	0	0	0		192 891	5 321	1 292 666	667 564	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	170 620	460 433	136 470	145 291	1 960 230				
CR112	10 392	1	2 347 536	0	646 095	32 000	50 654	0	0		950 034	22 464	3 943 665	1 922 824	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	1 533 351	929 870 909	716 058	11 045 418	5 866 489	-4 333 138	924 004 420	-3 159 840	coût dispro
CR113	5 319	1	1 824 700	0	27 662	0	13 391	0	0		146 913	3 474	1 999 276	308 492	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	770 039	2 959 084	366 504	721 039	2 307 768				
CR114	0	1	0	0	0	0	0	0	0		202 779	4 795	202 779	87 706	0	0	0	0	0	0	0	0	ok 2015	0	24 441	0	0	290 485				
CR115	5 604	3	678 851	1 077 431	421 666	12 000	16 382	0	0		223 863	5 293	1 324 380	20 324 398	ok 2015	ok 2027	0	ok 2027	ok 2015	0	0	0	ok 2015	9 295 799	9 658 078	260 129	386 142	21 648 779	-12 352 979	-11 990 701	-8 023 224	coût dispro
CR116	3 796	3	0	0	1 104 616	160 000	20 943	0	0		258 850	6 121	1 363 466	3 421 774	ok 2015	ok 2015	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	9 288 670	10 092 493	261 562	433 012	4 785 240	4 503 430	5 307 253	5 460 478	coût non dispro
CR117	407	1	182 206	0	1 009 950	160 000	1 550	0	0		247 560	5 854	1 439 716	3 062 153	ok 2015	0	ok 2027	ok 2015	ok 2021	0	0	0	ok 2015	60 053	235 565	28 044	35 367	4 501 869	-4 441 815	-4 266 303	-3 541 442	coût dispro
CR118	892	0	0	0	1 500	0	0	0	0		0	0	1 500	0	ok 2015	0	0	ok 2015	0	0	0	0	0	131 616	249 893	0	0	1 500				
CR119	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	56 045	0	0	0				
CR120	1 088	2	434 212	23 142	5 108	0	5 021	0	0		0	0	439 320	515 152	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	143 839	266 376	81 233	120 854	954 472				
CR121	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 875	0	0	0				
CR122	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR123	11 201	4	3 386 345	11 810	64 564	0	41 383	0	0		2 648 845	43 246	6 099 754	1 764 078	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	2 442 699	19 924 574	1 244 197	9 036 235	7 863 832				
CR124	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR125	2 313	2	898 066	0	317 358	48 000	6 944	0	0		372 352	10 272	1 587 776	1 192 929	ok 2015	0	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	341 286	805 238	256 926	327 801	2 780 705	-2 439 419	-1 975 467	-1 883 278	coût dispro
CR126	12 692	3	3 761 971	0	1 507 731	152 000	48 311	0	0		821 700	22 668	6 091 402	4 078 727	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 872 718	3 716 085 479	1 409 816	9 303 046	10 170 129				
CR127	12 701	3	3 217 062	7 209	161 574	0	27 037	0	0		1 638 637	45 204	5 017 273	1 453 298	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 874 046	793 910 509	1 410 816	15 232 079	6 470 571				
CR128	6 599	2	2 355 004	0	817 590	112 000	20 345	0	0		260 448	7 185	3 433 041	2 552 283	cb 2027	0	cb 2027	ok 2021	ok 2015	0	0	0	ok 2015	795 376	1 989 714	500 020	733 011	5 985 324	-5 189 948	-3 995 611	-3 992 884	coût dispro
CR129	2 345	2	986 405	0	172 212	0	13 391	0	0		261 420	7 212	1 420 037	376 863	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	346 007	84 480 125	260 481	545 841	1 796 901	-1 450 893	82 683 224	-1 091 513	coût dispro
CR130	3 868	3	990 965	0	14 574	0	15 063	0	0		406 888	11 225	1 412 427	480 852	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	570 728	37 971 471	429 654	1 369 740	1 893 279				
CR131	3 960	2	1 174 300	0	72 166	0	17 452	0	0		532 486	14 689	1 778 951	587 929	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	584 302	25 517 285	439 873	739 199	2 366 880	-1 782 578	23 150 405	-1 309 202	coût dispro
CR132	0	2	0	0	0	0	0	0	0		251 789	6 946	251 789	127 055	0	0	0	0	0	0	0	0	ok 2015	0	60 516	0	0	378 844				
CR133	16 706	2	4 994 317	59 251	8 064 960	1 220 000	129 690	0	0		239 994	6 621	13 299 272	25 893 493	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	2 361 377	20 625 513	1 855 688	6 113 295	39 192 765				
CR134	3 935	2	100 000	0	209 716	0	41 208	0	0		181 519	5 007	491 235	845 374	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	580 614	95 917 903	437 096	673 727	1 336 610				
CR135	1 904	2	1 381 034	39 185	9 054	0	1 687	0	0		269 031	7 422	1 659 119	883 392	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	280 937	4 735 128	211 495	255 448	2 542 512				
CR136	3 841	2	1 093 892	244 526	102 000	16 000	0	0	0		370 845	10 230	1 566 737	4 952 679	ok 2021	0	ok 2015	ok 2015	0	0	0	0	ok 2015	566 744	104 825 860	426 655	648 027	6 519 416	-5 952 672	98 306 445	-4 648 789	coût dispro
CR137	0	2	0	0	0	0	0	0	0		177 780	4 316	177 780	78 955	0	0	0	0	0	0	0	0	ok 2015	0	46 241	0	0	256 735				
CR138	5 518	1	3 117 195	232 579	527 883	64 000	31 788	0	0		315 414	7 658	3 960 493	6 146 570	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	814 187	243 643 874	380 216	842 371	10 107 063				
CR139	1 210	3	547 607	10 925	136 160	0	20 682	0	0		177 534	4 310	861 301	657 012	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	447 163	1 420 530	134 406	187 684	1 518 313	-1 071 150	-97 783	-767 488	coût dispro
CR140	1 219	2	50 000	0	5 358	0	5 021	0	0		161 413	3 919	216 771	163 530	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	142 550	3 661 999	86 339	135 405	380 301				
CR141	3 960	2	100 000	0	423 823	0	11 320	0	0		257 631	6 255	781 454	321 489	ok 2015	ok 2015	0	ok 2021	ok 2015	0	0	0	ok 2015	584 302	78 297 672	439 873	543 464	1 102 943	-518 641	77 194 729	-298 052	coût dispro
CR142	3 154	1	599 200	249 600	54 397	0	38 113	0	0		388 664	9 436	1 042 261	5 435 473	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	465 376	8 840 574	217 325	397 855	6 477 734				
CR143	5 915	2	50 000	76 032	261 724	0	99 247	0	0		470 315	11 419	782 039	3 415 080	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	872 765	235 584 837	657 033	937 862	4 197 119				
CR144	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR145	4 527	2	592 500	44 846	27 582	0	11 354	0	0		764 609	18 564	1 384 691	1 367 589	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	667 964	6 208 616	502 855	2 421 489	2 752 280				
CR146	17 407	2	2 642 268	563 083	612 071	16 000	156 836	0	0		563 759	13 688	3 818 098	13 711 827	ok 2021	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	2 568 422	22 341 522 693	1 933 554	20 942 751	17 529 925	-14 961 504	22 323 992 767	-11 455 519	coût dispro
CR147	2 378	2	50 000	0	38 912	0	25 291	0	0		360 600	8 755	449 512	622 772	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	330 424	18 739 418	200 130	264 146	1 072 284				
CR148	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR149	2 658	2	1 577 500	71 086	10 304	0	1 687	0	0		250 488	6 082	1 838 292	1 442 412	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	392 191	56 119 626	295 248	727 495	3 280 703				
CR150	3 651	3	3 367 500	151 549	23 540	0	19 750	0	0		0	0	3 391 040	3 133 403	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	1 234 642	1 782 344	318 528	405 550	6 524 443				
CR151	45 379	3	1 342 500	71 111	1 028 498	0	389 759	0	0		3 208 108	50 544	5 579 106	9 354 775	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	6 863 579	408 360 840	5 040 660	115 880 609	14 933 881				
CR152	4 664	2	1 917 500	86 422	415 064	40 000	30 507	0	0		683 786	18 439	3 016 350	3 207 836	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	688 178	5 740 790	518 073	2 151 166	6 224 185				
CR153	8 305	2	350 000	0	436 584	0	48 872	0	0		548 270	14 785	1 334 854	1 164 411	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	1 225 412	2 092 001 855	922 512	5 286 005	2 499 265	-1 273 853	2 089 502 590	-774 000	coût dispro
CR154	12 960	2	997 500	26 931	803 191	16 000	97 451	0	0		1 850 000	60 000	3 650 691	3 665 381	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 912 262	7 620 266 741	1 439 585	10 200 741	7 316 072				
CR155	6 615	3	402 500	15 926	53 470	0	22 480	0	0		1 644 609	24 793	2 100 579	1 156 038	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	976 050	122 205 035	734 788	1 047 222	3 256 617				
CR156	4 753	2	3 470 000	154 008	82 416	0	12 953	0	0		515 000	16 000	4 067 416	3 346 722	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	701 310	418 564 685	527 959	1 797 984	7 414 138	-6 712 827	411 150 547	-5 230 000	coût dispro
CR157	2 182	2	0	0	16 108	0	6 944	0	0		412 517	8 289	428 625	278 646	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	321 956	933 776	242 375	287 810	707 271				
CR711	1 981	2	185 000	8 370	70 068	0	4 948	0	0		396 622	7 970	651 690	389 394	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	#N/A	#N/A	220 048	435 229	1 041 084	#N/A	#N/A	#N/A	coût dispro
CR712	11 619	2	4 960 000	218 917	903 632	76 000	72 962	0	0		758 426	15 240	6 622 058	7 008 014	ok 2015	0	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	#N/A	#N/A	1 290 628	8 508 704	13 630 072	#N/A	#N/A	#N/A	coût dispro
CR160	9 535	2	3 122 141	187 923	1 012 538	93 664	82 369	0	0		289 133	5 810	4 423 813	6 763 766	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 406 900	2 283 867 916	1 059 139	5 362 234	11 187 579				
CR161	2 001	1	0	0	5 608	0	5 021	0	0		642 342	17 322	647 950	408 691	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	295 250	1 112 799	137 878	325 142	1 056 641				
CR162	2 753	1	200 000	0	1 750	0	0	0	0		477 995	12 890	679 745	235 780	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	406 208	27 797 828	189 695	738 678	915 524				

*Dispro. cost

CR163	0	2	0	0	0	0	0	0	0		157 958	4 260	157 958	77 916	0	0	0	0	0	0	0	0	ok 2015	0	74 919	0	0	235 873				
CR164	996	3	0	0	151 408	0	5 021	0	0		548 104	14 780	699 512	362 207	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	146 961	472 704	110 635	122 757	1 061 719	-914 758	-589 015	-702 414	coût dispro *
CR165	3 731	3	0	1 529	382 624	48 000	18 008	0	0		257 247	6 937	639 871	1 362 277	ok 2015	0	ok 2015	ok 2027	ok 2015	0	0	0	ok 2015	550 513	87 721 152	414 436	1 015 116	2 002 148	-1 451 635	85 719 004	-1 051 205	coût dispro
CR166	7 871	2	1 432 500	62 238	2 878 012	403 463	38 138	0	0		548 104	14 780	4 858 616	9 486 618	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	1 161 375	657 751 674	874 304	2 350 626	14 345 234				
CR167	5 362	1	50 000	0	144 578	0	43 891	0	0		0	0	194 578	802 848	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	0	791 169	156 044 593	595 606	1 071 324	997 426				
CR168	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	29 642	0	0	0				
CR169	6 732	2	7 867 500	401 542	696 422	64 000	51 306	0	0		586 195	15 808	9 150 117	9 743 355	cb 2027	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	993 314	38 185 708	747 785	1 830 329	18 893 473	-17 900 159	19 292 235	-14 121 464	coût dispro
CR170	3 881	2	342 500	15 544	22 224	0	17 113	0	0		916 626	13 818	1 281 350	850 138	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	572 646	311 720 478	431 098	1 834 783	2 131 488				
CR171	3 910	2	474 114	0	35 508	0	6 474	0	0		210 606	3 175	720 228	176 499	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	576 925	109 252 467	434 319	611 573	896 727				
CR172	15 584	3	4 455 000	200 545	957 918	0	31 679	0	0		497 539	7 501	5 910 457	4 385 056	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	2 154 020	7 403 951	1 731 057	2 154 050	10 295 513	-8 141 492	-2 891 562	-6 082 390	coût dispro
CR173	6 312	3	1 447 095	0	403 190	24 000	52 345	0	0		710 621	10 713	2 560 906	1 592 466	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	931 342	274 095 908	701 131	2 074 476	4 153 372				
CR174	6 033	2	0	3 092	53 366	0	38 793	0	0		1 198 839	23 710	1 252 205	1 199 860	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	890 176	354 971 066	670 140	2 240 844	2 452 065	-1 561 889	352 519 001	-1 071 476	coût dispro
CR175	21 137	4	100 000	35 146	1 243 606	96 000	71 343	0	0		530 501	10 492	1 874 107	3 895 849	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	3 682 425	54 131 508	2 347 879	15 548 966	5 769 956				
CR176	7 268	2	150 000	0	988 320	96 000	25 150	0	0		306 400	6 060	1 444 720	2 326 926	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	1 072 401	1 043 001 874	807 323	2 084 545	3 771 646	-2 699 245	1 039 230 228	-1 944 916	coût dispro
CR177	3 918	2	150 000	0	2 211 253	337 095	11 704	0	0		411 384	8 136	2 772 637	6 529 073	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	595 811	97 035 453	269 969	729 384	9 301 710				
CR178	7 346	2	1 046 698	2 396	128 314	0	27 532	0	0		449 679	8 894	1 624 691	710 118	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 083 910	2 112 039 713	815 987	6 187 112	2 334 809				
CR179	2 540	3	777 430	0	35 112	0	17 881	0	0		608 243	12 030	1 420 785	547 124	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	437 741	1 032 532	175 018	339 266	1 967 909				
CR180	4 124	1	1 600 096	20 794	18 108	0	6 944	0	0		553 153	10 940	2 171 358	707 494	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	608 501	30 143 072	284 163	2 485 328	2 878 852				
CR181	2 326	1	0	0	27 162	0	16 961	0	0		362 961	7 178	390 123	441 560	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	343 204	1 288 607	160 272	425 466	831 683				
CR182	1 080	1	100 000	0	1 000	0	0	0	0		334 079	6 607	435 079	120 860	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	140 879	529 378	74 417	128 993	555 939	-415 060	-26 562	-303 872	coût dispro
CR183	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	35 374	0	0	0				
CR184	745	2	50 000	0	0	0	0	0	0		152 329	3 013	202 329	55 108	ok 2015	0	0	0	0	0	0	0	ok 2015	94 295	224 630	64 603	82 754	257 437				
CR185	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR186	512	0	250 000	11 262	250	0	0	0	0		0	0	250 250	206 010	ok 2015	0	0	ok 2015	0	0	0	0	0	52 692	136 780	0	0	456 260				
CR187	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	79 671	0	0	0				
CR188	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	62 305	0	0	0				
CR189	5 154	1	0	38 219	499 657	29 280	26 426	0	0		0	0	499 657	1 718 066	ok 2015	0	ok 2021	ok 2015	ok 2015	0	0	0	0	760 478	264 236 936	572 502	715 707	2 217 723	-1 457 245	262 019 212	-1 013 700	coût dispro
CR190	8 063	3	450 000	41 692	392 334	0	49 062	0	0		627 237	12 405	1 469 571	1 886 993	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	1 207 411	360 837 959	895 631	7 269 340	3 356 564	-2 149 154	357 481 394	-1 477 841	coût dispro
CR191	1 794	2	200 000	0	8 150	0	1 490	0	0		281 233	5 562	489 383	128 997	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	264 707	20 304 906	199 276	479 702	618 380				
CR192	629	1	100 000	0	0	0	0	0	0		0	0	100 000	0	ok 2015	0	0	0	0	0	0	0	0	99 535	208 686	0	0	100 000				
CR193	6 484	3	1 554 680	353 738	142 818	0	34 234	0	0		531 622	10 514	2 229 120	7 289 117	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	974 427	258 512 138	720 237	9 489 426	9 518 237				
CR194	2 127	2	350 000	0	18 866	0	4 987	0	0		376 023	7 437	744 889	227 257	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	313 841	2 685 537	236 265	1 056 396	972 146				
CR195	3 728	2	102 500	4 822	25 662	0	15 771	0	0		332 589	6 578	460 751	497 016	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	550 070	122 426 555	414 103	1 956 823	957 767				
CR196	1 250	2	227 667	3 646	9 716	0	2 902	0	0		284 394	5 625	521 777	222 659	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	184 439	5 907 026	138 849	246 971	744 436	-559 997	5 162 590	-411 110	coût dispro
CR197	38 597	3	5 748 771	75 847	1 659 650	72 000	215 760	0	0		2 111 225	36 276	9 519 646	7 314 686	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	6 651 767	42 478 148 699	2 659 515	39 237 666	16 834 332				
CR198	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR199	55 505	3	6 019 160	500 523	3 201 855	0	417 512	0	0		764 180	15 356	9 985 195	17 073 606	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	8 049 001	188 532 247	6 165 447	54 778 313	27 058 802				
CR200	359	1	0	3 056	500	0	0	0	0		156 195	3 139	156 695	113 303	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	52 971	306 233	24 737	39 760	269 998				
CR201	518	2	0	0	250	0	0	0	0		139 363	2 800	139 613	51 225	ok 2015	0	0	ok 2027	0	0	0	0	ok 2015	53 697	146 093	32 523	57 539	190 837	-137 141	-44 744	-98 973	coût dispro
CR202	969	2	0	0	9 700	0	1 550	0	0		176 047	3 538	185 747	93 061	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	104 072	234 419	63 034	107 636	278 808				
CR203	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	207 485	0	0	0				
CR204	0	2	0	0	0	0	0	0	0		92 518	1 859	92 518	34 006	0	0	0	0	0	0	0	0	ok 2015	0	47 470	0	0	126 524				
CR205	23 609	2	17 070 558	1 496 162	1 833 014	225 600	95 447	0	0		3 100 000	72 000	22 003 572	34 557 470	ok 2015	cb 2027	ok 2027	ok 2015	ok 2015	0	0	0	ok 2015	3 483 534	27 623 775 441	2 622 467	57 047 771	56 561 041	-53 077 508	27 567 214 399	-41 765 299	coût dispro
CR206	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR207	13 945	3	6 394 593	174 257	19 215 234	2 927 024	85 607	0	0		420 000	30 400	26 029 827	58 850 737	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	2 057 600	2 359 546 556	1 548 998	6 416 229	84 880 564	-82 822 964	2 274 665 991	-65 846 851	coût dispro
CR208	13 714	4	235 056	69 156	1 137 236	0	67 733	0	0		1 028 226	20 772	2 400 518	2 883 945	ok 2015	0	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	4 966 750	11 959 387	944 959	3 905 313	5 284 462	-317 713	6 674 924	739 180	coût non dispro
CR209	21 268	3	2 363 775	40 325	1 640 186	48 000	172 233	0	0		382 428	7 726	4 386 389	4 907 451	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	3 510 949	25 071 729	1 465 465	5 980 761	9 293 840				
CR210	42 604	3	150 000	0	3 073 236	196 000	111 433	0	0		1 075 898	8 146	4 299 134	5 772 569	ok 2015	0	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	5 766 044	29 644 913	2 935 616	7 043 865	10 071 702	-4 305 658	19 573 211	-2 291 318	coût dispro
CR211	44 999	3	721 737	313 186	1 886 568	0	268 069	0	0		2 494 102	23 854	5 102 408	11 068 670	ok 2015	ok 2015	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	#VALEUR!	#VALEUR!	#VALEUR!	#VALEUR!	16 171 077	#VALEUR!	#VALEUR!	#VALEUR!	
CR212	44 601	4	3 494 088	29 326	2 205 107	18 000	224 069	0	0		3 227 695	58 709	8 926 890	6 038 267	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	6 580 926	83 149 172 659	4 954 240	60 415 121	14 965 157				
CR213	182 371	5	5 220 524	1 929 869	9 802 275	488 000	1 004 827	0	0		5 078 165	127 153	20 100 964	64 933 945	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	26 195 622	2 768 099 044	20 257 611	792 692 605	85 034 909				
CR214	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR215	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR216	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR217	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR218	1 513	2	0	0	8 358	0	1 451	0	0		180 962	3 656	189 320	93 414	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	149 510	6 342 256	90 555	168 063	282 733				
CR219	1 180	4	50 000	0	5 858	0	5 021	0	0		245 811	4 966	301 669	182 680	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	158 049	256 262	78 011	131 073	484 350				
CR220	0	4	0	0	0	0	0	0	0		107 767	2 177	107 767	39 824	0	0	0	0	0	0	0	0	ok 2015	0	23 214	0	0	147 590				
CR221	1 013	3	0	0	154 800	0	0	0	0		124 051	2 506	278 851	45 841	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	121 824	1 992 277	73 786	112 523	324 692				
CR714	4 728	4	50 000	0	204 530	0	23 220	0	0		0	0	254 530	424 741	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	#N/A	#N/A	311 751	525 182	679 271				
CR223	10 650	4	337 712	123 624	423 624	0	80 100	0	0		1 673 700	33 812	2 435 036	4 345 023	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	2 517 697	11 944 257	1 182 993	5 162 842	6 780 059	-4 262 362	5 164 198	-2 906 350	coût dispro
CR224	7 878	3	2 065 000	92 942	569 804	0	93 302	0	0		216 886	4 382	2 851 690	3 486 922	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	1 122 927	5 583 444	875 081	1 617 143	6 338 612				
CR225	4 904	3	0	4 730	888 620	48 000	16 765	0	0		616 062	12 446	1 504 682	1 498 864	ok 2015	ok 2015	0	ok 2021	ok 2015	0	0	0	ok 2015	1 437 239	4 368 394	337 909	1 358 776	3 003 545	-1 566 307	1 364 849	-965 598	coût dispro

