EPI WATER

Evaluating Economic Policy Instruments for Sustainable Water Management in Europe

Guidance on the design and development of Economic Policy Instruments in European water policy

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Foreword

Economic Policy Instruments (EPIs) are incentives designed and implemented with the purpose of adapting individual decisions to collectively agreed goals. They include incentive pricing, trading schemes, cooperation (e.g. payments for environmental services), and risk management schemes. EPIs can significantly improve an existing policy framework by incentivising, rather than commanding, behavioural changes that may lead to environmental improvement. They can have a number of additional benefits, such as creating a permanent incentive for technological innovation, stimulating the efficient allocation of water resources, generating revenues to maintain and improve the provision of water services, promoting water use efficiency, etc.

EPIs have received widespread attention over the last three decades in climate, energy, and air policy-making, but less so in water policy. In recent years, however, an increasing number of local, national and international EPI experiences in water management have appeared, and key legislative and policy documents, including the EU Water Framework Directive 2000 (WFD) and the Blueprint to Safeguard Europe's Waters (2012) now support their wider use. This guidance was developed to respond to this policy context, and take stock of existing experiences in order to support the further use of EPIs. It was developed as part of the research activities of the EU-funded EPI-Water project (see text box below). This guidance aims to:

- Support national decision-makers and experts in the development and implementation of EPIs in water management, mainly taking into account the EU legislative framework; and
- Raise awareness of EPIs, so that stakeholders can engage effectively with decision-makers and experts on the development and implementation of EPIs.

This guidance is designed to steer interested parties through an overall policy development process that can help address specific formulation and implementation issues. It focuses on key water management challenges relevant for the implementation of the EU WFD and related pieces of legislation (e.g. restoration of water ecosystems, tackling pollution, etc.) and more generally European water policy, including increased resilience to water scarcity and less vulnerability to drought or flood risk. It also sheds light on key concepts and definitions, and conveys the benefits, limitations, transaction costs, and opportunities of using EPIs in water policy. It presents key steps involved in the choice, design and implementation of EPIs, and illustrates them with *ad-hoc* examples and case-studies based on a wide set of implemented EPIs, as well as more innovative ones, within and outside the EU.

The EU FP7 EPI-Water project

Launched in January 2011 for a three-year period, the EPI-Water project's (standing for *Evaluating Economic Policy Instruments for Sustainable Water Management in Europe*) main aim was to assess the effectiveness and the efficiency of EPIs in achieving water policy goals. In a first *ex-post* assessment, the project studied 30 EPIs in Europe and around the world (Australia, Chile, China, Israel and the United States of America). The second phase of the project carried out in-depth *ex-ante* assessments of the feasibility and the expected outcome of EPIs in five EU areas (Hungary, Spain, France, Denmark, and Greece) facing different water management challenges. For more information on the EU-funded EPI-Water research project: http://www.feem-project.net/epiwater/

This guidance follows the style of available guidance documents on the application of economic analysis for the implementation of the Water Framework Directive. To better guide the user the following colour coding schemes have been used throughout:

Blue-coloured text boxes refer to actual illustrative examples coming directly from EPI-water public deliverables. They are intended to highlight best practice or specific examples to key conceptual and analytical issues that have been identified as relevant and put the interested reader on the track to further material.

Blue-coloured text boxes with exclamation marks refer to key/warning messages that highlight important conceptual and practical concepts to bear in mind at different stages of the EPI development cycle.

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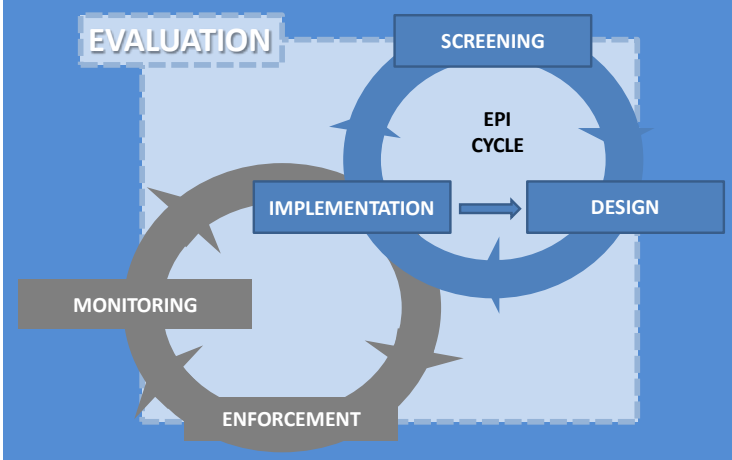
What will you find in this document?

What you will not find in this document

EPIs include a very wide array of instruments, and their successful formulation and implementation will be dependent on a variety of environmental, technical, institutional, economic and social factors that will differ amongst the types of EPIs and the context in which they are to be implemented. Therefore, this document does not provide detailed and rigid guidelines that would be difficult to adapt to local and site-specific contexts. Instead, it focuses on key conceptual and analytical issues, as well as referring to a large range of specific experiences to be used as sources of inspiration derived from the results of the FP7 EPI-water project. The document makes only slight references to the technical (ex-ante and ex-post) assessment of EPIs, this topic being covered in more detail in other work areas of the project (e.g. the EPI-Water Assessment Framework and Methodological Toolbox).

The "simplified" EPI development cycle applied in this guidance



Arguably, the full EPI development cycle includes the following sequential steps: screening, design, implementation, enforcement and monitoring. Each of these steps of the cycle is influenced by constant evaluation about their potential impacts that can at any given moment in the cycle force reconsideration or adjustment of the proposed EPI. The different steps are normally not easy to differentiate and are influenced by constant feedback loops between steps.

This guidance document, as it builds on experience from deliverables of the EPI-water project, focuses on sharing best practice that is mostly relevant for the Screening, Design and to some extent Implementation stages of the EPI development cycle. As they were not included in the remit of the EPI-water work programme, Enforcement and Monitoring have not been covered in this document.

Our definitions...

Screening:	Identifying why and when it is relevant to use any given EPI/s under certain conditions.
Design:	Understanding the different elements that are necessary to make the EPI "effective" in order to deliver its expected outcomes.
Implementation:	Reflects the cost and challenge of moving from a theoretical idea towards the practical application of an EPI.
Enforcement:	Associated rules and activities to ensure compliance with existing legislation and ensure the achievement of the EPI expected outcomes.
Monitoring:	Necessary formal procedures put in place to inform compliance checking and distance to target.
Evaluation:	Ex-ante or ex-post appraisal of EPI performance in relation with alternative policy tools.

What are Economic Policy Instruments (EPIs)?

Following a review of the literature, the EPI-Water consortium defines EPIs as incentives designed and implemented with the purpose of adapting individual decisions to collectively agreed goals. EPIs for sustainable water management are consequently designed and implemented both to induce some desired changes in the behaviour of all water users in the economy (being individuals, firms or collective stakeholders) and to make a real contribution to water policy objectives, in particular reaching the environmental objectives of the EU Water Framework Directive, at least cost for society.

Three ideas are crucial when thinking of EPIs: incentives, motivation, and voluntary choice. Rather than prescribing a particular type of behaviour that the user should comply with, EPIs create or harness economic incentives to encourage or discourage certain behaviour, but finally leave it to the user to devise his/her way of dealing with those incentives based on individual motivations. An EPI must result in voluntary changes (i.e. of practices, technology, etc.) that contribute to improving the status of ecosystems and meeting relevant environmental objectives.

Securing the environmental effectiveness of EPIs

Not all economic instruments may induce changes that contribute to meeting environmental objectives. For instance, an increase in water tariffs to recover the cost of drinking water supply might not necessarily result in reducing water use. To be environmentally effective, tariffs should be designed by taking into account how users may respond to the price signal.

Four main forms of EPIs can be broadly distinguished: pricing, trading, cooperation, and risk management schemes:

- In pricing mechanisms, incentives are usually introduced via tariffs, charges or fees, taxes or subsidies;
- Trading relies on the exchange of rights or entitlements for abstracting or using water, or polluting the water environment;
- Cooperative mechanisms are based on the voluntary adoption of new practices leading to reduced pressure on the water environment. They can either be self-motivated –without monetary incentives- or accompanied with some form of payments (e.g. subsidies);
- Risk-based mechanisms rely on the influence of differential insurance premiums and compensation levels.

Table 1.1 presents in more detail the main characteristics of the four main forms of EPIs.

Table 1.1. Typology of EPIs relevant to water management.