*Dispro. cost

CR226	0	2	0	0	0	0	0	0	0		134 527	2 718	134 527	49 713	0	0	0	0	0	0	0	0	ok 2015	0	19 308	0	0	184 240				
CR227	0	2	0	0	0	0	0	0	0		106 320	2 148	106 320	39 289	0	0	0	0	0	0	0	0	ok 2015	0	23 310	0	0	145 609				
CR228	13 721	4	100 000	3 045	1 870 910	144 000	108 280	0	0		840 884	16 988	2 811 794	4 981 146	ok 2015	cb 2027	0	ok 2015	ok 2021	0	0	0	ok 2015	3 051 024	11 702 260	945 441	4 937 003	7 792 940	-4 741 916	3 909 319	-3 183 328	coût dispro *
CR229	6 175	2	216 040	114 163	1 039 970	144 000	24 685	0	0		425 147	8 589	1 681 157	5 330 963	ok 2015	ok 2027	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	911 128	1 529 998 583	685 914	4 621 656	7 012 120	-6 100 992	1 522 986 463	-4 698 568	coût dispro
CR230	4 813	1	2 739 080	105 861	743 068	96 000	20 639	0	0		941 213	19 014	4 423 361	4 417 784	ok 2015	ok 2015	0	ok 2015	ok 2027	0	0	0	ok 2015	710 163	195 002 991	331 638	1 754 562	8 841 145	-8 130 982	186 161 846	-6 362 753	coût dispro
CR231	366	0	153 270	3 054	250	0	0	0	0		0	0	153 520	55 867	ok 2015	0	0	ok 2015	0	0	0	0	0	54 004	501 160	0	0	209 387				
CR232	1 381	1	193 686	15 389	15 300	0	2 980	0	0		469 606	9 487	678 592	509 535	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	203 768	1 496 695	95 157	440 331	1 188 128				
CR233	1 123	2	0	1 652	5 108	0	2 046	0	0		461 045	18 239	466 153	401 266	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	133 366	270 599	80 777	124 742	867 418				
CR234	3 933	1	0	0	119 524	0	32 462	0	0		0	0	119 524	593 796	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	0	580 318	156 027 840	436 874	549 199	713 320				
CR235	2 105	2	1 021 490	38 495	0	0	0	0	0		276 043	10 920	1 297 533	903 906	ok 2015	0	0	0	0	0	0	0	ok 2015	310 595	44 754 095	233 822	433 933	2 201 440				
CR236	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	32 779	0	0	0				
CR237	797	0	1 540 820	70 568	18 504	0	22 242	0	0		0	0	1 559 324	1 697 687	ok 2021	0	0	ok 2015	ok 2015	0	0	0	0	98 639	1 331 947	0	0	3 257 011	-3 158 372	-1 925 064	-2 506 970	coût dispro
CR238	2 999	1	50 000	0	108 206	0	17 333	0	0		0	0	158 206	317 054	ok 2015	0	0	ok 2015	ok 2021	0	0	0	0	467 126	991 615	0	0	475 260				
CR239	5 114	2	219 772	198 544	91 778	0	41 579	0	0		431 016	17 051	742 566	4 704 245	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	754 576	707 912 052	568 059	2 075 485	5 446 811				
CR240	1 305	2	614 775	7 675	1 250	0	0	0	0		293 253	11 601	909 278	352 594	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	192 554	2 830 135	144 958	453 670	1 261 871	-1 069 317	1 568 263	-816 943	coût dispro
CR241	2 896	3	0	104 320	17 616	0	7 962	0	0		574 068	22 710	591 684	2 469 284	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	427 308	6 527 317	321 685	2 413 751	3 060 968				
CR242	8 844	3	710 247	92 303	54 324	0	19 047	0	0		587 010	23 222	1 351 581	2 461 596	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 340 327	1 671 763 468	982 384	8 967 047	3 813 177				
CR243	434	1	0	1 560	7 900	0	1 490	0	0		0	0	7 900	55 793	ok 2015	0	0	ok 2015	ok 2021	0	0	0	0	40 782	124 164	24 700	48 208	63 693				
CR244	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	32 273	0	0	0				
CR720	462	1	0	0	6 356	0	1 451	0	0		145 772	5 767	152 128	132 028	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	#N/A	#N/A	23 213	31 834	284 157	#N/A	#N/A	#N/A	coût dispro
CR721	147	2	0	14 297	250	0	0	0	0		181 806	7 192	182 056	393 081	ok 2015	0	0	ok 2021	0	0	0	0	cb 2027	12 952	44 323	7 295	10 129	575 137	-562 185	-530 814	-447 157	coût dispro
CR246	1 049	1	0	4 650	10 716	0	10 637	0	0		92 837	5 087	103 553	372 690	ok 2021	0	0	ok 2015	ok 2015	0	0	0	ok 2015	154 781	428 024	72 281	137 769	476 243	-321 462	-48 219	-226 213	coût dispro
CR247	565	2	1 357 530	25 545	750	0	0	0	0		161 560	8 853	1 519 840	629 207	cb 2027	0	0	ok 2015	0	0	0	0	cb 2027	83 366	797 054	62 760	220 698	2 149 047	-2 065 681	-1 351 994	-1 635 871	coût dispro
CR248	7 797	3	556 105	10 649	448 444	0	37 597	0	0		232 411	12 735	1 236 960	1 115 458	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	#VALEUR !	#VALEUR !	#VALEUR !	#VALEUR !	2 352 418	#VALEUR !	#VALEUR !	#VALEUR !	
CR249	8 597	3	152 280	26 100	170 980	0	37 900	0	0		643 451	35 258	966 711	1 815 627	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 268 497	49 622 577	954 947	16 542 468	2 782 338				
CR250	4 170	2	4 687 425	138 490	42 270	0	35 805	0	0		689 987	27 296	5 419 682	3 687 513	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	622 666	16 463 713	287 333	3 468 222	9 107 195				
CR251	379	1	798 495	27 725	500	0	0	0	0		0	0	798 995	507 146	ok 2015	0	0	ok 2015	0	0	0	0	0	55 922	254 053	42 099	56 341	1 306 141				
CR252	334	1	746 570	31 126	250	0	0	0	0		0	0	746 820	569 352	cb 2027	0	0	ok 2021	0	0	0	0	0	39 455	146 367	23 897	37 100	1 316 172	-1 276 718	-1 169 805	-1 013 483	coût dispro
CR253	3 624	3	2 165 970	77 730	9 304	0	1 687	0	0		207 828	11 388	2 383 102	1 660 999	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	571 066	5 261 956	402 551	2 495 740	4 044 101				
CR254	1 210	2	1 264 255	44 843	500	0	0	0	0		143 524	7 864	1 408 279	964 116	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	178 537	818 994	134 406	277 076	2 372 394				
CR255	1 429	2	1 286 060	37 351	1 250	0	0	0	0		136 919	7 502	1 424 229	820 452	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	210 851	1 808 027	158 732	649 553	2 244 681				
CR256	588	1	268 255	14 955	48 602	0	7 206	0	0		0	0	316 857	405 376	ok 2015	0	0	ok 2015	ok 2027	0	0	0	0	86 760	772 561	65 315	220 977	722 233	-635 473	50 328	-491 026	coût dispro
CR257	138	2	381 215	12 982	0	0	0	0	0		59 798	3 277	441 013	297 406	cb 2027	0	0	0	0	0	0	0	ok 2015	15 796	45 801	9 567	15 329	738 420	-722 624	-692 618	-574 940	coût dispro
CR258	1 726	2	2 245 275	73 053	9 054	0	1 687	0	0		158 015	8 658	2 412 344	1 525 521	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	254 673	8 090 294	191 723	789 404	3 937 865				
CR259	1 252	2	2 142 435	64 474	316 858	48 000	4 564	0	0		156 590	8 580	2 615 883	2 297 820	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	184 734	1 694 859	139 071	669 063	4 913 703				
CR260	1 767	3	2 354 870	66 729	250 358	16 000	23 009	0	0		146 011	8 001	2 751 239	2 080 505	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	304 523	3 014 358	196 277	1 116 571	4 831 745	-4 527 222	-1 817 387	-3 560 873	coût dispro
CR261	351	2	757 910	19 689	0	0	0	0	0		97 090	5 320	855 000	457 467	ok 2021	0	0	0	0	0	0	0	ok 2015	51 790	206 748	38 989	57 936	1 312 467	-1 260 676	-1 105 719	-998 183	coût dispro
CR262	2 101	2	2 128 905	21 289	11 700	0	2 040	0	0		229 607	12 581	2 370 212	656 872	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#VALEUR !	#VALEUR !	#VALEUR !	#VALEUR !	3 027 084				
CR263	1 067	2	1 158 000	15 360	18 504	0	7 297	0	0		88 565	4 853	1 265 069	503 212	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#VALEUR !	#VALEUR !	#VALEUR !	#VALEUR !	1 768 280				
CR264	651	2	926 575	34 116	250	0	0	0	0		65 995	3 616	992 820	690 194	ok 2021	0	0	ok 2021	0	0	0	0	ok 2015	96 056	611 915	44 857	106 043	1 683 014	-1 586 959	-1 071 099	-1 250 356	coût dispro
CR265	314	1	453 580	16 576	0	0	0	0	0		58 614	3 212	512 194	361 954	ok 2027	0	0	0	0	0	0	0	ok 2015	46 331	188 532	21 636	32 146	874 149	-827 818	-685 617	-652 988	coût dispro
CR266	220	2	422 540	8 985	4 608	0	1 451	0	0		57 426	3 147	484 574	248 462	ok 2021	0	0	ok 2027	ok 2015	0	0	0	ok 2015	32 461	285 233	24 437	40 521	733 036	-700 575	-447 802	-553 967	coût dispro
CR267	4 012	3	4 124 130	139 311	75 466	0	8 533	0	0		1 350 000	40 000	5 549 596	3 436 054	ok 2021	0	0	ok 2021	ok 2015	0	0	0	cb 2027	591 975	24 079 385	276 446	4 318 826	8 985 650	-8 393 675	15 093 735	-6 596 545	coût dispro
CR268	1 106	2	0	1 530	9 966	0	3 497	0	0		95 280	5 221	105 246	187 448	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	163 192	1 270 034	122 854	326 492	292 694				
CR269	3 008	3	0	0	245 452	0	6 906	0	0		88 477	4 848	333 929	215 011	ok 2015	0	0	cb 2027	cb 2027	0	0	0	ok 2015	443 834	9 223 463	334 126	943 079	548 941	-105 107	8 674 522	4 681	coût non dispro
CR270	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	130 129	0	0	0				
CR271	1 044	1	0	0	4 608	0	2 046	0	0		0	0	4 608	37 426	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	154 043	1 240 859	115 967	190 997	42 034				
CR272	3 759	2	237 222	27 379	42 966	0	11 508	0	0		952 873	29 075	1 233 062	1 243 175	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	554 645	9 371 203	417 546	2 523 215	2 476 237	-1 921 592	6 894 966	-1 426 345	coût dispro
CR273	1 543	1	2 763 940	125 359	500	0	0	0	0		0	0	2 764 440	2 293 078	ok 2021	0	0	ok 2015	0	0	0	0	0	227 671	1 429 087	171 395	210 332	5 057 518	-4 829 847	-3 628 431	-3 818 343	coût dispro
CR274	7 599	2	2 385 426	62 417	156 565	0	32 688	0	0		489 127	14 925	3 031 117	2 012 660	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 121 241	175 333 701	844 090	1 472 088	5 043 777				
CR275	3 755	3	3 861 925	160 660	19 358	0	4 564	0	0		1 340 452	37 848	5 221 735	3 714 609	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	939 582	14 841 437	417 102	3 130 503	8 936 344	-7 996 762	5 905 093	-6 209 493	coût dispro
CR276	1 663	3	1 413 625	45 247	9 804	0	5 257	0	0		614 548	17 352	2 037 977	1 241 229	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	419 160	5 711 353	184 725	470 880	3 279 205				
CR277	5 908	2	0	1 515	193 872	0	39 491	0	0		426 559	24 969	620 431	1 206 816	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	871 732	176 975 857	656 255	1 374 817	1 827 247				
CR278	31 965	4	250 000	1 568	2 752 262	128 000	175 496	0	0		393 441	23 031	3 395 703	6 001 506	ok 2015	0	ok 2027	ok 2015	ok 2015	0	0	0	ok 2015	4 419 541	48 609 090	3 550 644	14 102 933	9 397 208	-4 977 667	39 211 882	-3 098 225	coût dispro
CR279	9 956	4	642 500	29 850	1 139 490	24 000	41 540	0	0		4 980 611	30 903	6 762 601	2 310 173	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 469 019	13 535 359	1 105 904	5 653 557	9 072 774				
CR280	3 978	3	177 228	6 226	320 622	0	46 206	0	0		4 689 389	29 097	5 187 239	1 491 327	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	595 811	8 359 203	441 873	2 003 757	6 678 566				
CR281	7 416	3	0	3 075	196 878	0	22 179	0	0		305 496	12 696	502 374	694 187	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	1 094 239	134 400 030	823 763	2 076 109	1 196 562	-102 323	133 203 468	136 989	coût non dispro
CR282	11 206	4	150 000	0	212 527	0	42 099	0	0		391 615	9 806	754 142	949 438	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	1 653 458	1 103 836 229	1 244 753	2 602 835	1 703 580				
CR283	194 183	4	12 450 000	0	5 063 314	64 800	686 907	0	0		492 524	12 332	18 005 838	13 975 826	ok 2015	ok 2015	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	25 983 982	561 134 689	21 569 677	160 412 729	31 981 665	-5 997 683	529 153 024	398 650	coût non dispro

*Dispro. cost

CR284	1 580	3	307 395	7 740	7 650	0	1 490	0	0		553 237	25 479	868 282	634 889	ok 2015	0	0	ok 2015	ok 2021	0	0	0	cb 2027	252 183	2 240 024	175 505	405 112	1 503 171	-1 250 988	736 853	-950 354	coût dispro *
CR285	5 678	1	4 133 295	41 333	94 886	0	27 698	0	0		1 521 384	70 066	5 749 565	2 544 364	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	837 795	36 260 193	391 241	6 967 940	8 293 929	-7 456 134	27 966 265	-5 797 348	coût dispro
CR286	25 246	4	8 990 734	1 188 788	770 659	0	118 720	0	0		563 934	25 971	10 325 327	24 392 044	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	3 725 075	21 836 753 392	2 804 304	17 704 142	34 717 371				
CR287	4 739	2	106 756	70 364	71 224	0	38 702	0	0		780 000	64 000	957 980	3 165 720	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	699 245	9 900 149	526 404	3 806 986	4 123 700				
CR288	178	2	0	0	0	0	0	0	0		129 431	11 015	129 431	201 494	cb 2027	0	0	0	0	0	0	0	ok 2015	15 136	123 499	9 167	19 772	330 925	-315 789	-207 426	-249 604	coût dispro
CR289	4 402	2	270 816	150 697	34 966	0	18 648	0	0		247 035	21 024	552 817	3 482 233	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	649 520	11 598 672	488 970	3 315 476	4 035 050				
CR290	6 163	3	0	18 443	40 614	0	24 698	0	0		335 633	19 840	376 247	1 152 048	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	909 357	315 498 635	684 581	6 774 555	1 528 296				
CR291	2 327	2	0	3 083	6 608	0	1 451	0	0		0	0	6 608	82 927	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	494 511	1 990 677	258 481	624 680	89 535				
CR292	1 553	1	0	1 705	8 304	0	1 687	0	0		158 617	9 376	166 921	233 560	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	178 278	939 036	88 770	107 009	400 481				
CR293	1 047	1	117 416	9 322	8 804	0	5 257	0	0		165 297	9 771	291 517	445 411	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	154 486	641 781	72 143	208 261	736 927				
CR294	4 082	1	1 497 500	70 542	560 562	80 000	15 616	0	0		217 796	12 875	2 275 858	3 274 879	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	602 304	209 244 005	281 269	911 898	5 550 737				
CR295	9 109	4	4 647 500	224 500	356 024	16 000	24 727	0	0		763 443	45 130	5 766 967	5 677 049	ok 2015	0	ok 2021	ok 2021	ok 2015	0	0	0	ok 2015	2 325 352	15 333 938	627 653	5 721 544	11 444 016	-9 118 664	3 889 923	-6 829 861	coût dispro
CR296	899	3	0	3 023	1 000	0	0	0	0		252 136	14 905	253 136	327 926	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	922 220	2 647 155	61 945	254 489	581 062				
CR297	7 882	2	460 640	18 441	863 056	80 000	19 877	0	0		137 078	8 103	1 460 774	2 312 493	ok 2015	ok 2015	0	ok 2021	ok 2015	0	0	0	ok 2015	1 162 998	650 158 635	875 526	1 736 994	3 773 266	-2 610 269	646 385 369	-1 855 615	coût dispro
CR298	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	41 176	0	0	0				
CR299	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	67 164	0	0	0				
CR300	585	2	67 500	3 072	250	0	0	0	0		0	0	67 750	56 191	ok 2015	0	0	ok 2015	0	0	0	0	0	59 147	186 888	35 824	64 981	123 941				
CR301	636	1	0	0	16 108	0	20 034	0	0		0	0	16 108	366 463	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	93 842	288 336	0	0	382 571				
CR302	872	1	0	1 625	48 500	0	0	0	0		0	0	48 500	29 724	ok 2015	0	0	ok 2027	0	0	0	0	0	88 200	238 104	0	0	78 224	9 976	159 880	25 621	coût non dispro
CR303	1 804	3	476 025	4 760	24 662	0	12 796	0	0		301 012	13 863	801 699	574 718	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	332 347	1 105 624	124 304	249 271	1 376 417				
CR304	1 042	1	915 060	9 151	1 250	0	0	0	0		257 178	11 844	1 173 488	384 036	ok 2021	0	0	ok 2015	0	0	0	0	cb 2027	153 748	1 703 400	71 799	312 750	1 557 524	-1 403 775	145 877	-1 092 271	coût dispro
CR305	1 294	2	2 240 300	75 253	8 804	0	9 422	0	0		307 797	14 175	2 556 901	1 808 173	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	190 931	1 955 961	143 736	412 036	4 365 075	-4 174 144	-2 409 114	-3 301 129	coût dispro
CR306	845	2	912 015	9 120	17 254	0	3 832	0	0		195 459	9 002	1 124 728	401 580	ok 2015	0	0	ok 2021	ok 2015	0	0	0	cb 2027	124 681	1 093 674	93 862	289 956	1 526 308	-1 401 627	-432 634	-1 096 365	coût dispro
CR307	570	1	98 593	1 532	250	0	0	0	0		0	0	98 843	28 028	ok 2015	0	0	ok 2015	0	0	0	0	0	84 104	474 393	62 903	63 315	126 871				
CR308	862	1	314 217	0	500	0	0	0	0		0	0	314 717	0	ok 2015	0	0	ok 2021	0	0	0	0	0	110 163	225 589	66 723	95 750	314 717	-204 554	-89 129	-141 611	coût dispro
CR309	5 269	1	50 000	7 728	52 824	0	23 212	0	0		0	0	102 824	565 956	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	777 447	572 014 160	585 276	2 141 576	668 780				
CR310	7 059	1	3 198 180	145 879	251 844	0	43 907	0	0		0	0	3 450 024	3 471 570	ok 2021	0	ok 2015	ok 2015	ok 2015	0	0	0	0	1 041 563	1 187 596 169	784 108	2 042 521	6 921 594	-5 880 031	1 180 674 575	-4 495 712	coût dispro
CR311	0	2	0	0	0	0	0	0	0		53 990	4 595	53 990	84 050	0	0	0	0	0	0	0	0	cb 2027	0	19 858	0	0	138 040	-138 040	-118 182	-110 432	coût dispro
CR312	377	2	0	1 544	750	0	0	0	0		55 647	4 736	56 397	114 874	ok 2015	0	0	ok 2021	0	0	0	0	ok 2015	41 163	154 732	24 931	41 877	171 271	-130 108	-16 539	-95 853	coût dispro
CR313	470	2	0	21 772	0	0	0	0	0		73 688	6 271	73 688	512 978	ok 2015	0	0	0	0	0	0	0	ok 2015	69 349	326 831	52 207	106 024	586 667				
CR314	271	2	0	3 040	0	0	0	0	0		103 095	8 774	103 095	216 101	ok 2015	0	0	0	0	0	0	0	cb 2027	39 986	110 975	28 569	30 102	319 196	-279 209	-208 221	-215 370	coût dispro
CR315	1 744	2	0	15 240	20 150	0	4 080	0	0		174 079	14 815	194 229	624 406	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	257 329	2 355 881	193 722	924 012	818 635	-561 306	1 537 246	-397 579	coût dispro
CR316	230	1	0	1 512	0	0	0	0	0		103 035	8 769	103 035	188 063	ok 2015	0	0	0	0	0	0	0	ok 2015	33 937	256 575	15 848	21 968	291 098				
CR317	829	1	818 865	22 679	0	0	0	0	0		167 229	6 950	986 094	541 964	ok 2015	0	0	0	0	0	0	0	ok 2015	122 320	1 277 799	57 122	252 921	1 528 058				
CR318	3 286	2	0	0	25 662	0	9 821	0	0		189 564	7 878	215 226	323 750	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	484 853	52 345 288	226 421	382 931	538 976				
CR319	0	2	0	0	0	0	0	0	0		107 711	4 476	107 711	81 881	0	0	0	0	0	0	0	0	cb 2027	0	35 482	0	0	189 592	-189 592	-154 110	-151 674	coût dispro
CR320	3 107	1	4 230 010	188 258	123 314	0	21 272	0	0		2 037 022	30 298	6 390 346	4 386 951	ok 2015	0	0	ok 2015	ok 2021	0	0	0	cb 2027	458 441	4 491 162	214 087	1 256 231	10 777 297	-10 318 856	-6 286 135	-8 163 397	coût dispro
CR321	15 035	4	4 158 032	203 915	226 504	0	89 362	0	0		1 727 978	25 702	6 112 514	5 834 773	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	2 218 431	213 889 494	1 670 075	15 058 303	11 947 287	-9 728 856	201 942 207	-7 339 399	coût dispro
CR322	93	0	151 515	1 515	0	0	0	0	0		0	0	151 515	27 715	ok 2015	0	0	0	0	0	0	0	0	12 023	86 067	0	0	179 230				
CR323	225	3	0	3 033	0	0	0	0	0		0	0	0	55 488	ok 2015	0	0	0	0	0	0	0	0	1 088 112	1 272 923	24 993	28 483	55 488				
CR324	402	1	606 165	6 062	250	0	0	0	0		0	0	606 415	110 880	ok 2015	0	0	ok 2015	0	0	0	0	0	63 614	542 176	0	0	717 295				
CR325	267	1	0	0	250	0	0	0	0		0	0	250	0	ok 2015	0	0	ok 2015	0	0	0	0	0	24 095	127 632	14 594	29 658	250				
CR326	8 138	1	50 000	1 514	365 838	0	51 533	0	0		0	0	415 838	970 340	ok 2015	0	0	ok 2027	ok 2015	0	0	0	0	1 200 771	1 405 927 458	903 962	2 645 160	1 386 178	-185 407	1 404 541 280	91 828	coût non dispro
CR327	3 090	3	61 558	106 185	9 554	0	1 687	0	0		552 295	16 364	623 407	2 272 529	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	455 933	7 928 135	343 234	2 109 820	2 895 936				
CR328	10 591	2	100 000	1 515	355 374	0	52 212	0	0		0	0	455 374	982 779	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	0	1 562 714	1 774 857 643	1 176 439	6 306 428	1 438 153				
CR329	28 076	3	250 000	0	1 006 402	0	203 281	0	0		154 984	4 592	1 411 386	3 802 413	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	3 770 473	50 006 679	3 118 657	14 442 677	5 213 799	-1 443 326	44 792 880	-400 566	coût dispro
CR330	37 499	1	100 000	0	498 262	0	47 879	0	0		0	0	598 262	875 804	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	0	5 248 792	29 143 977	4 165 356	8 638 123	1 474 066				
CR331	8 295	3	0	28 884	148 128	0	51 859	0	0		651 021	19 290	799 149	1 829 804	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	1 223 936	20 973 203	921 401	8 468 308	2 628 953	-1 405 017	18 344 250	-879 226	coût dispro
CR332	248	2	697 125	22 721	0	0	0	0	0		1 224 550	12 800	1 921 675	649 756	ok 2021	0	0	0	0	0	0	0	cb 2027	36 593	129 870	23 114	27 548	2 571 431	-2 534 838	-2 441 560	-2 020 552	coût dispro
CR333	19 154	3	10 016 680	359 150	1 560 771	114 000	144 851	0	0		4 593 066	84 226	16 170 517	12 845 141	ok 2015	ok 2015	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	2 850 893	6 673 875 705	2 127 610	54 938 670	29 015 658				
CR334	7 404	2	152 835	35 509	71 120	0	38 495	0	0		1 936 543	48 800	2 160 498	2 246 330	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 092 468	38 088 968	822 430	12 191 935	4 406 828				
CR335	143 060	3	6 900 000	7 630	4 190 176	0	687 257	0	0		1 352 249	33 600	12 442 425	13 325 510	ok 2015	0	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	19 721 749	676 918 591	15 890 979	197 196 393	25 767 935	-6 046 186	651 150 656	-892 599	coût dispro
CR336	2 608	3	788 930	33 229	66 608	0	6 944	0	0		218 548	6 476	1 074 086	853 302	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	384 813	1 476 211	289 694	598 672	1 927 388	-1 542 575	-451 176	-1 157 097	coût dispro
CR337	848	3	2 117 875	75 429	250	0	0	0	0		386 796	11 461	2 504 921	1 589 384	ok 2027	0	0	ok 2015	0	0	0	0	cb 2027	125 123	1 438 118	94 195	311 436	4 094 305	-3 969 182	-2 656 187	-3 150 321	coût dispro
CR338	2 340	3	0	16 761	9 054	0	1 687	0	0		435 574	13 921	444 628	592 101	ok 2015	0	0	ok 2021	ok 2015	0	0	0	cb 2027	345 270	9 836 692	259 925	1 679 038	1 036 729	-691 460	8 799 963	-484 114	coût dispro
CR339	2 274	3	0	7 598	9 400	0	1 980	0	0		283 013	11 369	292 413	383 159	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	384 715	9 891 137	252 594	1 665 854	675 573				
CR340	897	2	0	1 521	5 358	0	1 451	0	0		196 355	5 818	201 713	160 794	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	117 008	431 589	99 638	127 921	362 507				
CR341	2 683	3	100 000	0	13 824	0	19 228	0	0		149 847	3 611	263 671	417 767	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	424 567	11 831 944	298 025	419 124	681 438				
CR342	1 679	3	50 000	3 074	9 054	0	2 282	0	0		254 872	6 142	313 926	210 317	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	265 690	1 410 748	115 691	306 637	524 244	-258 553	886 504	-153 705	coût dispro