Type of instrument		Definition	What can the EPI deliver for water policy?
Pricing	*Tariffs*	Price to be paid for a given quantity of water or sanitation service, either by households, irrigators, retailers, industries, or other users.	Encouraging technological improvements or changes in behaviour leading to a reduction in water consumption or in the discharge of pollutants. In addition, they generate revenues for water services or infrastructures.
	Taxes	Compulsory payment to the fiscal authority for a behaviour that leads to the degradation of the water environment.	Encouraging alternative behaviour to the one targeted by the tax, for example the use of less-polluting techniques and products.
	Charges (or fees)	Compulsory payment to the competent body (environmental or water services regulator) for a service directly or indirectly associated with the degradation of the water environment.	Discouraging the use of a service. For example, using charges in a licensing scheme may discourage users to apply for a permit.
	Subsidies on products	Payments from government bodies to producers with the objective of influencing their levels of production, their prices or other factors.	Leading to a reduction in the price of more water-friendly products, resulting in a competitive advantage with comparable products.
	Subsidies on practices	Payments from government bodies to producers to encourage the adoption of specific production processes.	Leading to the adoption of production methods that limit negative impacts, or produce positive impacts, on the water environment.
Trading	*Trading of permits for using water*	The exchange of rights or entitlements to consume, abstract and discharge water.	Encouraging the adoption of more water efficient technologies. May improve the allocation of water amongst water users.
	Trading of permits for polluting water	The exchange of rights or entitlements to pollute the water environment through the discharge of pollutants or wastewater.	Encouraging the adoption of less water polluting technologies. Improve the allocation of abatement costs amongst water users.
Cooperation		Negotiated voluntary arrangement between parties to adopt agreed practices often linked to subsidies or offset schemes.	Encouraging the adoption of more water-friendly practices.
Risk management schemes	*Insurance*	Payment of a premium in order to be protected in the event of a loss.	Water users' aversion to risk and willingness to pay for income stabilisation. When properly designed, insurance premiums signal risk and discourage behaviours that increase risk or exposure
	Liability	Offsetting schemes where liability for environmental degradation leads to payments of compensation for environmental damage.	Liability as a means to incentivise long-term investments in water efficient devices.

Why considering EPIs?

Water management issues remain in Europe

With the end of the first cycle of the implementation of the WFD River Basin Management Plans (RBMP) in 2015, it is becoming clear that environmental objectives set by the WFD are far from being achieved: only slightly over half of water bodies in the European Union are likely to achieve the Good Ecological Status by 2015 (EC, 2012). In parallel, water scarcity, droughts and flood risks are under renewed policy attention as the impacts of anthropogenic climate change are becoming clearer and more real. In this context, EPIs can offer new and complementary modes of governmental actions. Rather than using explicit regulation on water uses, EPIs are based on voluntary behavioural change supported by a system of economic incentives. In doing so, they encourage water uses to realise optimal rates of resource use or pollution emission while supporting the attainment of environmental objectives at least cost for society.

The use of innovative EPIs can save money

Historically, New York City has enjoyed unfiltered drinking water. Land use changes, however, began to degrade water quality. To solve the problem, an innovative Watershed Agricultural Program was developed as part of an agreement with the US Environmental Protection Agency to avoid filtration requirements for part of the city's water supply. Under an agreement with farmers, a farmer-run institution, the Watershed Agricultural Council (WAC), was established to develop and implement best management practices (BMPs) on farms whose owners voluntarily participate. The city is financing the operating costs of the WAC and covering all the costs to farmers of adopting BMPs. In this sense, the WAP is an example of "payments for ecosystem services" (PES): the city is paying for the service of improved source water quality.

Under the agreement, New York City is purchasing critical lands, regulating to some extent land uses, financing a watershed agricultural program, and investing to upgrade infrastructure, such as septic systems and waste water treatment plants. This is costing the city around $1.5 billion (1.16 EUR) so far. Compared to the alternative option, building a filtration plant for the Cat-Del system (90% of the city's water by volume) was estimated to cost, in 1990 dollars, $4-8 billion (roughly $6.5 billion to $13 billion in 2010 dollars or approximately 5 to 10 billion EUR) in up-front capital costs and $250 million annually in operating costs.

EPIs can bring benefits

Besides influencing the behaviour of water users to reach environmental objectives, EPIs can have a number of additional benefits, notably by:

- Increasing the economic efficiency of governmental action. EPIs allow water users to meet environmental targets by adopting practices and/or technologies at least cost. Water users with lower marginal abatement costs will find an incentive to reduce pollution first, so the overall aggregate costs of meeting environmental targets are lower than if all water users are targeted indiscriminately. Finally, EPIs may maximise overall benefits by allocating water resources to most valuable uses;
- Generating financial resources to maintain and improve the delivery of water services. EPIs may help recover capital and operational costs, as well as so-called environmental and resource costs (as required by the EU WFD);
- Creating permanent incentives for continued technological innovation, as opposed to regulatory instruments that may only provide incentives to innovate until compliance is achieved;
- Flexibility and the capacity to adjust to shifting conditions, with minimal transaction costs (e.g. option value that informs infrastructure design and investment).

Each type of EPI has more specific benefits (OECD, 2001; 2010; 2012). Some of those are listed in the templates provided in the Chapter "Rapid Appraisal of Selected Instruments".

EPIs are not THE ONLY answer!

The use of EPIs clearly faces several challenges in Europe, notably due to misconceptions on their costs and benefits, and limited interest or, in some cases, political resistance. While it is often stated that EPIs are more "adaptable" and easier to reform than other instruments, adjusting EPIs can in reality face similar rent-seeking practices and constraints than any other policy instruments. As for any other policy instruments, the choice, design and implementation of EPIs must be encompassed with a careful analysis of the environmental, social and economic context, and embedded in critical debate on their relevance, their limitations, and their potential synergies and conflicts with other forms of governmental action.

EPIs are already part of the regulatory framework

Most importantly, EPIs are recognised at political level in several major pieces of European legislation and policy documents. The EU Water Framework Directive (WFD) adopted in 2000 is playing a major role in furthering the use of economic instruments, in particular

through the requirement for using water pricing as one of the policy instruments to be used to meet environment objectives, and more specifically to recover the full economic costs of water services. EPIs have also received specific attention in a range of related European policies (Table 1.2).

Table 1.2. How are EPIs part of the regulatory framework?

Policy/legal document	Linkage with EPI...
The EU Water Framework Directive (2000)	Introduces a set of principles and measures that rationalize water use across member states. Its Article 9 calls for the full cost recovery of water services through pricing.
The recent EU Blueprint to Safeguard Europe's Waters (2012)	Emphasises the importance of incentive water pricing and other EPIs such as water trading and Payments for Ecosystem Services in the policy mix to improve Europe's water
The EU Action on Water Scarcity and Droughts (from 2007)	Highlights the role of incentive pricing for adapting water demands and ensuring sustainable water management
The EU Floods Directive (2007)	Encourages, as part of its implementation, the uptake of green infrastructures and natural flood management by financially rewarding land managers and water users
The Common Agriculture Policy (currently being revised)	Includes financial reward (in the form of subsidies) for the protection of the water environment. Measures such as flood risk and drought insurance may be included in the future
The Nitrate Directive (1991)	Promotes the adoption of cooperative agreements through codes of Good Agricultural Practices
The Climate Change Adaptation Strategy (2013)	Encourages the greater use of insurance to build resilience against climate change impacts in particular water scarcity, droughts and flood risk
European Cohesion and Structural policies	Includes new *ex-ante* conditions on water pricing in order to be eligible for funding
EU biodiversity policy (including the Habitat and Birds Directives and the LIFE financing mechanism)	Encourages the use of financial and non-financial rewards for the protection of aquatic ecosystems.

EPIs are not "just theory"

A wide range of EPIs has been applied at different spatial scales (e.g. national, regional, river basin, etc.) and on different sectors (e.g. water utilities, industry, agriculture, tourism, hydropower generation, etc.). Tariffs, taxes and charges are by far the most recurrent EPIs, followed by subsidies and cooperative schemes. While trading schemes on water quantity have been limited to a few cases in Europe (e.g. Spain, England and Wales), they have been more popular elsewhere, notably in Australia, the semiarid Western states of the USA, or

Chile. Table 1.3 presents some examples drawn from the 30 selected cases of the EPI-Water research project.

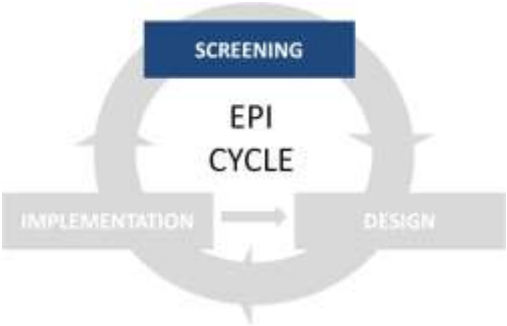
Table 1.3. Some examples of the EPIs investigated in the EPI-Water project.

Type of instrument		Matching cases
Pricing	*Tariffs*	United Kingdom (mainly England and Wales); Israel; Colorado (US)
	Taxes	Denmark; Hungary; the Netherlands; Germany
	Charges (or fees)	Hungary; Baden- Württemberg (Germany); Po Basin (Italy)
	Subsidies on products	Switzerland; Germany
	Subsidies on practices	Cyprus
Trading	*Tradable permits for using water*	Tagus Basin (Spain); Colorado (US); Murray-Darling basin (Australia); Chile
	Tradable permits for polluting water	Ohio (US); North Carolina (US)
Cooperation		Lower Ebro basin (Spain); Evian (France); New York (US); Dorset (United Kingdom)
Risk management schemes		Australia

Which EPIs are relevant to a given context? - **Screening** the available options

Definition

- This early step in the EPI development cycle is about identifying why and when it is relevant and appropriate (or inappropriate) to use any given EPI(s);
- It is also concerned by whether there is an opportunity the EPI may contribute to address; taking into account the social and economic context.



What you will find in the Chapter "screening"

- Key steps for performing a rapid screening of EPIs in order to help interested parties to decide whether or not to consider them further.

Section highlights

- Drawing attention to water policy challenges (keeping in mind path dependence)
- Identifying opportunities or favourable conditions for introducing EPIs:
  - Potential for adopting a co-ordinated approach between uses;
  - Scope for improving technical efficiency;
  - Willingness to pay for environmental services and reliable water supply;
  - Possibility to exploit existing environmental and technological assets.
- Taking into account the existing policy mix or the need for water policy reform.