*Dispro. cost

CR343	1 814	3	0	13 740	250	0	0	0	0		1 554 328	38 215	1 554 578	950 371	ok 2015	0	0	ok 2021	0	0	0	0	cb 2027	293 885	4 344 283	201 498	981 259	2 504 948	-2 211 064	1 839 335	-1 710 074	coût dispro *
CR344	743	2	0	6 772	8 554	0	5 257	0	0		222 740	7 644	231 294	359 862	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	109 630	1 778 062	82 532	264 717	591 155	-481 525	1 186 906	-363 294	coût dispro
CR345	4 196	3	0	4 605	13 466	0	10 042	0	0		312 881	12 569	326 347	497 819	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	619 124	8 756 684	466 088	3 010 336	824 166				
CR346	58	3	150 975	1 510	250	0	0	0	0		163 689	4 024	314 914	101 233	ok 2015	0	0	ok 2027	0	0	0	0	cb 2027	34 096	92 106	4 766	6 443	416 146	-382 051	-324 040	-298 821	coût dispro
CR347	171	2	0	0	0	0	0	0	0		155 969	4 959	155 969	90 703	ok 2027	0	0	0	0	0	0	0	cb 2027	15 560	131 888	9 425	18 995	246 672	-231 112	-114 785	-181 777	coût dispro
CR348	268	1	0	1 520	0	0	0	0	0		0	0	0	27 803	ok 2015	0	0	0	0	0	0	0	0	39 544	216 503	29 503	29 769	27 803				
CR349	250	1	0	3 015	500	0	0	0	0		116 529	4 681	117 029	140 776	ok 2027	0	0	ok 2015	0	0	0	0	cb 2027	36 888	417 362	17 226	31 994	257 805	-220 917	159 557	-169 356	coût dispro
CR350	592	2	0	1 522	8 054	0	2 282	0	0		45 277	1 819	53 331	102 850	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	87 350	326 607	65 759	65 948	156 181				
CR351	3 459	2	538 880	19 851	12 966	0	10 042	0	0		364 390	8 780	916 236	707 411	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	510 379	18 695 550	384 223	1 653 116	1 623 647				
CR352	1 945	1	50 000	0	1 000	0	0	0	0		163 274	3 934	214 274	71 967	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	199 605	586 451	100 638	134 020	286 241				
CR353	5 950	1	100 000	0	74 966	0	10 318	0	0		408 024	9 832	582 990	368 583	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	863 111	3 269 401	409 983	796 654	951 572				
CR354	7 181	1	250 000	0	82 236	0	21 728	0	0		319 593	7 701	651 829	538 317	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	1 014 101	12 461 318	494 805	3 036 446	1 190 145	-176 044	11 271 173	61 985	coût non dispro
CR355	632	0	1 303 960	40 830	0	0	0	0	0		0	0	1 303 960	746 856	ok 2015	0	0	0	0	0	0	0	0	93 252	445 417	0	0	2 050 816				
CR356	784	1	187 010	20 681	0	0	0	0	0		745 351	13 814	932 361	630 986	ok 2015	0	0	0	0	0	0	0	cb 2027	115 680	672 154	54 021	167 169	1 563 347	-1 447 667	-891 193	-1 134 998	coût dispro
CR357	307	1	0	7 545	250	0	0	0	0		494 242	9 160	494 492	305 578	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	45 298	614 456	21 154	75 287	800 070	-754 772	-185 614	-594 758	coût dispro
CR358	1 534	2	1 042 270	17 104	8 804	0	1 687	0	0		0	0	1 051 074	343 722	ok 2021	0	0	ok 2015	ok 2015	0	0	0	0	1 326 053	5 310 611	0	0	1 394 796	-68 743	3 915 815	210 216	coût non dispro
CR359	103	0	0	0	0	0	0	0	0		0	0	0	0	ok 2015	0	0	0	0	0	0	0	0	8 287	48 363	0	0	0				
CR360	158	0	0	1 525	0	0	0	0	0		0	0	0	27 896	ok 2015	0	0	0	0	0	0	0	0	22 371	122 986	0	0	27 896				
CR361	881	0	920 605	23 203	8 054	0	9 422	0	0		0	0	928 659	596 785	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	129 993	800 542	0	0	1 525 444				
CR362	1 885	0	87 494	67 772	9 804	0	2 282	0	0		0	0	97 298	1 281 432	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	278 134	3 564 805	0	0	1 378 730				
CR363	488	0	950 065	41 855	17 254	0	3 727	0	0		0	0	967 319	833 779	ok 2021	0	0	ok 2015	ok 2015	0	0	0	0	72 005	429 029	0	0	1 801 098	-1 729 093	-1 372 069	-1 368 874	coût dispro
CR364	1 215	0	2 287 390	101 694	5 108	0	1 451	0	0		0	0	2 292 498	1 886 730	ok 2021	0	0	ok 2015	ok 2015	0	0	0	0	179 275	519 473	0	0	4 179 228	-3 999 953	-3 659 755	-3 164 108	coût dispro
CR365	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	126 279	249 679	0	0	0				
CR366	1 988	1	0	25 877	17 608	0	6 944	0	0		0	0	17 608	600 356	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	293 332	4 787 567	220 825	718 338	617 964				
CR367	3 794	1	150 000	14 312	10 054	0	2 282	0	0		0	0	160 054	303 543	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	559 809	398 353 257	421 434	2 379 586	463 597				
CR368	2 843	1	100 000	67 714	26 808	0	9 054	0	0		0	0	126 808	1 404 239	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	419 488	332 462 391	315 798	1 624 345	1 531 047				
CR369	5 348	2	100 000	23 111	272 216	0	19 243	0	0		0	0	372 216	774 737	ok 2015	ok 2015	0	ok 2021	ok 2015	0	0	0	0	907 144	399 366 051	594 051	2 704 160	1 146 953	-239 809	398 219 097	-10 419	coût dispro
CR370	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	419 778	0	0	0				
CR371	10 693	2	600 000	30 740	126 966	0	18 973	0	0		0	0	726 966	909 348	ok 2015	0	0	ok 2021	ok 2015	0	0	0	0	1 686 606	46 048 216	1 187 769	12 783 970	1 636 314	50 292	44 411 901	377 555	coût non dispro
CR372	1 421	2	50 000	0	146 550	0	0	0	0		100 528	3 444	297 078	63 001	ok 2015	0	0	ok 2027	0	0	0	0	ok 2015	209 670	17 388 433	154 241	157 843	360 079	-150 409	17 028 354	-78 393	coût dispro
CR373	3 676	3	100 000	0	9 054	0	2 282	0	0		109 787	3 761	218 841	110 547	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	641 407	3 616 120	408 327	929 210	329 387				
CR374	2 677	2	50 000	0	38 404	0	10 887	0	0		180 757	6 193	269 161	312 427	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	394 994	161 191 616	297 359	775 657	581 587				
CR375	1 659	3	140 000	6 383	8 804	0	1 687	0	0		152 668	5 231	301 472	243 291	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	244 787	19 848 835	184 280	722 083	544 763				
CR376	981	2	40 000	1 840	12 500	0	0	0	0		230 790	7 907	283 290	178 303	ok 2015	0	0	cb 2027	0	0	0	0	ok 2015	144 748	648 608	108 969	269 611	461 593	-316 845	187 015	-224 527	coût dispro
CR377	7 001	2	150 000	0	129 020	0	28 395	0	0		294 796	10 100	573 816	704 153	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	986 536	5 224 139	777 665	1 548 408	1 277 969				
CR378	9 098	2	100 000	0	234 377	0	59 339	0	0		199 844	6 847	534 221	1 210 670	cb 2027	0	0	ok 2021	ok 2015	0	0	0	ok 2015	1 256 971	4 537 563	626 895	1 045 312	1 744 891	-487 920	2 792 671	-138 942	coût dispro
CR379	3 638	2	225 000	5 628	241 166	0	4 882	0	0		148 263	5 080	614 429	285 161	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	546 216	3 221 253	250 675	768 341	899 589				
CR380	12 802	3	4 874 305	218 243	891 146	73 600	61 368	0	0		2 459 917	88 208	8 225 367	8 074 445	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	12 952	3 985 019	0	882 118	16 299 812				
CR381	57 774	4	2 370 188	0	2 195 559	64 000	293 925	0	0		1 550 357	29 597	6 116 104	7 088 548	ok 2015	0	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	8 021 693	155 627 994	6 417 485	44 654 949	13 204 652	-5 182 959	142 423 342	-2 542 029	coût dispro
CR382	12 712	3	9 144 478	289 212	1 239 800	160 000	73 375	0	0		824 288	32 686	11 208 566	10 157 059	ok 2027	cb 2027	0	ok 2015	ok 2015	0	0	0	ok 2015	2 049 452	25 751 050	1 412 038	11 324 764	21 365 625	-19 316 173	4 385 425	-15 043 048	coût dispro
CR383	4 812	2	9 101 805	296 608	38 716	0	8 533	0	0		1 204 791	47 774	10 345 312	6 455 527	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	627 695	26 158 860	534 513	7 753 350	16 800 839	-16 173 144	9 358 021	-12 812 976	coût dispro
CR384	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	44 413	0	0	0				
CR385	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	22 650	0	0	0				
CR386	1 659	1	1 312 478	22 966	500	0	0	0	0		0	0	1 312 978	420 096	ok 2015	0	0	ok 2015	0	0	0	0	0	182 223	11 514 473	110 368	184 280	1 733 074				
CR387	0	2	0	0	0	0	0	0	0		430 125	8 211	430 125	150 199	0	0	0	0	0	0	0	0	ok 2015	0	156 558	0	0	580 324				
CR388	1 474	2	798 708	15 499	4 858	0	1 451	0	0		89 079	1 701	892 645	341 165	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	217 490	630 454	163 731	200 617	1 233 809	-1 016 319	-603 355	-769 557	coût dispro
CR389	1 468	2	1 581 902	41 308	16 358	0	3 969	0	0		263 139	5 023	1 861 399	920 089	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	216 605	2 512 905	163 064	179 341	2 781 488	-2 564 883	-268 583	-2 008 585	coût dispro
CR390	1 297	2	118 965	23 793	160 500	0	0	0	0		242 806	4 635	522 270	520 008	ok 2015	0	ok 2015	ok 2015	0	0	0	0	ok 2015	144 323	2 513 580	87 413	144 070	1 042 278				
CR391	6 510	1	2 499 274	116 800	36 966	0	24 003	0	0		747 284	14 266	3 283 524	2 836 514	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	960 558	9 700 201	448 570	3 229 033	6 120 039	-5 159 481	3 580 162	-3 935 474	coût dispro
CR392	3 876	2	260 000	11 700	151 616	0	34 428	0	0		326 092	6 225	737 708	957 646	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	571 908	115 187 245	267 075	454 253	1 695 354	-1 123 446	113 491 891	-784 375	coût dispro
CR393	6 947	2	2 223 838	25 406	193 851	0	38 311	0	0		481 607	9 194	2 899 296	1 333 675	cb 2027	0	0	ok 2015	ok 2021	0	0	0	ok 2015	1 025 037	20 689 765	771 667	3 861 680	4 232 971	-3 207 933	16 456 795	-2 361 339	coût dispro
CR394	0	3	0	0	0	0	0	0	0		373 696	7 134	373 696	130 494	0	0	0	0	0	0	0	0	ok 2015	0	124 794	0	0	504 190				
CR395	10 780	2	1 186 872	88 159	92 594	0	50 687	0	0		571 235	10 905	1 850 701	2 739 244	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 590 601	3 071 408 716	1 197 433	5 798 870	4 589 945				
CR396	8 769	2	100 000	0	28 023	0	4 180	0	0		295 584	5 643	423 607	179 682	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 213 692	3 345 980	974 053	991 731	603 289	610 404	2 742 692	731 061	coût non dispro
CR397	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	112 194	0	0	0				
CR398	60 943	3	450 000	0	4 059 706	161 200	366 733	0	0		3 251 802	30 482	7 761 508	10 214 549	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	8 193 240	111 676 276	6 769 495	32 015 925	17 976 057				
CR399	4 521	3	665 000	56 538	41 520	0	19 740	0	0		207 501	7 109	914 021	1 525 314	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	658 972	4 568 739	502 189	1 282 132	2 439 335				
CR400	5 511	3	477 500	42 632	171 344	0	25 983	0	0		431 161	14 772	1 080 005	1 525 317	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	967 092	5 131 656	612 157	2 579 342	2 605 321				
CR401	41 127	3	50 000	0	841 188	0	170 641	0	0		208 513	7 144	1 099 701	3 252 055	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	4 676 145	12 609 758	3 166 546	4 568 351	4 351 756				
CR402	12 287	3	200 000	0	388 217	0	48 069	0	0		262 887	9 007	851 104	1 044 026	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	2 014 793	14 801 534	1 364 829	4 090 524	1 895 130				

*Dispro. cost

CR403	0	3	0	0	0	0	0	0	0	92 993	3 186	92 993	58 279
CR404	8 243	2	0	18 767	130 020	0	18 805	0	0	560 231	19 194	690 251	1 038 371
CR405	7 288	3	100 000	145 583	33 466	0	15 078	0	0	428 500	14 681	561 966	3 207 352
CR406	1 235	2	0	1 604	17 754	0	6 807	0	0	253 563	8 687	271 317	312 761
CR407	1 014	1	0	1 566	1 250	0	0	0	0	316 368	10 839	317 618	226 913
CR408	1 661	2	0	0	500	0	0	0	0	295 355	10 119	295 855	185 101
CR409	1 616	2	0	0	9 216	0	7 067	0	0	195 498	6 698	204 714	251 790
CR715	19 424	3	33 816 673	1 324 225	116 622	0	57 494	0	0	1 340 189	12 563	35 273 484	25 504 251
CR716	8 328		150 000	0	97 554	0	17 316			923 241	8 654		
CR717	2 533		0	23 535	83 660	0	19 285			714 768	6 700		
CR411	5 685	3	0	9 138	225 158	0	15 459	0	0	1 230 000	44 000	1 455 158	1 254 785
CR412	17 347	3	284 674	100 087	1 321 164	64 000	116 027	0	0	1 635 325	30 583	3 241 163	5 683 265
CR413	11 221	3	987 500	196 928	1 596 384	120 000	69 042	0	0	0	0	2 583 884	7 060 174
CR414	24 601	4	430 000	495 000	398 244	0	122 832	0	0	650 000	8 000	1 478 244	11 447 738
CR415	0	2	0	0	0	0	0	0	0	0	0	0	0
CR416	7 124	3	6 128 163	128 220	42 520	0	20 930	0	0	1 484 604	67 078	7 655 287	3 955 260
CR417	15 032	2	445 641	182 583	294 136	0	37 558	0	0	597 310	26 988	1 337 088	4 520 496
CR418	4 563	3	972 500	38 690	26 332	0	11 459	0	0	176 111	15 654	1 174 943	1 203 670
CR419	5 377	3	1 867 500	84 063	215 874	0	37 492	0	0	111 591	9 919	2 194 965	2 404 936
CR420	5 190	2	1 866 568	197 640	1 592 326	103 200	54 958	0	0	664 000	24 000	4 122 894	6 947 276
CR421	2 488	3	3 250 013	160 775	34 412	0	13 391	0	0	438 153	8 194	3 722 578	3 335 738
CR422	1 659	1	0	0	138 616	9 600	9 047	0	0	441 231	8 252	579 847	492 030
CR423	8 674	3	250 000	46 204	1 525 602	64 000	73 486	0	0	597 966	11 183	2 373 568	3 564 611
CR424	1 271	2	857 646	47 168	750	0	0	0	0	436 988	8 172	1 295 384	1 012 284
CR425	0	0	0	0	0	0	0	0	0	0	0	0	0
CR426	339	2	0	0	0	0	0	0	0	300 337	5 617	300 337	102 741
CR427	3 807	1	2 545 451	127 826	24 412	0	16 961	0	0	0	0	2 569 863	2 648 457
CR428	245	3	0	1 535	0	0	0	0	0	0	0	0	28 087
CR429	319	1	120 000	5 420	250	0	0	0	0	0	0	120 250	99 142
CR430	0	1	0	0	0	0	0	0	0	0	0	0	0
CR431	2 425	3	966 923	35 249	14 324	0	9 113	0	0	0	0	981 247	811 467
CR432	8 423	3	7 093 471	278 345	595 940	48 000	40 185	0	0	1 102 395	14 699	8 791 806	6 973 438
CR433	1 259	2	0	3 190	16 358	0	3 969	0	0	961 817	12 824	978 175	365 542
CR434	9 479	1	3 838 508	2 293 868	178 972	0	53 736	0	0	1 352 974	18 040	5 370 454	43 272 424
CR435	3 348	3	3 992 290	202 068	16 858	0	11 109	0	0	2 282 813	30 438	6 291 961	4 456 201
CR436	2 144	1	0	27 295	128 504	16 000	6 807	0	0	223 625	6 184	352 129	1 029 592
CR437	10 193	2	5 457 500	271 703	1 259 374	184 320	57 552	0	0	705 958	19 523	7 422 832	9 751 449
CR438	3 026	1	1 617 500	72 917	152 006	0	24 923	0	0	431 637	11 937	2 201 143	2 008 034
CR439	8 128	2	1 767 500	149 084	200 072	0	55 111	0	0	513 652	14 205	2 481 224	3 994 973
CR440	1 506	1	0	0	77 550	0	0	0	0	0	0	77 550	0
CR441	4 614	0	3 837 500	172 690	243 600	0	0	0	0	0	0	4 081 100	3 158 849
CR442	4 085	0	0	0	669 757	32 000	36 184	0	0	0	0	669 757	1 247 219
CR443	335	1	225 000	10 168	250	0	0	0	0	150 129	4 152	375 379	261 934
CR444	3 040	1	100 000	0	8 804	0	1 687	0	0	0	0	108 804	30 859
CR445	8 376	2	975 000	103 251	331 026	0	37 353	0	0	223 171	21 424	1 529 197	2 963 830
CR446	7 601	2	0	33 869	397 982	8 000	66 911	0	0	248 997	23 904	646 979	2 427 047
CR447	3 083	0	2 240 000	100 878	26 058	0	6 114	0	0	0	0	2 266 058	1 957 108
CR448	615	0	0	13 234	250	0	0	0	0	0	0	250	242 069
CR449	1 658	1	0	0	98 652	0	13 546	0	0	0	0	98 652	247 782
CR450	1 342	1	0	0	250	0	0	0	0	0	0	250	0
CR451	532	2	0	1 520	0	0	0	0	0	94 453	9 067	94 453	193 674
CR452	1 792	1	0	0	0	0	0	0	0	83 380	8 004	83 380	146 418
CR453	34 064	1	3 537 500	247 697	2 225 461	0	308 905	0	0	0	0	5 762 961	10 181 382
CR454	13 476	1	1 505 000	67 862	26 412	0	6 251	0	0	0	0	1 531 412	1 355 670
CR455	3 758	2	513 904	231 952	464 074	16 000	30 712	0	0	1 646 780	7 662	2 624 758	5 237 478
CR456	48 664	3	4 616 915	442 408	31 697 760	4 800 000	188 515	0	0	3 479 170	16 187	39 793 845	99 638 715
CR457	52 998	3	1 518 330	417 237	1 375 804	0	246 257	0	0	1 924 050	8 952	4 818 183	12 300 400
CR458	29 694	2	3 752 011	27 444	2 124 161	176 000	137 266	0	0	395 000	20 000	6 271 172	6 598 120
CR459	20 757	3	1 169 663	190 436	1 000 852	32 000	120 331	0	0	404 929	18 296	2 575 444	6 604 563
CR460	16 046	2	4 114 097	16 272	1 390 028	96 000	55 929	0	0	523 157	23 638	6 027 282	3 509 121