The screening of EPIs should not be done in isolation from later development stages!

Several iterations and feedback loops from design and implementation are needed to refine and adjust EPIs to new information and context...

The overall screening process for assessing possible new EPIs is outlined in Figure 2.1.

The screening process presented here focuses on three main factors: (i) the nature of the water policy challenge; (ii) the type of opportunities in the system being managed; and (iii) how to consider the existing policy-mix.

Figure 2.1. Key steps involved in the screening of EPIs.

Key Screening Steps	Definition
Path Dependence	To understand how the system managed is bounded by environmental, social and economic drivers, barriers and legacies. These exogenous factors may constrain the effectiveness of the EPI. They will help identify opportunities to introduce these instruments as well as the baseline against which the effectiveness of the EPI may always be assessed.
Environmental Issues	To identify the intended environmental outcome. Many EPIs are developed and used with no clear expected environmental outcomes: EPIs should change water users' behaviour in order to tackle specific environmental issues.
Water Policy Challenges	To identify the water policy challenge to be tackled. This should be primarily an environmental improvement objective, but may also include financial or developmental concerns.
Opportunities	To check whether key opportunities for introducing EPIs are met. These "opportunities" should not be seen as pre-conditions for the introduction of an EPI but only as favourable conditions for efficient and effective EPIs.
EPI Selection	Which EPI(s) fit best the water policy challenges and existing opportunities? This includes the screening of alternative instruments (e.g. second and third best options).
POLICY MIX	To be aware of the existing mix of policy instruments, its economic efficiency, and its effectiveness in improving the status of the water environment. This should inform the selection and design of the EPI, but also suggest necessary amendments to other policy instruments and the broader institutional framework.

Understanding your water policy challenges

There is a number of factors that could or should influence the selection of EPIs. Clearly, EPIs should be selected to obtain a particular behavioural response by a water user that is coherent with the goals of water policy. EPIs should ideally play different roles: as an incentive to meet environmental objectives, and also as a fiscal or financial mechanism (Table 2.2). Yet, meeting these potentially conflicting objectives may be impossible. For example, the OECD (2010) provides a detailed discussion of potential tensions between four sets of objectives (economic, social, financial, environmental efficiency) in the case of tariffs for water supply and sanitation services. In the context of the EPI-Water research project, it was considered that environmental objectives were the priority since they have been placed as an overarching policy goal by the WFD, while financial and development objectives remain instrumental.

Table 2.2. Screening - Linking water policy challenges, opportunities and EPIs.

Water policy challenges	Opportunities	EPI	EPI-WATER
Improving water quality	Willingness to pay for environmental services	Nitrate tax Voluntary agreements Trading schemes	Denmark (ex-ante and ex-post) UK (Dorset) USA (Ohio)
Restore damaged ecosystems	Willingness to pay for environmental services	PES	France (ex-ante and ex-post)
Responding to water scarcity and increased drought risk	Potential for a coordinated response to scarcity and drought risk Willingness to pay for reliable supply of good quality water Technical efficiency gap Insurance mechanisms can discourage behaviour that increases potential liabilities	Water markets, drought Insurance pricing schemes	Spain (ex-ante)
Reducing flood risk	Potential for a coordinated response to flood risk Willingness to pay for environmental services Insurance mechanisms can discourage behaviour that increases potential liabilities	Compensation payments for flood water storage	Hungary (ex-ante)

The EPI-Water column refers to specific examples examined in the EPI-Water research project. Ex-post case-studies refer to those examples where EPIs have already been implemented; ex-ante case-studies refer to those examples where the potential for EPIs were explored.

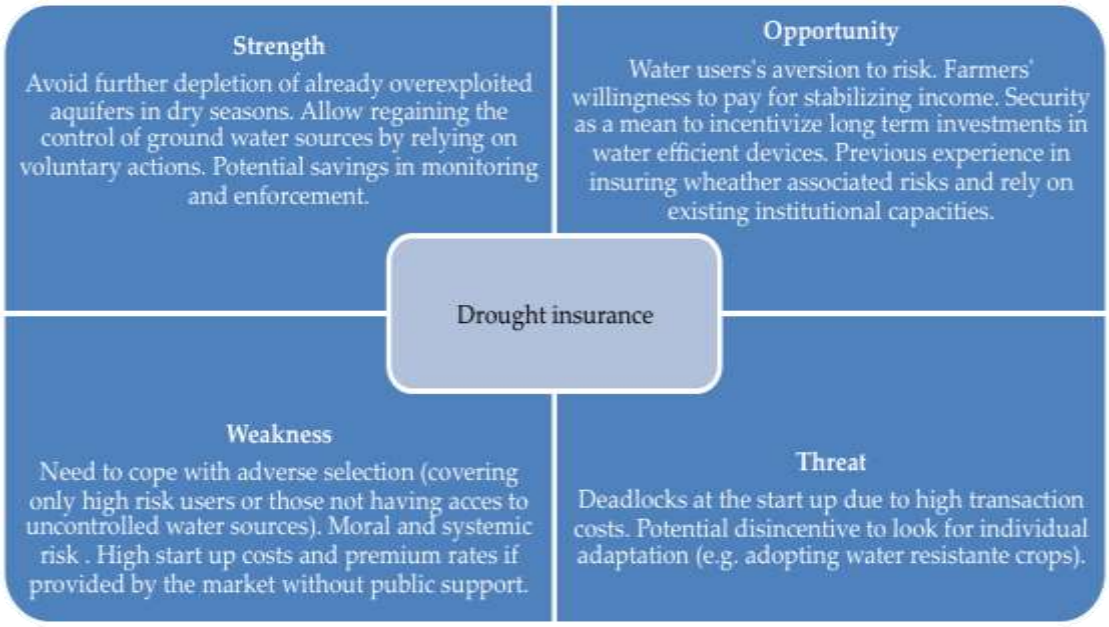
Key opportunities to introduce EPIs

In addition to the type of water policy challenge, the selection of EPIs can take into account the existence of key economic, social, and physical characteristics of the system to be managed. Such opportunities include:

- Willingness to pay for environmental services and reliable water supply, or to re-allocate water amongst uses. Social and political acceptability are paramount to the success of EPIs;
- Potential for adopting a co-ordinated approach between water uses, preferably with high heterogeneity between single users. EPIs such as trading schemes can exploit these differences to increase the economic efficiency of governmental action;

- Scope for improving technical efficiency, for example when a substantial amount of water is used in low productive or low efficient ways. EPIs such as incentive pricing can encourage rapid adoption of new, more efficient technologies;
- Possibility to exploit existing environmental and technological assets. For example, EPIs such as PES schemes could be effective where specific land use changes can result into real benefits to society (e.g. flood risk reduction). EPIs involving the transfer of water rights can profit from infrastructures that can reallocate water amongst places and users at a low cost;
- Opportunity to adopt a different behaviour (e.g. flood insurance schemes operate when there is an opportunity to (re)locate outside of flood-prone areas).

Figure 2.3: An example on assessing the key strengths and weaknesses of EPIs, and their opportunities and threats.



Watch out!

EPIs work best if specific environmental, technical, economic, social and institutional conditions are met. For more information, go to individual EPI templates in the chapter on "Rapid Appraisal of Selected EPIs".

Which pre-conditions are necessary for implementation of Payments for flood storage

- Good hydrological skills to design location and capacity of the storage;
- Sufficient space for storage capacity;
- High variability in land use value;
- Clear ownership of land.

Considering the policy mix

EPIs are by no means substitutes for other modes of governmental action, but instruments that can complement and strengthen water governance as part of a broad mix of policy instruments. Broadly, one can discern between (i) combinations of EPIs, as part of a strategy for "packaging incentives", and (ii) mixing with other types of policy instruments, including regulatory, awareness raising, information, etc. When screening potential EPIs, one should be aware of the existing policy mix, but the selection should not be dictated by it.

The two key questions to ask at this stage include:

- What type of regulatory, economic and voluntary instruments are already in place for tackling the water policy challenge at stake?
- Broadly, how effective are they and why?
- Is it effective and efficient to keep and adapt existing economic instruments to make them perform better as EPIs?
- Would a new EPI (selected based on water policy challenges and opportunities) (i) replace or (ii) complement other policy instruments?

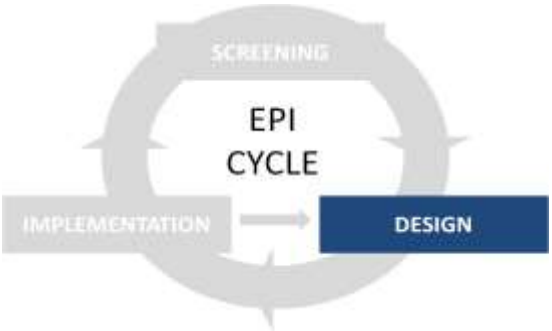
Watch out!

Issues of coherence between EPIs and other existing policy instruments can be tackled at a later stage. See the chapter on "What to keep in mind during implementation" and individual EPI templates in the chapter on "Rapid Appraisal of Selected EPIs".

What to do when **designing** EPIs?

Definition

- This step is concerned with the design of what is necessary to make the EPI "effective" in order to deliver its expected outcomes;
- Understanding this "delivery mechanism" is crucial to assess the effectiveness of an EPI. For example, flat-rate pricing is ineffective to change consumption in agriculture but marginal pricing could be more effective;
- This is the stage where the specific design of an EPI should be adjusted to the local context.