CR403	0	0	0	0	0	0	0	0	ok 2015	0	66 739	0	0	151 272				
CR404	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 350 528	14 334 524	567 981	5 810 612	1 728 622				
CR405	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 075 352	1 060 108 867	809 545	6 693 335	3 769 318				
CR406	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	182 226	727 031	137 183	179 317	584 078				
CR407	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	149 617	6 135 752	69 869	114 908	544 530				
CR408	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	245 082	1 032 016	184 502	427 975	480 957				
CR409	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	238 443	18 073 314	111 350	349 805	456 504	-218 062	17 616 810	-126 761	coût dispro *
CR715	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#N/A	#N/A	2 157 601	7 242 770	60 777 735				
CR716	cb 2027	0	ok 2015	ok 2015	ok 2021	0	0	0	ok 2015									
CR717	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015									
CR411	ok 2015	0	0	cb 2027	ok 2015	0	0	0	ok 2015	#VALEUR!	#VALEUR!	#VALEUR!	#VALEUR!	2 709 943	#VALEUR!	#VALEUR!	#VALEUR!	coût dispro
CR412	ok 2015	0	ok 2027	ok 2021	ok 2015	0	0	0	ok 2015	2 503 993	37 406 602	1 926 890	11 087 122	8 924 428	-6 420 435	28 482 174	-4 635 550	coût dispro
CR413	ok 2015	ok 2015	ok 2015	ok 2021	ok 2015	0	0	0	0	1 655 671	1 101 192 891	1 246 419	7 735 426	9 644 058	-7 988 387	1 091 548 833	-6 059 576	coût dispro
CR414	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	3 312 169	30 758 814	2 732 657	9 116 753	12 925 982				
CR415	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
CR416	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#VALEUR!	#VALEUR!	#VALEUR!	#VALEUR!	11 610 547				
CR417	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	2 217 988	15 842 000 139	1 669 741	34 389 040	5 857 584				
CR418	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	750 986	9 387 202	506 854	4 070 683	2 378 613				
CR419	cb 2027	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	851 119	3 763 812	370 501	878 306	4 599 900	-3 748 782	-836 088	-2 828 802	coût dispro
CR420	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	765 790	10 195 572	576 501	4 196 267	11 070 170	-10 304 380	-874 598	-8 090 346	coût dispro
CR421	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	428 779	4 513 531	171 435	1 595 390	7 058 316				
CR422	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	244 787	8 331 516	114 313	171 169	1 071 876				
CR423	ok 2015	0	ok 2015	ok 2027	ok 2015	0	0	0	ok 2015	1 653 125	10 526 827	597 679	4 492 021	5 938 180	-4 285 055	4 588 647	-3 097 419	coût dispro
CR424	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	187 537	781 476	87 578	246 676	2 307 669				
CR425	0	0	0	0	0	0	0	0	0	0	10 514	0	0	0				
CR426	ok 2015	0	0	0	0	0	0	0	cb 2027	19 448	96 735	11 779	37 656	403 078	-383 630	-306 344	-303 014	coût dispro
CR427	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	561 727	161 183 147	422 878	2 703 686	5 218 320				
CR428	ok 2015	0	0	0	0	0	0	0	0	27 427	107 179	12 934	27 214	28 087				
CR429	ok 2015	0	0	ok 2021	0	0	0	0	0	34 036	113 567	20 615	35 434	219 392	-185 356	-105 825	-141 478	coût dispro
CR430	0	0	0	0	0	0	0	0	0	0	17 523	0	0	0				
CR431	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	417 922	2 093 505	269 367	759 651	1 792 714				
CR432	ok 2015	0	ok 2021	ok 2021	ok 2015	0	0	0	ok 2015	1 242 823	1 472 288 035	935 619	11 802 513	15 765 244	-14 522 421	1 456 522 791	-11 369 372	coût dispro
CR433	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	185 767	451 117	139 849	144 357	1 343 717				
CR434	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 398 637	2 908 670 001	653 148	4 250 591	48 642 878	-47 244 242	2 860 027 122	-37 515 666	coût dispro
CR435	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	#VALEUR!	#VALEUR!	#VALEUR!	#VALEUR!	10 748 162	#VALEUR!	#VALEUR!	#VALEUR!	coût dispro
CR436	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	316 350	1 924 345	147 732	660 097	1 381 721				
CR437	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	1 503 988	1 481 490 908	1 132 229	11 031 869	17 174 281	-15 670 293	1 464 316 627	-12 235 437	coût dispro
CR438	ok 2015	0	0	ok 2027	ok 2021	0	0	0	ok 2015	446 490	8 050 140	208 506	741 354	4 209 177	-3 762 687	3 840 964	-2 920 852	coût dispro
CR439	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 199 295	1 325 954 591	902 851	3 534 788	6 476 197				
CR440	ok 2015	0	0	ok 2027	0	0	0	0	0	155 658	3 050 764	94 278	167 285	77 550	78 108	2 973 214	93 618	coût non dispro
CR441	ok 2015	0	ok 2015	ok 2015	0	0	0	0	0	454 907	1 391 202	0	0	7 239 949				
CR442	cb 2027	0	ok 2015	ok 2015	ok 2015	0	0	0	0	602 746	172 552 851	0	0	1 916 976	-1 314 230	170 635 874	-930 835	coût dispro
CR443	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	40 298	84 115	20 066	23 083	637 313				
CR444	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	448 555	19 156 230	0	0	139 663				
CR445	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	1 235 888	1 503 762 166	930 399	4 438 957	4 493 027	-3 257 139	1 499 269 139	-2 358 534	coût dispro
CR446	ok 2015	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	1 121 536	1 581 902 149	844 312	5 563 323	3 074 025	-1 952 489	1 578 828 124	-1 337 684	coût dispro
CR447	ok 2021	0	0	ok 2015	ok 2015	0	0	0	0	454 900	50 714 707	0	0	4 223 166	-3 768 265	46 491 542	-2 923 632	coût dispro
CR448	ok 2015	0	0	ok 2015	0	0	0	0	0	78 045	137 571	0	0	242 319				
CR449	ok 2015	0	0	ok 2015	cb 2027	0	0	0	0	216 276	772 473	184 169	228 957	346 434	-130 158	426 039	-60 872	coût dispro
CR450	ok 2015	0	0	ok 2021	0	0	0	0	0	161 721	404 636	110 797	149 068	250	161 471	404 386	161 521	coût non dispro
CR451	ok 2015	0	0	0	0	0	0	0	ok 2015	78 497	382 723	59 094	91 736	288 127				
CR452	ok 2015	0	0	0	0	0	0	0	ok 2015	264 412	16 885 459	123 477	293 186	229 799				
CR453	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	0	4 646 310	89 788 723	3 783 799	26 612 911	15 944 343				
CR454	cb 2027	0	0	ok 2015	ok 2015	0	0	0	0	1 874 443	16 227	1 496 902	4 809 858	2 887 082	-1 012	13 340	-435 223	coût
CR455	ok 2015	ok 2015	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	462 516	55 894 458	280 135	417 435	7 862 236	-7 399 720	48 032 222	-5 827 273	coût dispro
CR456	cb 2027	ok 2021	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	6 576 832	79 192 499	5 405 554	22 777 147	139 432 560	-132 855 728	-60 240 061	-104 969 216	coût dispro
CR457	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	7 151 637	141 579 901	5 886 971	40 417 114	17 118 583	-9 966 946	124 461 318	-6 543 230	coût dispro
CR458	ok 2015	0	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	4 198 750	108 604 609	2 046 056	25 583 920	12 869 292	-8 670 542	95 735 317	-6 096 684	coût dispro
CR459	ok 2015	0	ok 2015	ok 2015	ok 2021	0	0	0	ok 2015	3 088 266	23 505 362 318	2 305 669	36 044 944	9 180 007	-6 091 741	23 496 182 311	-4 255 740	coût dispro
CR460	ok 2015	0	ok 2027	ok 2015	ok 2015	0	0	0	ok 2015	2 367 605	17 467 875 230	1 782 376	21 327 063	9 536 402	-7 168 798	17 458 338 827	-5 261 517	coût dispro

*Dispro. cost

CR461	563	2	50 000	0	250	0	0	0	0		58 281	5 181	108 531	94 762	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	83 071	240 692	62 538	72 699	203 293				
CR462	6 134	2	190 084	45 042	505 626	0	37 353	0	0		106 212	9 441	801 922	1 679 866	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	905 078	990 388 179	681 359	2 282 792	2 481 788	-1 576 710	987 906 391	-1 080 352	coût dispro *
CR463	1 245	1	0	0	1 250	0	0	0	0		63 742	5 666	64 992	103 641	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	183 701	2 344 446	85 786	193 119	168 633				
CR464	1 742	2	3 725 790	155 278	250	0	0	0	0		0	0	3 726 040	2 840 349	cb 2027	0	0	ok 2015	0	0	0	0	0	334 744	1 288 943	193 500	615 930	6 566 389	-6 231 644	-5 277 446	-4 918 367	coût dispro
CR465	3 865	2	0	0	27 808	0	4 924	0	0		109 736	9 754	137 544	268 496	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	570 285	157 166 666	429 321	2 221 753	406 040				
CR466	818	3	386 852	77 473	250	0	0	0	0		112 984	10 043	500 086	1 600 854	ok 2021	0	0	ok 2015	0	0	0	0	ok 2015	198 407	308 273	90 863	104 229	2 100 941	-1 902 534	-1 792 668	-1 482 346	coût dispro
CR467	419	2	0	25 920	500	0	0	0	0		48 359	4 299	48 859	552 760	cb 2027	0	0	ok 2021	0	0	0	0	ok 2015	42 835	89 738	25 944	46 542	601 619	-558 785	-511 882	-438 461	coût dispro
CR468	3 906	2	5 782 445	233 314	26 058	0	19 624	0	0		112 984	10 043	5 921 487	4 810 466	ok 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	576 335	28 391 113	433 875	3 019 072	10 731 954	-10 155 619	17 659 160	-8 009 228	coût dispro
CR469	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	13 173	0	0	0				
B1R470	5 979	3	0	128 228	510 419	38 400	61 510	0	0		1 825 612	37 847	2 336 031	4 865 398	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	#VALEUR !	#VALEUR !	#VALEUR !	#VALEUR !	7 201 429				
B1R471	2 569	2	253 326	346 616	612 054	96 000	9 422	0	0		865 150	20 578	1 730 530	8 645 123	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	379 059	3 951 076	285 362	1 207 131	10 375 653				
B1R472	49 882	4	3 013 074	762 246	5 462 582	504 000	336 666	0	0		4 362 846	60 651	12 838 502	30 429 950	ok 2015	ok 2021	ok 2027	ok 2015	ok 2015	0	0	0	ok 2015	7 443 588	67 793 083 588	3 437 104	124 588 671	43 268 453	-35 824 865	67 749 815 135	-27 171 174	coût dispro
B1R473	0	3	150 000	12 103	253 122	16 000	55 771	0	0		1 589 277	19 875	1 992 399	1 897 782	cb 2027	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	12 952	639 230	0	0	3 890 181	-3 877 229	-3 250 951	-3 099 193	coût dispro
B1R474	6 270	5	50 000	24 500	523 014	76 000	32 698	0	0		3 443 103	43 058	4 016 117	3 224 081	ok 2015	0	ok 2021	ok 2015	ok 2015	0	0	0	cb 2027	1 090 402	17 362 309	432 032	4 760 973	7 240 198	-6 149 796	10 122 111	-4 701 756	coût dispro
B1R475	35 146	4	1 310 000	50 888	3 804 722	349 664	201 921	0	0		1 940 102	36 377	7 054 824	11 685 874	cb 2027	ok 2015	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	5 185 831	50 773 726 689	2 421 724	26 534 370	18 740 697	-13 554 867	50 754 985 991	-9 806 727	coût dispro
B1R476	67 453	3	335 000	1 601	3 047 647	144 000	318 803	0	0		1 611 940	28 752	4 994 587	9 020 823	ok 2015	0	ok 2015	ok 2021	ok 2015	0	0	0	ok 2015	9 419 571	239 823 040	4 647 828	56 679 634	14 015 409	-4 595 838	225 807 631	-1 792 757	coût dispro
B1R477	32 015	4	10 370 000	470 729	1 738 113	0	146 872	0	0		3 872 959	66 871	15 981 072	12 520 397	cb 2027	ok 2015	ok 2015	ok 2015	ok 2021	0	0	0	ok 2015	4 972 663	1 456 167 575	2 205 984	26 657 008	28 501 468	-23 528 805	1 427 666 106	-17 828 512	coût dispro
B1R478	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
B1R479	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
B1R480	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
B1R481	0	2	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
B1R482	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
B1R483	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
B1R484	315	2	0	0	4 858	0	5 021	0	0		307 777	6 429	312 635	209 439	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	27 823	166 340	16 852	34 990	522 074	-494 251	-355 734	-389 836	coût dispro
B1R485	2 296	2	0	0	10 304	0	5 257	0	0		857 601	17 913	867 905	423 833	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	338 777	1 916 566	255 038	716 920	1 291 737	-952 960	624 829	-694 613	coût dispro
B1R486	2 130	2	0	39 634	297 054	32 000	9 607	0	0		1 626 506	33 974	1 923 560	2 107 523	ok 2015	ok 2021	0	ok 2027	ok 2015	0	0	0	cb 2027	314 284	5 439 166	236 599	1 540 735	4 031 083	-3 716 799	1 408 083	-2 910 583	coût dispro
B1R487	3 280	2	0	26 577	429 558	64 000	15 459	0	0		970 544	20 272	1 400 102	2 310 446	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	483 968	6 944 686	364 340	2 732 283	3 710 548				
B1R488	206	1	0	1 528	0	0	0	0	0		0	0	0	27 955	ok 2021	0	0	0	0	0	0	0	0	18 945	76 659	11 475	22 882	27 955	-9 010	48 704	-3 419	coût dispro
B1R489	691	0	1 144 070	33 019	500	0	0	0	0		0	0	1 144 570	603 977	ok 2015	0	0	ok 2015	0	0	0	0	0	101 958	679 080	0	0	1 748 547				
B1R490	4 541	1	2 372 285	87 848	38 912	0	6 846	0	0		579 597	12 106	2 990 794	1 953 600	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	670 030	21 428 553	312 896	2 433 928	4 944 395				
B1R491	135	1	0	1 518	38 500	0	0	0	0		179 381	3 747	217 881	96 299	ok 2015	0	0	cb 2027	0	0	0	0	cb 2027	12 508	80 627	6 228	9 302	314 180	-301 672	-233 553	-238 836	coût dispro
B1R492	11 263	1	1 150 360	0	809 904	16 000	98 122	0	0		1 035 692	21 633	2 995 956	2 483 234	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	1 661 868	5 076 448 378	776 074	7 032 288	5 479 190				
B1R493	4 451	1	1 277 165	1 784 238	47 166	0	29 123	0	0		726 635	15 178	2 050 966	33 447 686	ok 2021	0	0	ok 2015	ok 2015	0	0	0	ok 2015	656 750	135 614 010	306 695	3 267 063	35 498 653	-34 841 903	100 115 357	-27 742 172	coût dispro
B1R494	1 752	2	0	32 969	10 554	0	9 422	0	0		1 050 279	21 938	1 060 833	1 176 708	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	258 510	2 905 435	120 721	855 527	2 237 541	-1 979 031	667 894	-1 531 523	coût dispro
B1R495	2 812	1	3 216 325	100 233	149 264	0	25 987	0	0		0	0	3 365 589	2 308 815	ok 2027	ok 2015	0	ok 2015	ok 2021	0	0	0	0	484 617	6 325 461	0	0	5 674 404	-5 189 787	651 057	-4 054 906	coût dispro
B1R496	1 007	1	0	34 106	750	0	0	0	0		0	0	750	623 863	ok 2021	0	0	ok 2015	0	0	0	0	0	148 584	579 809	111 857	202 476	624 613	-476 029	-44 805	-351 107	coût dispro
B1R497	411	1	0	3 026	0	0	0	0	0		0	0	0	55 356	ok 2015	0	0	0	0	0	0	0	0	60 643	503 346	45 654	109 834	55 356				
B1R498	650	1	0	9 085	500	0	0	0	0		0	0	500	166 182	ok 2021	0	0	ok 2015	0	0	0	0	0	95 908	968 218	72 201	202 615	166 682	-70 774	801 536	-37 437	coût dispro
B1R499	114	1	0	1 515	0	0	0	0	0		0	0	0	27 708	ok 2015	0	0	0	0	0	0	0	0	10 326	61 022	6 254	12 663	27 708				
B1R500	328	0	0	3 028	0	0	0	0	0		0	0	0	55 380	ok 2015	0	0	0	0	0	0	0	0	48 397	423 916	0	0	55 380				
B1R501	365	1	0	1 547	1 000	0	0	0	0		0	0	1 000	28 290	ok 2015	0	0	ok 2015	0	0	0	0	0	53 856	154 703	40 544	41 554	29 290				
B1R502	2 219	2	0	1 511	87 266	0	2 902	0	0		142 220	8 879	229 486	243 142	ok 2015	0	0	ok 2021	ok 2015	0	0	0	ok 2015	327 416	6 137 352	229 243	246 485	472 628	-145 212	5 664 725	-50 686	coût dispro
B1R503	592	3	2 103 655	62 825	8 554	0	1 687	0	0		118 697	7 411	2 230 905	1 315 605	ok 2021	0	0	ok 2015	ok 2015	0	0	0	ok 2015	102 025	1 029 734	65 759	198 139	3 546 510	-3 444 486	-2 516 777	-2 735 184	coût dispro
B1R504	4 028	2	457 820	12 301	224 556	16 000	20 272	0	0		296 887	18 536	979 263	1 227 557	ok 2015	0	ok 2015	ok 2027	ok 2015	0	0	0	ok 2015	594 336	9 924 633	447 427	2 713 830	2 206 820	-1 612 484	7 717 814	-1 171 120	coût dispro
B1R505	2 144	1	0	3 056	66 745	0	8 443	0	0		193 083	12 055	259 828	430 850	ok 2015	0	0	ok 2015	cb 2027	0	0	0	ok 2015	316 350	3 179 663	147 732	568 229	690 677	-374 328	2 488 986	-236 192	coût dispro
B1R506	1 309	0	0	1 552	47 554	0	5 257	0	0		0	0	47 554	124 549	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	193 144	405 707	0	0	172 103				
B1R507	2 625	2	0	7 558	14 758	0	3 536	0	0		182 763	11 411	197 521	411 652	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	387 322	4 451 495	291 583	1 299 540	609 173				
B1R508	0	3	0	0	0	0	0	0	0		119 463	7 459	119 463	136 432	0	0	0	0	0	0	0	0	ok 2015	0	154 083	0	0	255 895				
B1R509	2 194	3	115 728	175 114	48 852	0	10 476	0	0		200 564	12 522	365 144	3 623 883	ok 2015	0	0	ok 2015	ok 2021	0	0	0	ok 2015	343 401	2 434 540	243 708	763 035	3 989 027	-3 645 626	-1 554 487	-2 847 821	coût dispro
B1R510	0	2	0	0	0	0	0	0	0		92 777	5 792	92 777	105 956	0	0	0	0	0	0	0	0	cb 2027	26 227	110 736	0	0	198 732	-172 505	-87 996	-132 759	coût dispro
B1R511	1 285	1	0	6 164	4 858	0	2 046	0	0		0	0	4 858	150 177	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	189 603	1 699 556	142 737	553 745	155 035				
B1R512	435	2	0	0	0	0	0	0	0		0	0	0	0	ok 2021	0	0	0	0	0	0	0	0	90 412	459 532	48 319	117 124	0	90 412	459 532	90 412	coût non dispro
B1R513	4 872	3	50 000	0	385 826	0	28 529	0	0		97 857	6 110	533 683	633 617	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	450 654	16 040 759	257 065	541 177	1 167 300	-716 647	14 873 459	-483 187	coût dispro

*Dispro. cost

B1R514	1 408	2	100 000	3 021	10 966	0	14 207	0	0		137 972	8 614	248 938	472 702
B1R515	677	3	0	6 095	750	0	0	0	0		204 811	12 787	205 561	345 396
B1R516	372	1	0	1 551	1 250	0	0	0	0		0	0	1 250	28 378
B1R517	152	2	0	3 019	250	0	0	0	0		95 073	5 936	95 323	163 797
B1R518	45	2	0	1 504	0	0	0	0	0		96 912	6 051	96 912	138 184
B1R519	282	1	0	4 531	0	0	0	0	0		130 746	8 163	130 746	232 202
B1R520	479	2	0	4 569	0	0	0	0	0		160 776	10 038	160 776	267 183
B1R521	322	2	0	4 536	250	0	0	0	0		167 043	10 429	167 293	273 750
B1R522	90	2	0	1 511	0	0	0	0	0		84 678	5 287	84 678	124 350
B1R523	944	2	50 000	0	2 000	0	0	0	0		103 002	6 431	155 002	117 634
B1R524	435	2	0	3 052	500	0	0	0	0		125 141	7 813	125 641	198 736
B1R525	1 445	1	100 000	0	32 966	0	26 978	0	0		0	0	132 966	493 482
B1R526	3 619	2	50 000	0	27 558	0	8 459	0	0		146 318	9 135	223 876	321 835
B1R527	497	2	1 133 557	44 394	0	0	0	0	0		119 269	7 446	1 252 826	948 276
B1R528	189	2	0	1 525	0	0	0	0	0		138 992	8 678	138 992	186 634
B1R529	496	2	0	4 548	250	0	0	0	0		116 302	7 261	116 552	216 007
B1R530	233	2	0	3 025	0	0	0	0	0		113 764	7 103	113 764	185 265
B1R531	401	0	0	3 056	0	0	0	0	0		0	0	0	55 902
B1R532	217	1	0	3 032	0	0	0	0	0		70 521	4 403	70 521	135 991
B1R533	1 225	1	0	7 628	250	0	0	0	0		280 781	17 530	281 031	460 191
B1R534	1 212	3	0	9 075	500	0	0	0	0		298 818	18 656	299 318	507 270
B1R535	318	2	0	3 041	0	0	0	0	0		89 142	5 566	89 142	157 431
B1R536	907	2	50 000	1 522	750	0	0	0	0		65 629	4 098	116 379	102 785
B1R537	671	1	0	0	250	0	0	0	0		0	0	250	0
B1R538	0	1	0	0	0	0	0	0	0		0	0	0	0
B1R539	214	2	0	3 028	250	0	0	0	0		0	0	250	55 395
B1R540	220	1	0	3 031	0	0	0	0	0		0	0	0	55 442
B1R541	38 931	2	495 000	6 551	1 385 198	120 000	162 659	0	0		671 123	21 554	2 551 321	5 684 508
B1R722	8 052	2	6 767 500	313 748	423 570	0	41 865	0	0		0	0	7 191 070	6 504 876
B1R723	9 174	3	1 257 500	74 828	119 436	0	26 782	0	0		0	0	1 376 936	1 858 656
B1R544	627	2	0	0	128 412	0	9 226	0	0		233 170	4 540	361 582	251 816
B1R545	12 747	2	200 000	0	282 320	0	17 545	0	0		212 233	4 133	694 553	396 530
B1R700	5 565	3	3 756 782	398 431	45 992	0	37 989	0	0		619 761	12 068	4 422 535	8 203 761
B1R701	4 504		0	3 061	21 568	0	5 656				619 761	12 068		
B1R547	6 236	2	50 000	4 595	571 518	52 800	30 739	0	0		555 568	10 818	1 177 086	1 810 041
B1R548	603	2	0	0	750	0	0	0	0		249 866	4 866	250 616	89 001
B1R549	5 291	1	227 974	35 595	275 620	0	9 030	0	0		0	0	503 594	816 277
B1R550	7 093	2	2 403 427	296 215	343 398	48 000	23 581	0	0		1 128 692	21 979	3 875 517	7 129 774
B1R551	1 992	1	0	1 507	11 216	0	3 497	0	0		735 173	14 316	746 389	353 394
B1R552	413	1	0	6 056	0	0	0	0	0		575 778	11 212	575 778	315 864
B1R553	151	1	0	1 519	0	0	0	0	0		264 787	7 498	264 787	164 942
B1R554	865	4	0	20 844	8 054	0	1 687	0	0		193 100	5 468	201 154	512 171
B1R555	285	2	0	3 043	250	0	0	0	0		146 938	4 161	147 188	131 777
B1R556	2 979	1	0	144 664	26 662	0	12 796	0	0		0	0	26 662	2 880 265
B1R557	909	2	0	6 090	8 054	0	2 282	0	0		0	0	8 054	153 146
B1R558	174	1	0	1 524	250	0	0	0	0		0	0	250	27 877
B1R559	453	1	0	4 567	0	0	0	0	0		0	0	0	83 532
B1R560	268	2	0	1 538	0	0	0	0	0		184 387	5 222	184 387	123 645
B1R561	67	2	0	1 509	0	0	0	0	0		192 566	5 453	192 566	127 359
B1R562	2 097	2	0	15 182	500	0	0	0	0		707 928	20 048	708 428	644 428
B1R563	64	3	0	1 508	0	0	0	0	0		185 441	5 251	185 441	123 652

B1R514	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	207 752	2 140 292	156 399	699 887	721 640				
B1R515	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	126 119	1 288 273	75 201	166 459	550 957	-424 838	737 316	-314 646	coût dispro *
B1R516	ok 2015	0	0	ok 2015	0	0	0	0	0	37 600	101 396	22 773	41 321	29 628				
B1R517	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	22 428	209 529	16 884	20 570	259 120	-236 692	-49 591	-184 868	coût dispro
B1R518	ok 2015	0	0	0	0	0	0	0	cb 2027	5 737	101 434	3 475	4 999	235 096	-229 359	-133 662	-182 340	coût dispro
B1R519	ok 2015	0	0	0	0	0	0	0	cb 2027	41 609	431 787	19 431	44 806	362 948	-321 338	68 840	-248 749	coût dispro
B1R520	ok 2015	0	0	0	0	0	0	0	cb 2027	70 677	564 900	53 207	89 414	427 960	-357 283	136 940	-271 691	coût dispro
B1R521	ok 2021	0	0	ok 2015	0	0	0	0	cb 2027	47 511	626 097	35 767	65 805	441 043	-393 531	185 054	-305 323	coût dispro
B1R522	ok 2015	0	0	0	0	0	0	0	cb 2027	8 109	72 012	4 911	9 997	209 029	-200 920	-137 017	-159 114	coût dispro
B1R523	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	72 135	246 139	43 690	104 859	272 636				
B1R524	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	56 743	192 433	48 319	57 036	324 377	-267 634	-131 944	-202 759	coût dispro
B1R525	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	213 211	3 297 415	0	0	626 448				
B1R526	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	533 987	62 867 161	401 995	459 881	545 712	-11 724	62 321 449	97 418	coût non dispro
B1R527	ok 2015	0	0	0	0	0	0	0	cb 2027	73 333	231 359	55 206	68 603	2 201 102	-2 127 769	-1 969 743	-1 687 549	coût dispro
B1R528	ok 2015	0	0	0	0	0	0	0	cb 2027	19 027	104 318	11 524	20 994	325 626	-306 599	-221 308	-241 474	coût dispro
B1R529	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	73 185	1 119 100	55 095	139 651	332 560	-259 374	786 541	-192 862	coût dispro
B1R530	ok 2015	0	0	0	0	0	0	0	cb 2027	34 379	237 472	25 881	34 199	299 029	-264 650	-61 557	-204 844	coût dispro
B1R531	ok 2015	0	0	0	0	0	0	0	0	59 168	160 169	0	0	55 902				
B1R532	ok 2015	0	0	0	0	0	0	0	cb 2027	31 358	175 705	14 952	15 614	206 512	-175 154	-30 808	-133 852	coût dispro
B1R533	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	180 750	2 981 674	84 408	408 018	741 222				
B1R534	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	#VALEUR !	#VALEUR !	#VALEUR !	#VALEUR !	806 587	#VALEUR !	#VALEUR !	#VALEUR !	coût dispro
B1R535	ok 2015	0	0	0	0	0	0	0	cb 2027	46 921	116 449	31 092	35 323	246 573	-199 651	-130 124	-150 337	coût dispro
B1R536	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	133 829	430 091	100 749	106 053	219 164				
B1R537	ok 2015	0	0	ok 2021	0	0	0	0	0	99 007	936 815	74 534	141 775	250	98 757	936 565	98 807	coût non dispro
B1R538	0	0	0	0	0	0	0	0	0	0	95 431	0	0	0				
B1R539	ok 2015	0	0	ok 2015	0	0	0	0	0	33 864	179 881	23 771	25 983	55 645				
B1R540	ok 2015	0	0	0	0	0	0	0	0	32 461	414 916	23 703	24 437	55 442				
B1R541	ok 2015	ok 2015	ok 2021	ok 2015	ok 2015	0	0	0	ok 2015	5 744 312	129 310 685 994	4 324 421	43 713 447	8 235 829	-2 491 517	129 302 450 165	-844 352	coût dispro
B1R722	ok 2015	0	0	ok 2027	ok 2021	0	0	0	0	#N/A	#N/A	894 409	4 795 274	13 695 946	#N/A	#N/A	#N/A	coût dispro
B1R723	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	#N/A	#N/A	632 132	8 513 231	3 235 592				
B1R544	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	92 515	284 292	59 457	69 647	613 398	-520 883	-329 106	-398 204	coût dispro
B1R545	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 817 560	10 937 509	1 415 926	3 241 821	1 091 082				
B1R700	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#N/A	#N/A	618 155	2 801 559	12 626 296	#N/A	#N/A	#N/A	coût dispro
B1R701	cb 2027	0	0	ok 2015	ok 2015	0	0	0	ok 2015									coût dispro
B1R547	ok 2015	0	ok 2021	ok 2015	ok 2021	0	0	0	ok 2015	920 129	14 380 780	692 689	4 791 402	2 987 127	-2 066 999	11 393 653	-1 469 573	coût dispro
B1R548	ok 2021	0	0	ok 2021	0	0	0	0	ok 2015	74 353	261 090	45 034	66 981	339 616	-265 263	-78 527	-197 340	coût dispro
B1R549	ok 2015	0	0	ok 2021	ok 2015	0	0	0	0	780 693	240 524 366	587 720	1 690 298	1 319 870	-539 177	239 204 496	-275 203	coût dispro
B1R550	ok 2027	0	cb 2027	ok 2015	ok 2015	0	0	0	ok 2015	1 046 580	18 992 450	488 741	5 454 349	11 005 291	-9 958 711	7 987 159	-7 757 653	coût dispro
B1R551	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	293 922	2 947 410	137 258	701 571	1 099 783	-805 861	1 847 627	-585 904	coût dispro
B1R552	ok 2015	0	0	0	0	0	0	0	cb 2027	60 939	499 196	28 458	87 154	891 641	-830 703	-392 445	-652 374	coût dispro
B1R553	ok 2015	0	0	0	0	0	0	0	cb 2027	13 654	83 479	6 799	10 405	429 729	-416 074	-346 250	-330 129	coût dispro
B1R554	ok 2015	0	0	ok 2027	ok 2015	0	0	0	ok 2015	149 073	792 067	96 083	205 240	713 325	-564 251	78 743	-421 586	coût dispro
B1R555	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	42 052	107 367	31 658	37 587	278 965	-236 913	-171 598	-181 120	coût dispro
B1R556	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	439 555	18 569 010	330 905	3 405 239	2 906 927				
B1R557	ok 2015	0	0	ok 2021	ok 2015	0	0	0	0	134 124	1 198 005	100 971	248 048	161 200	-27 076	1 036 805	5 164	coût non dispro
B1R558	ok 2021	0	0	ok 2015	0	0	0	0	0	14 720	97 915	8 916	19 328	28 127	-13 407	69 788	-7 781	coût dispro
B1R559	ok 2015	0	0	0	0	0	0	0	0	66 841	349 805	50 319	71 262	83 532				
B1R560	ok 2015	0	0	0	0	0	0	0	ok 2015	23 929	154 690	14 493	29 769	308 032				
B1R561	ok 2015	0	0	0	0	0	0	0	cb 2027	4 005	69 199	2 426	7 442	319 925	-315 919	-250 725	-251 934	coût dispro
B1R562	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	309 415	4 965 442	232 933	1 278 822	1 352 855	-1 043 441	3 612 587	-772 870	coût dispro
B1R563	ok 2015	0	0	0	0	0	0	0	cb 2027	4 856	101 193	2 742	7 109	309 093	-304 237	-207 900	-242 418	coût dispro