What you will find in the "design" chapter

- In this section particular attention is given to the delivery mechanism and the institutional framework.

Section highlights

- Setting the right delivery mechanism that will trigger the intended behavioural change on the ground (e.g. level of volumetric pricing, type and length of contracts in water trading, etc);
- Needs accounting for:
  - Specific environmental, social and economic context;
  - Evaluating baseline;
  - Assessing impacts.

Designing the delivery mechanism

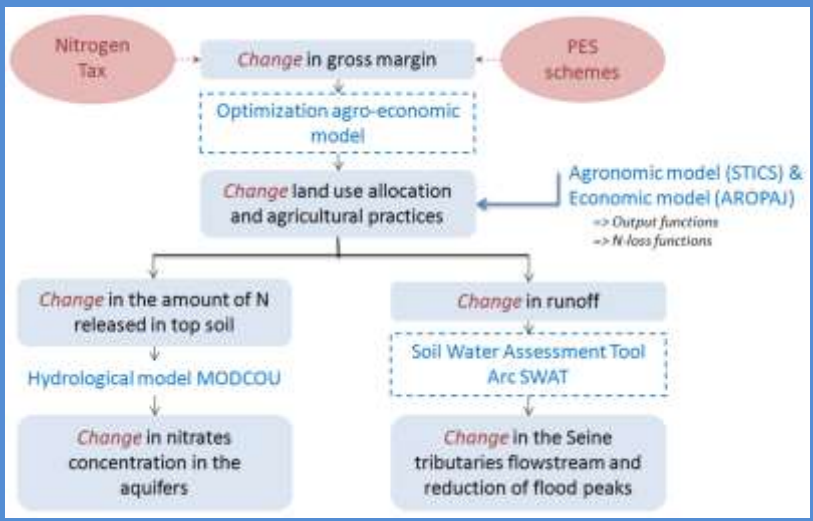
The delivery mechanism is the mechanism that triggers a behavioural change on the ground. For example, a subsidy to reduce the use of fertilisers could be implemented through a number of different delivery mechanisms such as: a code of practice that has to be applied in order to get the funding, investments in technology, or mandatory training to be eligible for funding.

Any EPI has the following main characteristics:

- The target population: type of water users (households, irrigators, a particular type of industry, etc), their spatial distribution (whole country, a region, a river basin, etc);
- The form of the incentive: for example, for water tariffs, whether fixed or increasing block rates will be used;
- The intensity of the incentive, for example the price to be paid per unit of water use, or the levels of risk premiums;
- The conditions attached to the incentive: for example, whether obtention of subsidy requires adoption of particular code of good practice.

Identifying the right level of Payment for Water ecosystem Services

The EPI research project has investigated the potential for a PES scheme to contribute to a change in land use practices leading to reduce nitrogen use and leaching in the Bassée-Voulzie catchment in France. An agro-economic optimisation model was developed to simulate the land use reallocation related to the implementation of the EPI. Farmers, as rational economic agents, are expected to react to the signals (level of payment) by changing the allocation of their land between different types of crops, their production levels and the level of inputs used. These changes are then translated into environmental impacts and benefits through a hydrological model. The case-study results found that PES based on payments higher than 4 €/kg of nitrogen loss avoided can lead to a 50% reduction in nitrogen loss.



The delivery mechanism does not connect the EPI with the environmental objective (e.g. reduced scarcity) but only to the intended change in behaviour (e.g. lower consumption). To be effective, the delivery mechanism will need to take into account how the intended change in behaviour will lead to the environmental objective.

The process of designing an EPI will typically involve:

- Identifying the type and level of environmental improvements needed to reach the objectives (taking into account baseline);
- Assessing the type and level of changes that the targeted water use(s) need to adopt to result in meeting environmental objectives;
- Evaluating how the targeted water use(s) will respond to different forms and levels of incentives based on economic criteria (social ones should be considered in the next step), and how that result in different environmental outcomes;
- Assessing how the incentives can contribute to non-environmental objectives (e.g. cost recovery);
- Evaluating socio-economic impacts and their distribution.

Ideally, different scenarios based on different priorities regarding the objectives and impacts of the EPI should be performed in order to obtain a hierarchy of options. Different design options can also be compared to the ideal form and level of the incentive for meeting the objectives. A number of methods can be used for each of these steps (Table 3.1).

Table 3.1. Examples of assessments methods relevant for EPI design.

Step	Potential methods
Assessing changes needed from water uses to result in meeting environmental objectives	Agronomic models Hydrological and rainfall-runoff models Water diffuse pollution models Environmental Impact Assessment models
Evaluating response of water uses to different types and levels of incentives	Water demand functions/econometric models Hydro-economic models Multi-criteria decision method Valuation methods Principal-agent models
Assessing contribution to non-environmental objectives	Budgetary analysis Calculation of revenue/cost ratio
Evaluating socio-economic impacts of incentives	Water productivity methods Cost-benefit analysis (including valuation methods) Cost effectiveness analysis

The EPI-Water Assessment Framework and methodological toolbox

The EPI-Water project has developed a comprehensive **assessment framework** that clarifies the criteria and indicators towards which EPIs can be assessed, including environmental outcomes, economic efficiency, financial revenues, transaction costs for regulator and regulated entities, social impact and equity issues and policy implementability. The AF makes it easier to systematically assess the effectiveness and impact of water policies and allows for comparison between policy choices, so that policymakers can sort projects from better to worse as well as understand why some projects or policies succeed or fail with respect to different assessment criteria. These comparisons facilitate institutional learning and adoption of best practises.

The **methodological toolbox** is organised as a database or catalogue advising the choice from among the variety of assessment methodologies and tools available, applicable for any given criterion of the AF. These tools allow for flexibility needed to analyse the different EPI and the background conditions under which these are set to operate.

Identify necessary adaptations in the institutional framework

The good performance of EPIs does not only depend on the form and level of the economic incentive, but may also on a number of key social factors such as individual perception, social norms and expectations, or political acceptability, as well as institutional factors such as water rights and the legal framework.

Water rights as a key dimension for water trading

The structure and features of water rights affect the manner in which markets for water trading perform. For example, systems that limit marketable volumes to consumed water can curb externalities and environmental threats. In contrast, systems that allow the transfer of nominal entitlements without considering effective use face problems of overallocation and consequent environmental externalities. This is for example the case for the water market created in the **Murray-Darling Basin in Australia**. Therefore, key institutional arrangements (such as well-defined property rights, appropriate regulations for markets and adequate provision of entitlements to secure environmental protection) need to be established a priori before the development of water markets.

In addition to the specific design of the economic incentive explained above, the design of an EPI will therefore need to include the following:

- Identifying what conditions (rules) need to be attached to the incentive to ensure water uses respond effectively and efficiently;

- Assessing how the legal framework for water rights and entitlements may constrain the performance of the incentive;
- Naming who can be responsible for what. It will be important to discuss the design of the EPI with them early on, and it may involve creating new bodies (e.g. body responsible for managing water rights or a licensing scheme attached to water charges).

Various methods can be used to support these assessments, for example institutional analysis, policy/governance analysis, stakeholder analysis (see the **methodological toolbox**).

Watch out!

Issues with political acceptability or the re-organisation of the legal and organisational framework should be tackled during implementation. More information on the requirements of individual EPI is provided in the EPI templates in the chapter on "Rapid Appraisal of Specific Instruments".

Identify necessary adaptations in monitoring and evaluation

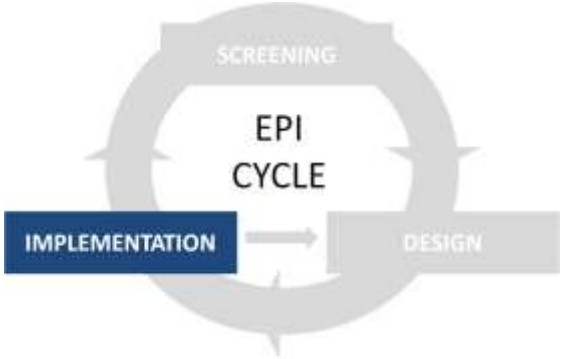
Watch out!

The performance of an EPI will benefit from an effective monitoring and evaluation system. This may or may not require changes to current systems depending on the prevailing regulatory framework/policy mix and the characteristics of the individual EPI.

What to keep in mind… during **implementation**

Definition

- This step reflects the cost and challenge of moving from a theoretical idea towards the practical application of an EPI;
- Successful implementation will depend on dealing with the specific social and political context, creating the necessary technical and institutional conditions, and adequately streamlining EPIs.



What you will find in the "implementation" chapter

- Insights of a selection of key topics relevant for the implementation of water EPIs highlighting best practice with examples from the case studies of EPI-Water research

Section highlights

- Across the EPI cycle:
  - Dealing with transaction costs;
  - Dealing with uncertainties.
- Specifically during EPI implementation:
  - Creating a balanced policy mix, including packaging incentives, combining with other policy instruments and sequencing;
  - Engaging with stakeholders and creating supporting institutions.

Watch out!

Implementation is a dynamic, learning-by-doing process, which will require coming back to earlier stages of the EPI development process. This will improve the selection and design of EPIs, and ease the implementation process.