*Dispro. cost

B1R564	5 332	3	3 503 335	278 469	565 512	0	17 286	0	0		458 501	12 984	4 527 348	5 647 474	ok 2015	ok 2015	0	ok 2027	ok 2015	0	0	0	ok 2015	786 742	13 984 923	592 274	1 737 630	10 174 823	-9 388 080	3 810 101	-7 353 116	coût dispro *
B1R565	285	2	0	3 043	250	0	0	0	0		217 239	6 152	217 489	168 185	ok 2015	0	0	ok 2021	0	0	0	0	ok 2015	42 052	190 741	19 638	25 973	385 674	-343 622	-194 933	-266 487	coût dispro
B1R566	283	2	0	1 537	250	0	0	0	0		292 864	8 293	293 114	179 820	ok 2015	0	0	ok 2015	0	0	0	0	cb 2027	27 986	112 656	16 950	31 435	472 934	-444 949	-360 278	-350 362	coût dispro
B1R567	625	2	0	0	500	0	0	0	0		340 035	9 629	340 535	176 140	ok 2015	0	0	ok 2021	0	0	0	0	cb 2027	59 973	240 339	36 324	69 424	516 674	-456 701	-276 335	-353 366	coût dispro
B1R568	481	2	0	3 066	250	0	0	0	0		350 667	9 930	350 917	237 725	ok 2015	0	0	ok 2021	0	0	0	0	ok 2015	70 972	313 818	53 429	66 672	588 642	-517 670	-274 824	-399 941	coût dispro
B1R569	2 413	2	150 000	4 610	1 500	0	0	0	0		297 253	13 988	448 753	340 204	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	356 041	3 315 283	166 267	970 145	788 957				
B1R570	1 985	1	0	0	33 108	0	4 564	0	0		147 584	6 945	180 692	210 526	ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015	292 889	1 010 802	136 776	282 377	391 218				
B1R571	1 192	0	0	4 655	4 858	0	17 516	0	0		0	0	4 858	405 548	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	175 881	610 096	0	0	410 406				
B1R572	1 638	2	50 000	1 557	500	0	0	0	0		252 200	11 868	302 700	245 574	ok 2015	0	0	ok 2015	0	0	0	0	ok 2015	241 689	1 929 451	181 948	494 455	548 274				
B1R573	6 881	1	9 589 798	794 235	1 438 412	96 000	21 851	0	0		85 451	4 021	11 113 662	16 757 470	ok 2015	0	cb 2027	ok 2021	ok 2015	0	0	0	ok 2015	1 015 299	474 245 197	474 133	689 575	27 871 131	-26 855 832	446 374 065	-21 281 606	coût dispro
B1R574	6 159	4	83 931	80 008	27 912	0	12 201	0	0		2 106 692	99 138	2 218 535	3 500 131	ok 2015	0	0	ok 2015	ok 2015	0	0	0	cb 2027	938 277	74 189 685	684 136	12 869 752	5 718 666	-4 780 389	68 471 019	-3 636 656	coût dispro
B1R575	934	2	0	7 582	43 744	0	7 255	0	0		0	0	43 744	271 404	ok 2015	0	0	ok 2015	ok 2021	0	0	0	0	147 799	2 506 973	103 748	419 390	315 148	-167 349	2 191 825	-104 319	coût dispro
B1R576	2 027	2	0	6 111	18 754	0	3 832	0	0		0	0	18 754	181 874	ok 2015	0	0	ok 2015	ok 2015	0	0	0	0	320 759	1 946 101	225 157	721 036	200 628				
B1R577	1 399	0	50 000	0	77 050	0	0	0	0		0	0	127 050	0	ok 2021	0	0	ok 2027	0	0	0	0	0	206 424	14 528 569	0	0	127 050	79 374	14 401 519	104 784	coût non dispro
B1R578	6 490	3	900 107	48 436	115 848	0	33 296	0	0		510 819	24 039	1 526 775	1 934 753	ok 2015	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 026 998	27 728 993	720 904	9 054 705	3 461 527				
B1R579	768	1	0	0	98 652	0	12 046	0	0		0	0	98 652	220 344	ok 2015	0	0	ok 2015	cb 2027	0	0	0	0	113 319	685 017	85 309	206 165	318 996	-205 677	366 021	-141 878	coût dispro
B1R718	2 031	1	0	3 043	6 856	0	1 687	0	0		122 981	6 361	129 837	202 885	ok 2021	0	0	ok 2015	ok 2015	0	0	0	ok 2015	#N/A	#N/A	139 945	863 435	332 722	#N/A	#N/A	#N/A	coût dispro
B1R719	6 266		0	15 500	241 068	32 000	5 656				524 285	27 118			ok 2015	0	ok 2015	ok 2015	ok 2015	0	0	0	ok 2015									coût dispro
B1R581	5 227	2	92 592	58 633	400 218	0	45 625	0	0		218 394	11 296	711 204	2 113 711	ok 2015	ok 2015	0	ok 2015	ok 2015	0	0	0	ok 2015	827 137	9 578 093	360 165	3 237 665	2 824 915				
B1R582	1 507	2	0	1 546	9 700	0	1 550	0	0		338 200	17 493	347 900	376 615	ok 2015	0	0	ok 2021	ok 2021	0	0	0	ok 2015	222 359	2 568 509	167 396	466 399	724 515	-502 156	1 843 994	-357 253	coût dispro
B1R583	690	1	0	4 591	44 244	0	5 455	0	0		0	0	44 244	183 775	ok 2015	0	0	ok 2021	cb 2027	0	0	0	0	101 810	662 807	76 645	158 287	228 019	-126 209	434 788	-80 605	coût dispro
B1R584	9 570	3	0	0	383 028	0	87 044	0	0		188 050	9 727	571 078	1 770 133	ok 2021	0	0	ok 2015	ok 2015	0	0	0	ok 2015	1 461 248	1 056 730 629	1 063 027	2 314 301	2 341 210	-879 963	1 054 389 418	-411 721	coût dispro
B1R585	1 296	2	0	1 521	142 152	0	12 046	0	0		362 496	18 750	504 648	591 134	ok 2015	0	0	ok 2015	cb 2027	0	0	0	ok 2015	191 226	945 885	89 300	200 274	1 095 781	-904 555	-149 896	-685 399	coût dispro
B1R586	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	37 657	0	0	0				
B1R587	1 781	0	0	0	335 600	0	0	0	0		0	0	335 600	0	ok 2015	ok 2015	ok 2015	ok 2021	0	0	0	0	0	204 951	537 003	0	0	335 600	-130 649	201 403	-63 529	coût dispro
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CL19	66										0	0	0	0	ok 2015	0	0	0	0	0	0	0	0	0	0	0	0	0				
CL26	507										0	0	0	0	ok 2015	0	0	0	0	0	0	0	0	0	0	0	0	0				
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CR222	0										426 410	8 614	426 410	157 574	0	0	0	0	0	0	0	0	ok 2015	0	0	0	0	583 983				
CR67	0										661 748	10 588	661 748	193 675	0	0	0	0	0	0	0	0	ok 2015	0	0	0	0	855 423				
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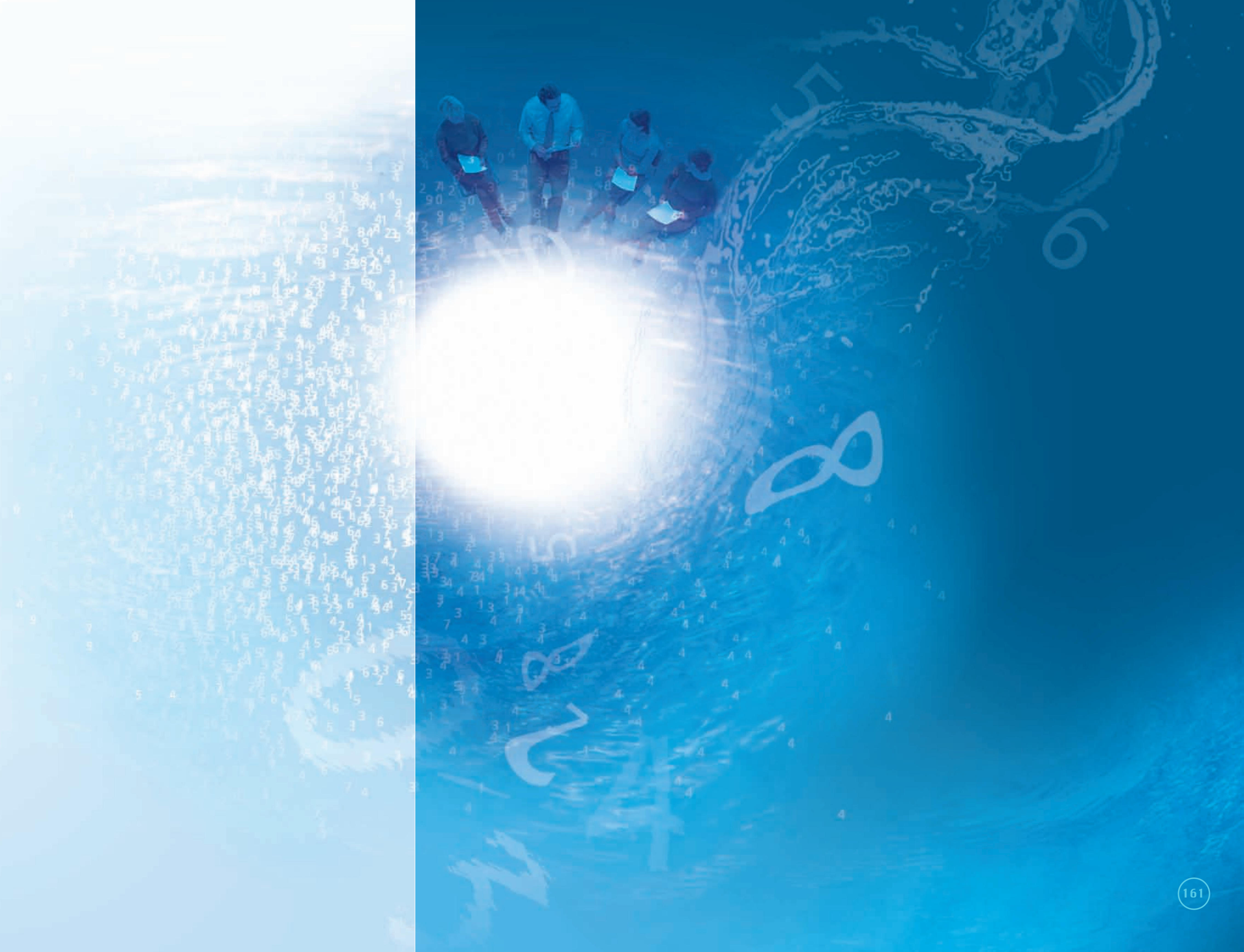
*Dispro. cost

Glossary



■ **Active population**

The part of the population comprising the working labour force (also called the employed population) and unemployed persons.

■ **Affordability**

Cost of water and sanitation services (drinking water, wastewater treatment) relative to the disposable income. This criterion must be taken into account, for example, when setting up water-pricing policies.

■ **Aggregation bias**

A type of bias resulting when the numbers of users from several sites are added together in cases where a general improvement in environmental quality will not produce identical benefits on each site.

■ **Amenity**

Services rendered free of cost by nature or the environment to people. Often associated with the concepts of comfort, convenience, pleasure and/or knowledge, and linked to a given place. For example, living next to a city park or spending time in a rural area provides certain advantages in terms of the landscape, the local weather, tranquillity, etc.

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■ **Analysis**

See Cost-benefit analysis (CBA), Cost-effectiveness analysis (CEA), Cost recovery, Economic analysis, Sensitivity analysis.

■ **Auction system**

The main technique among those used to value a good during a contingent valuation is the auction technique. It consists of successively proposing higher or lower values. For example, a price is proposed to a respondent and according to the answer (acceptance or refusal), a new price (higher or lower respectively) is proposed, followed again by another until the respondent reverses his answer. The main criticism of this technique is that the answers depend heavily on the first price mentioned.

■ **Bequest value**

Non-use value derived from the capacity to transmit value to future generations.

■ **Bias**

Approach or procedure that produces errors in study results. Examples are non-representative samples, poorly worded questions or influence exerted by the person conducting the study.

See also Aggregation bias, Hypothetical bias, Inclusion bias, Information bias, Investigator bias, Sampling bias, Self-selection bias, Strategic bias.

■ **Budgetary constraint**

Financial imitations confronting individuals or households. The latter are constrained by their revenues, i.e. they may not spend more.

■ **Closed and bounded question**

A survey technique consisting of asking a first valuation question such as "Would you be willing to pay ten euros for XXX?" and then a second question in which the amount depends on the answer to the first question. The amount in the second question is higher if the answer was "yes" and lower if it was "no". For the contingent-valuation method, closed and bounded questions may be difficult to use if the survey is sent by mail to the respondents. Mail surveys are not impossible for the contingent-valuation method, but they are not generally recommended.

■ **Compensatory costs**

Excess costs imposed on a water user following degradation of an aquatic environment and/or water resources by another water user.

■ **Complementary goods**

Two goods are said to be complementary if their joint use serves to satisfy a need. Examples are pen and paper.

■ **Contingent-valuation method (CVM)**

A method used to measure increases in well-being produced by an improvement in the environment. The method is based on surveys. The respondents are presented a fictive scenario and asked to declare the maximum amount of money they would be ready to pay for the given improvement in the environment.

■ **Cost**

See Compensatory costs, Cost-benefit analysis (CBA), Cost-effectiveness analysis (CEA), Cost recovery, Disproportionate costs, Environmental costs, External costs, Fixed costs, Opportunity costs, Private costs, Resource costs, Social costs, Total cost of water, Transaction costs, Variable costs.

■ **Cost-benefit analysis (CBA)**

Cost-benefit analysis compares all the benefits to all the costs of a given project and the alternative projects, taking into account the impacts that are not calculated in monetary terms (which is often the case for the environment), among other aspects. CBA is a decision-aid tool in that it provides objective data. Depending on the cost-benefit ratio, it is possible to determine whether the project is profitable or not. For example, it was possible to calculate the costs of restoring the ecological quality of the Alsatian water table and to assess the corresponding benefits.