How "best" can it fit? EPIs as components of the policy mix

EPIs are usually only one element of a larger policy mix. They are often combined with other policy instruments into a water policy or management strategy. EPIs are therefore never implemented in isolation and should be assessed as part of larger policy packages. General lessons are difficult to draw, and one should first consider the way instruments might interact in the specific context in which they are applied. In general, two dimensions to a good policy

mix include: (i) packaging incentives and (ii) combining with other (non-economic) policy instruments.

The packaging of incentives involves taking advantage of synergies between EPIs, and aim at a set of incentives. The text box below presents an example of combining smart pricing of water security, drought insurance and the trading of water use rights for the management of water scarcity and droughts. Non-monetary incentives can also be used, for example a labelling scheme for water-friendly practices with a water tax, water trading, or Payment for Ecosystem Services scheme.

Go for the full package – one for all and all for one

The three best-suited EPIs to take advantage of prevailing opportunities to cope with water scarcity and droughts in the **Tagus-Segura case study of EPI-Water** were: a pricing system, a formal insurance for the delivery of water for irrigation, a multi-level water-trading scheme. The three instruments were selected for their individual potential to make a relevant contribution to face current water challenges in the basins but their particular role could not be understood in isolation but rather as an integral part of a package designed as part of a drastic change in water policy in the area. Below, an example of packaging incentives from EPIs for water scarcity and drought management.

THIS EPI ...		... MIGHT BE DESIGNED TO REINFORCE...		
		PRICING	INSURANCE	TRADING
EPIs	PRICING		> Informing over the cost of water security.	> Deepening water markets. > Putting non-conventional water into trade. > Incentives to save water.
	INSURANCE	> Informing on the opportunity cost of groundwater. > Supporting metering and control of water supply.		> Safeguarding the environment against the risk of trade. > Enforcing property rights. Increase transparency.
	TRADING	> Reducing information costs. > Reducing the financial burden of water security.	> Providing an alternative to protect against droughts and allowing more efficient responses to risk.	

The combination of EPIs with other policy instruments can be recommended in many circumstances. For example, to secure the environmental effectiveness of a trading scheme, a cap might need to be introduced to ensure traded rights do not exceed relevant pollution loads or water use. EPIs may benefit when combined with regulatory instruments or the provision of information, in particular where direct monitoring is limited or difficult to achieve, or where governmental action need to be highly targeted spatially. In general however, the overlap of instruments should be avoided unless their complementarity is well

identified, and they mutually reinforce each other. This is why it is very important to re-evaluate the impacts of a policy mix every time a change occurs in any of its components.

The German effluent tax –a successful policy mix?

The **German effluent tax** illustrates a sound application of a policy mix, which consists of discharge permits, pollution limits and mandatory technological standards. Water pollution is levied by volume and according to the effluent allowance granted to each wastewater plant. In both cases the instrument has contributed to increase water prices and to reduce water demand (paradoxically performing better as a quantity instrument). But, there is no way to reward (through lower charges or fees) improvements in the quality of the effluent beyond what is legally prescribed.

Watch out, this case study proves that the policy-mix has been mostly successful in meeting its objectives, but it is impossible to single out the likely effect or benefits of the tax in isolation.

More information on the interaction of specific EPIs with other policy instruments is given in the chapter on "Rapid appraisal of specific instruments"!

How "optimal" can EPIs be? Balancing transaction costs and expected benefits

Transaction costs arise from a large range of activities, from design to implementation. They depend on the EPI, local conditions, institutions, and other factors. Transaction costs are influenced by information, technology, physical characteristics, economic and institutional context, and cultural norms, to name but a few. Transaction costs may include for example: staffing and training costs for bureaucracy and user groups; investments in property, infrastructure and equipment; time and money to integrate with existing bureaucratic and user institutions; and, time and money related to measurement, reporting, and enforcement and further evaluation.

The existence, magnitude and distribution of transaction costs may explain the difference between success and failure of an EPI on an individual or social scale. For example, transaction costs from monitoring groundwater may impede the adoption of such a tax, but it may also be worth paying to make sure the tax is effective. Likewise, a new water allocation mechanism may increase economic efficiency but impose high negotiation and enforcement costs, making simpler allocation mechanisms potentially preferable.

High transaction costs should not be a reason for inaction!

Transaction costs are involved in all governmental action, not only EPIs. The challenge is to be aware of transaction costs , compare potential transaction costs with a specific EPI with other form of governmental action, take into account broader, long-term costs and benefits, and take practical steps to minimise (but not necessarily to remove) them.

The burden-sharing of transaction costs between different actors (e.g. public and private) is also important, especially when costs go to one group and benefits to another. These costs may also be hard to identify, especially if costs are spread across many actors or concentrated in a few.

Assessment of transaction costs – a practical example

In the ex-post evaluation of **Subsidies for ecologically friendly hydro-power plants through favourable electricity remuneration in Germany**, transaction costs were summarized for different steps of the EPI development cycle: research, design, legal process, support to implementation (in the form of information provision), administrative control (controlling the fulfilment of the ecological requirements), monitoring and enforcement. The table below indicates the level on which transaction costs occur and their specific attribution to the EPI. As no comprehensive quantification of different transaction costs was possible, an indicative score was provided as a reference to help understanding the overall impact of transaction costs to successful implementation of the EPI.

Type of transaction costs	Level	Specific attribution to the EPI	Likely importance of TCs	Explication
Research	National	High	++	Specific studies have been carried out to support the design and implementation of the EPI.
Design of the instrument	National	Medium	+	The design phase included a part that is specific to hydropower. It considers, however, also significant aspects that are not directly linked to the ecological criteria.
Legal process	National	Low	+	The whole legal process includes only a relatively small part on hydropower issues.
Support to implementation	National and local	High	++	Instrument specific information is provided in the form of an operational guideline as well as specific discussions in the EEG clearing house.
Administrative control	Local / Regional	Low	+	The control of the ecological measures on site forms part of the legal approval procedure for hydropower plants.
Monitoring / Enforcement	Local	High	0	As no controls are carried out after the approval process, no transaction costs occur on this step.

Note: +++ indicates a very high importance of the transaction costs; ++ indicates significant transaction costs; + indicates low transaction costs; 0 indicates no transaction costs.

How to make EPIs "resilient"? Accounting for uncertainty

The implementation of EPIs will be surrounded by many uncertainties, arising from the complex and dynamic interaction of environmental, social, political, institutional factors. To deal with these uncertainties, different strategies can be adopted:

- Use of adequate assessment methods when designing EPIs which evaluate their performance under different scenarios;
- Setting safeguards in such a way that would not impair the achievement of the environmental objectives;
- Sequencing implementation, i.e. progressively implementing a policy reform. Sequencing can also reduce initial costs, gain political and market acceptance, and build trust through learning by doing.

Methods that can be used to evaluate uncertainties

Several methods can be used to identify and express uncertainties and risks, and outline strategies to manage them, including: (i) scenario-building and sensitivity analysis; (ii) more complex modelling techniques; and (iii) expert judgement (e.g. focus groups, expert meeting, interviews).

How to make EPIs "acceptable"… and understood? Establishing the right policy process

Not surprisingly, public participation is a crucial element in increasing the general acceptance of an EPI and in motivating stakeholders to participate in the EPI. This is not to say that public participation is always required to make the EPI acceptable. For example, the importance of public participation may be reduced in cases where the EPI as such, or the water management solution at hand, has already gained public (social) acceptance. Typical steps involved in a "good" EPI policy process include:

- Very early engagement, involving stakeholders in decisions about both the strategic directions of research and development activities and policy development;
- Transparent decision-making (e.g. detailed and publicly available records of meetings and agreements for future reference), and maintaining close exchange throughout the policy process;
- Building the capacity of administrative staff of the responsible authorities;
- Inform, involve and exchange with the broader target population, and, where necessary with individuals (e.g. negotiation for cooperative agreements such as Payment for Ecosystem Services).

Some thoughts on how to deal with political acceptability of EPIs...

In Europe, EPIs have often faced political and social opposition. Various strategies may be used to increase acceptance:

- ***Wait for a "window of opportunity"...***
  In emergency situations, such as droughts, citizens can be expected to accept more "out of the box" solutions to solve the current water management issues;
- ***Sequence the implementation of the EPI. ..***
  For example, sequencing the introduction of drought insurance may involve starting with the inclusion of permanent crops where exposure to risk is easier to control, and extending coverage to new crops and areas. A proper sequencing will reduce insurance firms' incentives to engage in rent seeking and regulatory capture and will link the development of the market to its own performance.
- ***Allow exemptions or extensions of deadlines...***
  But it may impede the functioning of the EPI and thus the achievement of the desired results.

Some good examples on acceptability...

The Vittel engagement programme

The establishment in 1990 of a stakeholder association involving villages from both the spring area and the catchment area, the Evian Company and national public bodies. The association negotiated a redistribution of the revenue from a tax on bottled water to benefit also catchment area villages, which is believed to have helped adopt and design the EPI.

The NYC Caskill watershed programme

A key institutional feature is the Watershed Agricultural Council (WAC) which was set up to oversee the PES program. The council board of directors is composed primarily of farmers and only one representative for the DEP, ensuring farmer autonomy. This feature paved the way for the farmers' willingness to enter an agreement about the EPI in the first.

Rapid appraisal of selected instruments

EPI Template 1 – Incentive pricing

What is it?	Incentive pricing mechanisms are meant **to convey information about the opportunity cost of using water** and to serve as an incentive to **reduce water consumption** as well as **to save water through discouraging non-essential uses** and **induce the use of more water-efficient infrastructures and appliances**. Unlike flat rates or social water prices defined on a per-household or per-hectare basis, **incentive pricing is defined per unit of water consumed**. They might consist in a unitary price per unit of water consumed, a combination of a fix price plus a variable one, a multipart tariff, a subsidy over discernible (and certified) amounts of saved water or even deposit rebate systems. Besides their role as water demand management instruments, **the different price categories can be designed and implemented for multiple purposes**. While incentive pricing focuses on demand reduction, cost-recovery objectives tend to focus on the revenue raising potential and social objectives give priority on low-enough prices to guarantee universal access to water (i.e. 100% coverage of water services). The trade-off between such potentially competing purposes should be considered while selecting a pricing EPI.
Which water management issues does the EPI address?	Through internalizing the opportunity cost of water and **making individuals accountable for the use they make of water resources**, incentive pricing is a means to reduce pressures over aquatic ecosystems. Along this line, incentive pricing might contribute to match water demand and supply at a level of water use below available renewable resources. Hence, incentive pricing might contribute to different water policy challenges such **as decoupling water use from economic growth**, **pacing down water demand growth**, and **reducing water scarcity**. By reducing excess demand, incentive pricing might contribute **to reduce the need for further infrastructures**. Incentive pricing might also help optimize installed capacities by making them more profitable in the short term and by improving their financial sustainability in the longer term. By penalizing excess consumption, incentive pricing might **contribute to cost recovery** and also **to reduce the bill paid by low-consumption users** making water more affordable for low-income households as well as for water efficient business as well as contributing to the equity and fairness objectives of water policy.
Which reference(s) in existing EU policy framework?	Incentive pricing is the EPI envisaged by the **WFD in article 9** for inducing i) full-cost recovery of water services, including environmental and resource costs, and ii) a more efficient use of water resources, concurring to the environmental objectives, within the context of the application of the Polluter Pays (PPP) and User Pays (UPP) Principles. A strong claim for incentive pricing is included in the recent **EU Blueprint to Safeguard Europe's Waters**.

Can we find it in Europe?	The **large majority of EU domestic / manufacturing water facilities nowadays use pricing** with the aim of rationalizing water uses and allowing for the application of the polluter / user pays principle, while this is rarely used in the agricultural sector. Application of pricing at national and local level can be found in e.g. Hungary, Netherlands, UK, Italy, or Cyprus.
Can we find it outside Europe?	Incentive pricing is usually found in those countries where water issues represent a specific risk for population and the economy. As a reference, two experiences from the EPI-Water project are listed: USA (California); and Israel.
Where can it work best?	Incentive pricing deploys its full potential in cases where: ➢ Water infrastructures have **low technical efficiency**; ➢ Water users strongly **undervalue / over-consume water resources**; ➢ Water users perceive **unfairness between water use and cost distribution**; ➢ **Responsiveness of users to price changes** in water provision is high.
What are the benefits of using it?	Incentive pricing may result in the following benefits: ➢ **Increased awareness** of the relative scarcity of the resource; ➢ **Fairer cost distribution** among users; ➢ **Cost-efficient use of water**; ➢ Avoiding costly expansion of water supply *via* a **reduced need of heavily engineered infrastructure.**
What are its potential negative side effects? Can they be addressed?	Incentive pricing may have the following negative impacts: ➢ **Excessive financial burden** on poorer households and producers' income, resulting in lower purchasing power and loss of competitiveness. This can be addressed by proper design of multi-level pricing structures and by complementary income support fiscal policies focused on the protection of vulnerable social groups; ➢ **Increase the total cost of water supply** due to transaction costs during design and implementation, in particular due to costly monitoring (metering) and enforcement costs. This cost can be minimized by using pricing schemes to incentivize voluntary metering as a means to reduce water expenditure at a household, firm or at a farm level; ➢ **Sub-optimal pricing levels**, not able to trigger the desired change in behaviour or to fully cover the costs. This may induce distortions and inefficiencies on environmental and economic grounds (excess consumption; under-investment in water infrastructures). This can be addressed via proper designed multi-part tariffs including low prices for essential (and price-inelastic) uses and high prices for non- essential (and price-elastic) uses of water.
Which pre-conditions are necessary for implementation?	Incentive pricing requires some enabling factors: ➢ Water authorities need to be able to **regulate** water use; ➢ **Monitoring system** that can measure water flows and water use at the level of any individual water user (household, farms, manufacturing or services firms, etc.); ➢ **Social acceptability that depends on the perception, socially and politically,** that water needs to be priced according to its availability.

What are the key steps for designing it?	The key steps for design include: ➢ **Assessing past and prospective levels of water scarcity** on the basis of observed and forecasted trends of economic development; ➢ **Assessment of the driving factors of water demand** for the different water users (for household consumption, manufacturing and service production, irrigation, etc.). This is the basic information required to anticipate behavioural responses to changes in water pricing; ➢ **Evaluation of the efficiency gap and potential savings** as well as a preliminary assessment of the capital and operational costs of bridging this gap. This analysis is intended to show what reduction in the water bill might induce users to voluntarily engage in water saving activities taking into account both water prices and the cost of taking actions; ➢ **Evaluation of the financial pool required for an acceptable level of cost recovery in the water industry;** ➢ Identification of the **relevant thresholds for water pricing** (basic needs, optional, superfluous water use, etc.) and of the unitary prices.
What are the key steps for implementing it?	Key implementation steps include: ➢ **Informing society from the onset** about the potential introduction of the instrument, and **stakeholder engagement** as a means to gain social acceptability and raising awareness; ➢ **Enactment of the regulatory changes** to allow innovative water pricing if required; ➢ **Capacity building** of administrative staff of the water authority; ➢ Adapting **monitoring and enforcement systems** to the instrument, including installing metering; ➢ Introducing adequate **information** provision services, in particular about charging and billing procedures to each single end-user; ➢ **Implementation test** within a restricted area, and fine-tuning the instrument for full implementation.

EPI Template 2 – Pricing water security

What is it?	Pricing water security is purposely designed and implemented **to convey information** and **to collect the financial resources** to finance the building of **collective water security i**n water scarce and drought-prone river basins. It aims to (i) reduce water demand in the short term, (ii) facilitate the adaptation of water demand and supply to sustainable yields, (iii) develop alternative sources and discourage the use of overexploited ones, while (iv) increase resilience to drought, through building effective and sustainable water buffer stocks from alternative sources, water savings, and the recovery of water bodies. Pricing water security can help **develop and optimize a water portfolio of surface, ground and non-conventional water sources**. Likewise incentive pricing, pricing water security is **a means to reduce water demand** and **set the appropriate incentives for water saving**. Unlike traditional water pricing where users pay for the amount of water consumed, pricing water security consists in a **regular payment for gaining privileged access to water in extraordinary dry periods**. The revenue so collected might be used to finance (i) the building of buffer stocks to reduce drought exposure recovering natural sources (depleted groundwater sources), or/and (ii) the building and maintenance of the capacity to produce non-conventional supplies (from the re-use of reclaimed wastewater, desalination, etc.).
Which water management issues does the EPI address?	Pricing water security is particularly relevant where **the river basin has already exhausted all the traditional alternatives to mobilize available water resources**, for example when both surface and groundwater sources are overexploited. Pricing security is a mechanism to correct the wrong management of the water portfolio typically consistent with the **overexploitation of surface water in normal periods and of groundwater in both normal and dry periods**, worsening scarcity and increasing the likelihood of water shortages in future periods. As a transitional solution, pricing water security facilitates **the use of non-conventional sources** to provide security in the short and medium term while **leaving leeway for the recovery of natural sources** that might better play the role of buffer stocks in the future. As such, it particularly helps regain **public control over overexploited groundwater sources**. With the exception of dry periods, buffer stocks from these non-conventional sources might be used instead of excess groundwater at an affordable price for water users as long as they leave the aquifer to recover under the control of the water authority. This should be done in such a way that **increased water use in one activity or one area** (let us say irrigation, urban development, tourism, etc.) **needs to be offset by water savings in other areas** (e.g. through reductions in water demand, higher water efficiency, water reallocation, replacement of conventional by desalinated or recycled water sources, etc.), rather than allowing for an increased supply by adding new freshwater resources (EEA, 2009).
Which reference(s) in existing EU policy framework?	Pricing water security may contribute in particular to **the EU Climate Change Adaptation** Strategy and **EU Action on Drought and Water Scarcity**, as well as **Article 9 of the WFD** where pricing water security can be interpreted as a mean to advance towards the recovery of the resource costs of water. In this case