■ **Cost-effectiveness analysis (CEA)**

Cost-effectiveness analysis is used to select the various options or measures required to attain a goal at the least possible cost. The analysis ranks measures depending on their effectiveness in reaching an environmental objective, but it does not inform on the relevance or utility of a measure or project.

■ **Cost recovery**

A general principle stipulating that water users should, to the greatest degree possible, bear the costs incurred by their use of water, namely the investment, operating and depreciation costs, as well as environmental and resource costs. The WFD 2000/60/EC set two cost-recovery objectives for the Member States. By the end of 2004 and in carrying out the characterisation processes, they were to determine the current level of recovery, taking care to distinguish at least three economic sectors (industry, agriculture, households) and, secondly, by 2010, apply the principle, notably via water pricing. The directive stipulates maximum transparency in funding of water policy, but does not require total cost recovery from users.

■ **Cross-subsidy**

A financial transfer between categories of users of the same water and sanitation services. As per the WFD 2000/60/EC, the main categories of water-service users are households, industry and agriculture.

■ **Demand function**

This function establishes the link between the optimum selection (the demanded quantities) and the various price and revenue values. For a given good, the demand function will depend on the price of all goods and on the revenue of the consumer.

■ **Depreciation**

Reduction in the value of fixed capital over a given period of time due to normal wear and foreseeable obsolescence. Note that obsolescence is the loss of value resulting from a drop in the desirability and the utility of a good due to its outdated design and construction.

■ **Discounting**

Mathematical calculation used to compare economic values over time by discounting the future value of a good or service to its present value. Discounting makes it possible to include future expenses and benefits in the analysis. The decision concerning the discount rate (the coefficient used to calculate the present value of a value occurring in the future) influences the analysis results. In 2005, the General planning commission recommended revising the discount rate for public investment projects.

■ **Discrete goods**
Goods that are naturally expressed in discrete (whole) units. For example, demand for automobiles is expressed in numbers of vehicles and not in terms of the time they are used (non-discrete units).

■ **Disproportionate costs**
Disproportionate costs are those sufficient to justify an exemption from the obligations stipulated by the Water framework directive 2000/60/CE. Costs are said to be disproportionate if the impact of measures on the price of water and on economic activities is judged excessive compared to the economic value of the projected environmental benefits and other advantages. The disproportion is analysed on a case-by-case basis taking into account criteria such as the financial resources available in the area affected by the measure and among the user group(s) required to assume the cost (in the case of households, the threshold is set by their capacity to pay significantly higher water bills) and/or the benefits of all types expected to be produced by reaching good status in 2015 (production of drinking water from a water table without additional treatment, restoration of wetlands that contribute to flood control, etc.). If the stakeholders in the river basin can demonstrate that the cost of a measure is disproportionate, they may receive an exemption. Spreading the cost of a measure beyond 2015 to 2021 or even 2027 may be sufficient to make the cost acceptable.

■ **Economic analysis**
Economic analysis employs analytical methods and economic instruments to assist in formulating water-management policies in compliance with the WFD (Water framework directive). The goal is to ensure that economics plays a role during several major steps in WFD implementation, namely contribute to achieving environmental objectives through incentive pricing, assess the economics of water use in the river-basin district and estimate the levels of cost recovery for services during the preparation of the characterisation reports, justify exemptions to good-status objectives (disproportionate cost of measures), assist in selecting measures for the river-basin district and in setting up the overall programmes of measures (programme optimisation by analysing the cost and effectiveness of each measure).
See Cost-benefit analysis (CBA), Cost-effectiveness analysis (CEA), Cost recovery, Sensitivity analysis.

■ **Economic good**
Any object capable of satisfying a need. There is an unlimited number of economic goods. Goods are determined not only by their physical characteristics, but also by their location and date of availability.

■ **Economic surplus**
The difference between the maximum willingness to pay for a good and the price of the good.

■ **Ecosystem service** (as per the Millenium Ecosystem Assessment, MEA)
A direct or indirect benefit derived by humans from nature. Services include the self-maintenance services, supply services, regulating services and cultural services.

■ **Elasticity of demand with respect to price**
Elasticity is calculated as the percentage of variation in water consumption if the price of water is increased by 1%. Generally speaking, the elasticity of household water consumption is low because most uses (drinking water, hygiene, etc.) are not very compressible. On the other hand, external consumption (watering of lawns, washing of cars, etc.) is much more elastic (significant drop following a price increase) because it covers non-essential needs.

■ **Environmental assessment method**
A method used to determine the environmental impact of environmental damage and benefits. There are a number of methods, including the contingent-valuation method, hedonic-pricing method, travel-cost method and protection-expenditure method.

■ **Environmental costs**
The cost of damage inflicted on the environment and ecosystems, and indirectly on those using them, e.g. lower quality of water resources and soil, cost of additional treatment required for drinking water assumed by local governments, etc. For the Water framework directive 2000/60/EC, economists look at the damages caused by water uses (abstractions, discharges, development work, etc.).

■ **Environmental damage** (as per an EU agreement on 18 September 2003)
A measurable, negative change in a natural resource (species, protected natural habitat, water and soil) or a measurable deterioration in a service provided by natural resources (functions provided by a natural resource benefiting another natural resource or the public) that may occur through direct or indirect action.

■ **Environmental economics**
A branch of economics studying the theory behind the relationships between human societies and the environment, notably in the framework of environmental economic policies.

■ **Environmental good**
A good available free of cost and whose production did not require any human work. This may be the air we breathe, a landscape, the quality of a water body, the presence of animals in an environment, the absence of noise and visual pollution, etc.

■ **Environmental tax**
A tax instituted by the State in order to limit pollution and overuse of water resources. In terms of pollution, the tax consists of a fee per unit of discharge that is equal to the marginal cost of reducing the pollution. Economically speaking, a tax is more efficient than a standard because the effort involved in reducing the pollution is apportioned naturally and at lesser cost.

■ **External costs**
Costs incurred by one activity to the detriment of another and not compensated or assumed by the entity generating those costs. For the Water framework directive 2000/60/EC, economists look at the external costs for the environment caused by water uses and, more generally, water-related activities (abstractions, discharges, development work, etc.). For example, if a resource is polluted, the cost of finding and operating a new resource is ultimately borne by the customers of the drinking-water service via the cost per cubic metre. One of the primary techniques used by environmental economics consists of integrating external factors affecting market prices. In other words, the price of environmental degradation (pollution, over-use, etc.), which would otherwise be ignored, is taken into account by environmental economists.

■ **Externality**
Externalities occur when the activity of an economic agent impacts other agents, in those cases where the impact is not the objective of the activity and the other agents are not involved in the activity. The other agents are not consulted and do not receive (if the impact is negative) or pay (if the impact is positive) any compensation. An externality may be positive or negative, and may be the result of production or consumption.

■ **Fixed capital**
All material means of production that are not consumed during the production process. Their service life exceeds one year.

■ **Fixed costs**
Fixed costs are that part of production costs that do not vary depending on the quantities produced. They depend on the structure of the economic activity. For example, fixed costs are the primary cost in industrial activities employing networks. For public water and sanitation services, fixed costs may represent 80% of total costs.

■ **Good**
See Complementary goods, Discrete goods, Economic good, Environmental good, Market good, Non-market good, Public good, Substitute (or substitutable) good.

■ **Green gross domestic product**
The result of a calculation subtracting any drop in the stock of natural resources (e.g. water resources) from the standard gross domestic product. This accounting method provides better information on whether an economic activity increases or decreases domestic wealth when it uses natural resources.

■ **Hedonic-pricing method**
A method used to determine the environmental factor in real-estate prices. The price of real estate depends on its characteristics and a number are directly related to the quality of the local environment.

■ **Heritage value**
The non-use value arising simply from the fact that the heritage exists.

■ **Hypothetical bias**
A type of bias resulting when respondents, confronted with a fictitious market, encounter difficulty in expressing their preferences. In the environmental field, the lack of references results in answers very different than the choices that individuals would make in a real situation.

■ **Inclusion bias**
A type of bias resulting when individuals report the same willingness to pay (WTP) for a particular environmental good (e.g. a river reach) and a larger good (e.g. all the rivers in the river basin or all the rivers in the department). This confusion between geographic scales or between environmental issues (aquatic environments, biodiversity, air quality) represents the inclusion bias.

■ **Information bias**
A type of bias resulting when the information on the assessed good is insufficient and the questioned person does not provide an accurate estimate of their willingness to pay.

■ **Internalisation**
This technique consists of integrating external costs in the economic flows. For example, the polluter-pays principle is a means to internalise the external costs created by the polluter and affecting other users and the environment.

■ **Investigator bias**
A type of bias resulting when the respondent indicates a willingness-to-pay value higher than the true value in order to please the investigator.

■ **Market good**
Market goods are items that may be bought or sold.

■ **Method**
See Contingent-valuation method (CVM), Environmental assessment method, Hedonic-pricing method, Protection-expenditure method, Travel-cost method.

■ **Natural monopoly**
Situation in which a single firm or person offers a particular good or service to an array of purchasers. The monopoly is said to be natural when production yields rise with output, notably when fixed costs are much higher than the variable costs.

■ **Non-market benefit**
Benefit that may result from a project, but is not marketable (saleable).

■ **Non-market good**
Non-market goods cannot be bought or sold.

■ **Non-use value**
The value assigned to a good or service due to its simple existence, by an economic agent who does not intend to use it. The non-use value comprises two components, the existence value and the value for others.

■ **Opportunity costs**
The value of the opportunity lost because one use of available resources was preferred over another, in cases where the resource is limited. In the water field, for example, this may be the value of irrigated corn that could have been produced if the river water had not been used for drinking water or to generate hydroelectricity.

■ **Option value**
The use value assigned to the preservation of an asset in view of its future use, e.g. the preservation of a plant due to its medicinal value.

■ **Pareto efficiency**
Situation in which it is impossible to make any one individual (or category of individuals) better off without making at least one individual (or category of individuals) worse off. This is a reference situation in economic theory dealing with resource allocation.

■ **Polluter-pays principle**
A principle, now inserted in the French Environmental code, stipulating that any costs arising from measures to prevent, reduce or eliminate environmental pollution must be assumed by the polluter.

■ **Pollution-rights market**
Market of tradable permits enabling a stakeholder (company, individual, etc.) to discharge a pollutant or to draw on natural resources. The State sets environmental-quality objectives and then grants a corresponding amount of rights. These rights may then be purchased and sold on the market, it being understood that a polluter may not discharge pollutants in excess of the corresponding permits in his possession.

■ **Price setting**
The purpose of this policy is to influence water use through the price paid by users. The WFD 2000/60/EC required that the Member States ensure, by 2010, that pricing policy encouraged efficient use of water to avoid waste.

■ **Private costs**
A private cost is the part of the social cost assumed by the economic entity incurring the cost. A private cost is an internal cost.

■ **Programme of measures**
A set of measures designed to reach the objectives for the entire river basin, contained in the river-basin management plan (RBMP).

■ **Protection-expenditure method**
A method of assessing pollution costs on the basis of expenses incurred by households to protect themselves from environmental degradation, e.g. the purchase of water softeners, bottled water, etc.

■ **Protest zero**
A rejection of all the proposed scenarios by a respondent during a contingent valuation. Some individuals may declare zero willingness to pay (protest zeros) in spite of the fact that they are in favour of the proposed project. It is possible to distinguish protest zeros from real zeros during a survey. Protest zeros are generally excluded from the analysis.

■ **Public good**
A good or service whose use is non-competitive and non-exclusive. The term "non-competitive" means that consumption/use of the good by one individual does not impede its consumption/use by another (e.g. fireworks). The term "non-exclusive" means that all individuals have free access to the good or service (e.g. public lighting).

■ **Resource costs**
The value of the opportunity lost because one use of available resources was preferred over another, in cases where the resource is limited. This is the difference in benefit value between the option producing the highest benefit value and the selected option.

■ **Sampling bias**
A type of bias resulting when the sample is not representative of the population receiving a benefit, for example a survey carried out exclusively in cities.

■ **Self-selection bias**
A type of bias resulting when individuals concerned by an issue or those visiting a site more frequently are more likely to be questioned (a situation encountered when face-to-face surveys are carried out on recreational sites).

■ **Sensitivity analysis**
Method of determining the robustness of economic-analysis results depending on variations in certain parameters or assumptions.

■ **Shadow-price value**
Amount that the Ecology ministry recommends for routine use in quantifying the value of non-market environmental services provided by aquatic environments, as profits from the preservation or restoration of aquatic environments or as losses incurred by their degradation.

■ **Social costs**
Social costs are the set of all costs incurred by an activity and borne by society as a whole. They include both private costs and external costs.

■ **Strategic bias**
A type of bias resulting when respondents think they can influence the final decision by exaggerating their willingness to pay. Some individuals may indicate a lesser value on the assumption that others will pay for them (stowaway phenomenon). These individuals have nothing to gain by revealing their true preferences if they think they can obtain an advantage by masking their opinions.

■ **Substitute** (or substitutable) good
Two goods are said to be substitutable if they satisfy the same or similar needs. Examples are automobiles and trains.

■ **Total cost of water**
The total cost of water, including environmental, resource and service costs.

■ **Total economic value**
The sum total of the use and non-use values of a good or service.

■ **Transaction costs**
Cost incurred during an economic exchange and, more precisely, on a market. The cost may be direct (stock-market fees) or indirect (prospecting costs, time and effort spend in negotiations and checking the transaction, etc.).

■ **Travel-cost method**
A method to estimate the maximum price that visitors would be willing to pay in order to continue visiting a site. It is based on the idea that the travel costs incurred by the visitors in reaching the site represent the amount they are willing to pay. The travel cost is a measure of each individual visit.

■ **Use value**
The value assigned to a good or service by an economic agent depending on the usefulness that may be derived from the good or service. The use value comprises two components, the effective use value and the option value residing in the possible future use.

■ **Value**
See Bequest value, Heritage value, Non-use value, Option value, Shadow-price value, Total economic value, Use value.

■ **Variable costs**
Variable costs are that part of production costs that vary depending on the quantities produced. For example, the procurement cost of raw materials is a variable cost that increases when business activities or production increase.

■ **Water body**
A homogeneous aquatic environment (lake, reservoir, river reach, unit of groundwater, etc.).

■ **Water footprint**
The footprint includes all the water used at all steps in the production process of a product (a facility, good or service). The total volume is also called the "virtual water content". For example, a total of 140 litres are required to produce a cup of coffee and 16 cubic metres (16 000 litres) are required to produce one kilogram of beef. The footprint represents the total amount of water (expressed in litres or cubic metres) that is used directly or indirectly for an activity and any related activities, including the water used in the supply system.

■ **Water-related activity**
Economic activity using water and water services.

■ **Water service**
Water services include, for households and all other economic activities, the abstraction, impoundment, storage, treatment and distribution of surface water or groundwater, as well as the collection and treatment facilities for wastewater prior to its discharge to surface waters.

■ **Wealth effect**
The influence of wealth on a datum. For example, the willingness to pay of wealthy persons is generally higher than that of poorer persons.

■ **Well-being**
The satisfaction of an individual or of a community.

■ **Willingness to accept (WTA)**
Amount of money that surveyed individuals are willing to accept in exchange for degradation to their environment.

■ **Willingness to pay (WTP)**
Amount of money that surveyed individuals are willing to pay to avoid degradation to an environmental good or for its improvement. WTP expresses in euros the change in well-being or satisfaction linked to the degradation/improvement in the environment.

■ **Willingness-to-pay survey card**
A card on which survey respondents may check one of several monetary amounts corresponding to their willingness to pay.

The above definitions were drawn from the EauFrance site (http://www.glossaire.eaufrance.fr/).

Bibliography and web references

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The Water framework directive marks a turning point for European legislation in the field of water preservation and pollution control by shifting from a set of required means to goals and required results. It is in this context that economics have become a decision-aid tool for public policy and taken on an important role in formulating management policies for water and aquatic environments.

Whether the goal is to characterise in social-economic terms how water is used in a given area or to assess the costs and environmental impacts of a programme of measures or a project, economic analysis is now an integral part of the preparatory and formulation processes of public policy.

Whatever the size of the project, cost-recovery analysis, cost-effectiveness analysis and cost-benefit analysis are all assessment techniques that water specialists must use to comply with regulations and implement water-management policy in their area.

This book in the *Knowledge for action* series takes an in-depth look at the main theoretical and practical aspects of using economic analysis for management of water and aquatic environments.

Maria Salvetti has worked as an economist at the Seine-Normandie Water agency, at the Environment Agency in the U.K., at the Water board for the Paris region and at the National agency for water and aquatic environments.

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