	resource costs are the equivalent to the cost or restoring a sustainable flow of water provisioning services.
Can we find it in Europe?	Not yet
Can we find it outside Europe?	-
Where can it work best?	Pricing Water Security becomes feasible when: ➢ There is **willingness to pay for water security:** those who assume the risk of denied access to water in the event of drought (as it is common in the EU to establish a hierarchy of uses that distributes the risks of any water shortage) will also be **willing to engage in saving water**, using more technically efficient devices to make their activities less vulnerable (Ward and Pulido-Velazquez, 2008). They are also **willing to accept metering** and **marginal pricing**; ➢ **There are welfare gains to be ripped off from a better management of the water portfolio**. When water is scarce, its supply derives from a mix of different sources (runoff, inter-basin water transfers, groundwater of different qualities and accessible at different costs, recycled water of different qualities suitable for different uses, brackish and seawater, etc.). Individual water users will usually **prefer cheaper resources** once they are available, e.g. surface freshwater, and will only accept expensive, e.g. desalinated water, ones in case of need (OECD, 2013a). Yet these rather obvious preferences may well lead to important **inconsistencies in the long term**. Cheap resources will be **overexploited** in the short term and alternative sources will only be developed once other alternatives have become expensive enough (that is to say when freshwater sources have been sufficiently degraded). **Managing the water portfolio implies not waiting for this scarcity trend** to take place and advancing in building up a sustainable water supply making the provision of water security cheaper in the short and medium terms; ➢ **There are welfare enhancing opportunities from improving water efficiency,** e.g. producing more without further environmental degradation or obtaining the same market values along with less pressures over water ecosystems. Incentives to increase the efficiency of water use can derive from allocation mechanisms that allow other alternative uses different from prevalent ones, abandoning the 'use it or lose it' principle (Garrido et al. 2012).
What are the benefits of using it?	Pricing water security can encourage m**ore production decoupled from further environmental degradation** or **obtaining the same market values with fewer pressures over water ecosystems**. As an example, security of water supply for urban uses could imply an increase in the security of supply for irrigated agriculture since the latter would benefit from the decision of the former of using desalinated water instead of further reducing water supply to the irrigated sector as permitted by the legal hierarchy of uses in place. Increased water availability and water security in agriculture will likely result in reduced income variability, stable employment and positive forward linkages with other economic sectors (e.g., agro-industry). Pricing water security may help mitigate uncertainty, long

	bargaining processes and transaction costs that characterize urgent solutions to water shortages in dry periods.
What are its potential negative side effects? Can they be addressed?	Pricing water security may lead to use the pricing scheme as a means to increase water supply in normal times.
Which pre-conditions are necessary for implementation?	Pricing water security requires the following: ➢ **A shared diagnostic** about the consequences of water scarcity and the need of a collective response in order to restore water supply and demand to a sustainable level; ➢ **Commitment of different stakeholders** and common perception of the advantages of cooperative solutions over pursuing individual competitive courses of action; ➢ **Public commitment** to restore the sustainable use of water and **a set of well-defined outcomes** in order to make progress measurable and to adapt price mechanisms to the intended objectives. One important target to be defined *a priori* is the optimal future water portfolio that the river basin and its economy must tend to; ➢ **Building of a stakeholder agreement** on how the excess costs of building water security is going to be shared among the different water users and how the benefits in terms of water security are going to be distributed; ➢ To be **coordinated** with decreasing scarcity in the medium term and enhancing security in the long term. Additional prices may need to be connected with perceptible benefits (e.g. paying a risk premium gives you access to water in dry periods).
What are the key steps for designing it?	➢ Once the **long-term water security strategy has been agreed** upon (and the optimal future sustainable water portfolio has been defined) **the price of water needs to be defined** on the basis of an agreement to distribute the implied cost among the different water users; ➢ Accepting an excess price in exchange of water security implies **the definition of property rights over additional water resources during dry periods**. This distribution and then the re-allocation of drought risks need to be settled in advance; ➢ **Decisions on the management of excess water in normal periods** (e.g. what to do with non-conventional sources in non-drought periods) including its potential allocation through water trading or its use in replacement of overexploited groundwater; ➢ **Redefinition of individual prices for the different water sources** depending on its reliability and its importance for the sustainable water portfolio. This implies increasing the price of surface water to reduce its demand to a sustainable yield, regain the control over groundwater and considering using water security revenues to subsidize the replacement of water sources in favour or preserving groundwater to enhance drought resilience in future periods.

What are the key steps for implementing it?	As a first approach this **analysis can be performed in the drinking water sector** taking account of the main drivers behind water demand (the expected effect of changes in prices over the amount of water demand, the positive effect of increases in income, the evolution of the scale of water consumption due to population change and to the expansion of other activities such as tourism, and so on). **Agreement between stakeholders** on cost sharing water security: those who contribute will receive in exchange privileged access in dry periods. The scheme works as a **cost-sharing mechanism** among those interested in a secure water supply and there are many opportunities depending on the number and the variety of users joining this risk pool. All these alternatives can be assessed on the basis of prospective water demand models.

EPI Template 3 - Nitrate tax

What is it?	A nitrate tax is a form of **environmental tax aimed at reducing pollution from the release of nitrogen in the environment**. An environmental tax can be defined as *"any compulsory, unrequited payment to general government levied on tax-bases deemed to be of particular environmental relevance. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments"* (OECD, 2001). In contrast, fees or charges are paid to an authority for obtaining a direct service or benefit in return. The basis of an environmental tax is a **physical unit** (or a proxy) of something that has a proven, specific negative impact on the environment. Nitrates taxation can take principally three forms: **taxing nitrogen fertilisers**, **taxing fodder nitrates** and **taxing nitrates loss**. The first two are linked to the resulting concentration of nitrates in surface water and groundwater through an impact pathway of leaching and run-off. Taxing nitrogen loss, can be done either as (i) a tax on nitrogen *surplus at the individual level*, based on analyses on soils to evaluate the amount of fertilisers released in water; or (ii) an *ambient tax on nitrogen surplus* based on analyses of aquifers subject to nitrogen pollution, but this approach is not compatible with the Nitrate Directive's focus on applications according the European Court of Justice in the Dutch MINAS case (see below).
Which water management issues does the EPI address?	Nitrogen emissions are linked to a variety of sources. The RBMPs indicated that **diffuse pollution by nutrients** is by far the most important pressure resulting from **agriculture**, largely due to **fertiliser use**; point source pollution is identified as significant to a lesser extent (EC, 2012).
Which reference(s) in existing EU policy framework?	There is no specific mention of a nitrate tax in EU law. However taxing fertilisers and nitrogen has long been in the policy debate. Nitrates taxation can contribute to reaching the environmental objectives of the **EU WFD**; the **Nitrates Directive** (1991), which aims to prevent nitrates from agricultural sources from polluting ground and surface waters; and the **Urban Wastewater Directive** (1991), which sets standards for the collection and treatment of wastewater from homes and some industrial sectors.
Can we find it in Europe?	Nitrates taxes have been in place in **several European countries**. A tax on fertilizers' use (per kilograms of nitrogen content) was applied in **Austria** (1986-1994), **Finland** (1976-1994), **Sweden** (1982-2010) and **Norway** (1988-2000). A tax on nitrogen surplus (above a tax-free surplus per hectare, "MINAS" scheme) was implemented in **the Netherlands** from 1998 to 2006. The OECD/EEA database on economic policy instruments reports **no current application** of nitrate taxes in EU Member States, with duties on ammonia nitrogen in **Czech Republic** and **Bulgaria** as possible exceptions. **Croatia** is reported to tax mineral fertilizer nitrogen at a rate of 1 kuna (16 eurocents) per kgN (UNECE EPR, in press). Several countries have fees or taxes on nitrogen discharged with urban waste water.
Can we find it outside Europe?	-
Where can it work best?	Opportunities to introduce a nitrates tax include when: ➢ Regions or states have **many intensive livestock production units or where**

	water bodies are particularly vulnerable to nitrates pollution, e.g. water supply zones; ➢ **Established monitoring and reporting systems** on nitrogen **are in place,** for example through existing legislation and regulations on fertilisers (e.g. Nitrate Directive, quotas, zoning, etc); ➢ **Fiscal reforms and stimulus packages** are occurring (e.g. shifting tax burden from labour to pollution, consolidating budgets, etc).
What are the benefits of using it?	The nitrate tax may have the following benefits: ➢ By increasing the costs of fertilizers, it will increase attractiveness of **domestic livestock fertilizers** (manure, etc) and help diminish use of **imported mineral fertilizers**; ➢ **Positive environmental outcome** through (i) the *total land effect*: a reduction of cropland area by an increase of perennial crop or meadows, resulting in reduced use of fertiliser and run-off/leaching; (ii) the *land-use reallocation effect*: a change in nitrogen loss due to crop reallocation; and (iii) the *input price effect*: a reduction in fertiliser use in agricultural practices (Bourgeois, 2012); ➢ Allows farmers to **freely choose most cost-efficient way** to reduce the environmental damage of nitrogen use; ➢ **Predictable costs for farmers** who can adequately plan their strategy to deal with the policy instrument; ➢ **Drive R&D and innovation** for alternative agricultural practices or cost-effective abatement measures.
What are its potential negative side effects? Can they be addressed?	A nitrates tax can have the following negative effects: ➢ **Lead to increased pollution** as farmers adopt crops that need less nitrogen but also do not absorb as much nitrogen. A tax on nitrogen fertilizer differentiated by crops could overcome the effects of land-use reallocation induced by the tax; however in practice this option is possibly not applicable due to high control costs (Bourgeois, 2012; Jayet, 2012); ➢ A tax on mineral fertiliser only could increase the use of manure and therefore its economic value, leading subsequently to **additional animal production** and associated pollution. Restrictions on livestock production could limit this side-effect, but a sound approach would be to tax all nitrogen input including also from fodder; ➢ **Impact on income distribution and competitiveness** and related issues of **acceptability amongst farmers**. Mitigation options include revenue neutrality where the revenues from nitrate taxation are returned to farmers to reduce other distorting taxes. This would seem to contradict the polluter-pays principle and so it is important that there is revenue neutrality at the aggregate level of farmers, not necessarily for each individual farmer. Returning revenues in a neutral way, per hectare of land, for instance, would not distort the efficient use of nitrogen from all sources.
Which pre-conditions are necessary for	A nitrates tax need the following to work: ➢ **Acceptability of the tax**: nitrates pollution must be seen as a social problem, and responsibility for the pollution is identified and accepted;

implementation?	➢ **Legitimacy of the decision**: as a fiscal instrument, a tax might need to be adopted by a legislative body; ➢ **Clear institutional responsibilities**: mandate to work on pollution, enforcement powers and practices.
What are the key steps for designing it?	The following key steps are involved in designing a nitrate tax: ➢ Assessing **past and prospective levels of nitrogen flows in the catchment or region targeted**, based on trends of economic development and including agricultural and non-agricultural sources of nitrogen; ➢ **Assessing factors influencing farmers decision-making** to help determine the potential effectiveness of a nitrates tax; ➢ **Defining the aim of the nitrates tax, its target** (physical unit/proxy), and **levels of taxation** based on farmers' needs, constraints and strategies.
What are the key steps for implementing it?	The following key steps are involved in implementing a nitrate tax: ➢ **Early engagement with stakeholders**, together with transparent development and enforcement; ➢ **Build political support** and **the regulatory basis** for implementation; ➢ Identify how the **negative impacts of tax** (e.g. affordability, distributional impact, competitiveness) **can be tackled** via the sequencing of implementation or other policy instruments (e.g. green subsidies); ➢ Adapting **monitoring and enforcement systems**.

EPI Template 4 - Payment for Ecosystem Services (PES)

What is it?	PES schemes are **cooperative agreements based on voluntary transactions between at least two social actors** with the aim of securing the provision of ecosystem services (ES) (e.g. clean water supply, flood risk mitigation, etc). Most PES schemes involve the buying of an ecosystem service through **maintaining a specific land use or securing a land use change** that will produce that service. PES are usually differentiated with: ➢ **The type of buyers**: "user-financed" programs occur where direct beneficiaries buy the ES, in contrast to "government-financed" programs where the public sector secures that ES for society; ➢ **The type of payment**: "direct" payments occur where the transaction is associated with a specific ES, in contrast to "bundled" payments where a group of ES is sold to one buyer and "layering" where a group of ES is sold to different buyers; ➢ **The level of payment**: payments can consider one or more of the following: production costs, opportunity costs, transaction costs, benefits to the buyer, etc.
Which water management issues does the EPI address?	By definition PES schemes are relevant for **all water-related ES**, and can therefore help improving water quality, restoring aquatic ecosystems, and reducing water-related risks (e.g. floods, droughts, water scarcity)... They can target all types of land uses that adversely or positively impact the water cycle (e.g. forests, wetlands, grasslands, agricultural land, urban areas, etc).
Which reference(s) in existing EU policy framework?	The role of PES schemes has been promoted in the **EU Biodiversity Strategy to 2020** as one of the tool required to its implementation. In addition, the potential of PES schemes is highlighted in the **Roadmap for a Resource Efficient Europe**. Clear and transparent definition and methodologies are still needed at EU level (and national level) to promote the implementation of PES schemes as water-related EPI. Many synergies potential exist between PES schemes and land use change measures promoted by the **WFD**, the **Flood Directive** and the **Common Agricultural Policy**.
Can we find it in Europe?	Given the significant diversity of PES schemes and varying definitions it is impossible to have a definite list of PES schemes throughout Europe. Some examples include: ➢ Munich (Germany), Vittel (France) and Switzerland; ➢ Evian Natural Mineral Water (France); ➢ UK, Italy, Spain and Sweden.
Can we find it outside Europe?	Buric et al. (2011) and Benett et al. (2013) listed several dozen of cases in south America (Brazil, Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, ...), Asia (China, India, Philippines), North America (New York USA, Santa Fe USA) and Africa (South Africa, Tanzania, Rwanda).
Where can it work best?	PES schemes are more likely to succeed when: ➢ There is a **good scientific understanding** of the ES and its functioning; ➢ The **ES provision potential is high** (i.e. changing land use will result in large

	transactions); ➢ **Land value is low** and the overall impact of the land use change on the land user business is **limited**; ➢ **Acceptability** with paying for the ES and with providing it (e.g. willingness of land users to change their practices).
What are the benefits of using it?	PES schemes can have the following positive impacts: ➢ **Increase the provision of target ES** and complementary ones. For instance, changing agricultural practices to restore water quality can lead to an increase of biodiversity; ➢ **Increase the revenue of land owners** securing or increasing the production of environmental services; ➢ **Contribute to reinforce the political voice** and legitimacy of stakeholders thanks to information exchange and dialogue during the negotiation process.
What are its potential negative side effects? Can they be addressed?	PES schemes can have the following negative impacts: ➢ **Inefficiency or even failures** (leading to a waste of resources), usually due to lack of adequate performance monitoring. A clear definition of goal and objectives is required, as well as ensuring a robust monitoring; ➢ **Lack of additionality** and dead-weigh effect. A baseline scenario must be clearly identified so that the environmental performance of the PES scheme can be assessed against it; ➢ **Free riding** issue associated to the nature and functioning of ecosystem services. Bundling or layering multiple ES can provide opportunities to increase the benefits of the PES scheme while reducing transaction costs; ➢ **Issue of acceptability** when payments can be seen as contradictory to the polluter-pays principle ("why paying polluters for polluting less?"). Coupling PES scheme and a system of taxation (the carrot and the stick) may increase acceptability.
Which pre-conditions are necessary for implementation?	PES schemes can only work if: ➢ The environmental issue is **clearly identified** in terms of ecosystem services (one main ES and eventually secondary ES considered in a second step) and well known from a scientific point of view; ➢ The main beneficiary must be **financially impacted** by the preservation or degradation of the ES (facing losses) and be a "**primary buyer**" (private organisation who benefit directly from improved ES provision); ➢ Ideally, the beneficiary should have a **few basic characteristics**: dynamism, local legitimacy, appreciated and willingness to involve other stakeholders and share information with them; ➢ **The institutional set up is clear** and adequate guidelines are accessible to public bodies both at national and local level on what is feasible in terms of involvement in such schemes (i.e. contracting, intermediation, act as buyers or sellers, etc.); ➢ In addition, you must be able to identify and mobilize a local "**champion**" known and recognised by the providers;

	➢ Having (or being able to produce) a good understanding of the situation / **good informational system** at local scale. This information should be produced and shared by an intermediary to be seen as neutral and acceptable.
What are the key steps for designing it?	In terms of design, the key steps are: ➢ **Identifying the ES** at stake and its nature; ➢ Developing an **understanding** of the ES functioning (the underlying biophysical science) and translating its potential co-benefits (ecosystem service supply); ➢ Identifying the main beneficiary(ies) and producer(s), i.e. a **clear definition of participants** (ES demand); ➢ **Gathering stakeholders** (beneficiaries from one side and producers from the other side) and creating (or identifying) an institution legitimate to host negotiations and act as mediator. This would lead to a reduction of transaction costs throughout the process; ➢ Develop **adequate contracts** and **conflict resolution** procedures.
What are the key steps for implementing it?	In terms of implementation: ➢ Setting up an **effective monitoring system**; ➢ Ensure that **information and knowledge is shared** in an equitable way as the process is supposed to lead to a win-win situation. In other words transparency is necessary to promote trust between service producers and beneficiaries ; ➢ Ensuring flexibility by adapting the terms of the contract based on **learning process** while maintaining a certain visibility of outcomes and conditions for the producers of services.

EPI Template 5 - Payments for flood risk mitigation

What is it?	**Payments for flood risk mitigation reward the creation of flood storage areas either in-stream** (e.g. obstructing channel flow, creating wetlands, re-meandering rivers) **or off-stream** (e.g. upland flood reservoirs). Traditionally, public authorities have used expropriation via land purchase or purchase-and-leaseback schemes. These instruments provide the maximum degree of control over the use of land, but cannot be considered as voluntary incentives. Payments for flood storage as EPIs include two main types: ➢ **As one-off or regular payments through voluntary private-private or public-private contracts or agreements**. Payments are predetermined or negotiated, but can also be determined via auctions; ➢ **As easement where the right to flood a property is bought** (in contrast to buying all rights over a property as in the purchase options). Easements usually compensates for the loss of land value and the irregular flood damage. The land value loss is compensated as a portion of the market value of the property but can vary depending on the envisaged land use and frequency of flooding. The damage compensation can take form of a one-off payment at the time of imposing easement, or annual fixed rewards, or irregular damage reimbursements. The different ways of damage compensation have an implication on how the associated risk (e.g. of increased frequencies of triggering events) is shared between private and public bodies.
Which water management issues does the EPI address?	Payments for flood risk mitigation primarily address **flood risk management issues**, but under specific circumstances the side-effects of river restoration can involve greater pollution control and nature/biodiversity preservation.
Which reference(s) in existing EU policy framework?	The **WFD** includes, among water services[1], flood protection, for which cost recovery is required. It also obliges Member States to maintain and restore good morphological conditions of water bodies. The **Floods Directive** mandates a programme of cost-effective flood management measures, which may include flood storage, where suitable and cost-effective. River restoration and water retention on agricultural land are among the measures supported by the **Rural Development Programmes** (RDP), under the second pillar of the **Common Agricultural Policy**.
Can we find it in Europe?	Easements have been widely used in the UK, Germany and the Netherlands notably for temporary flood storage on agricultural land. Lump-sum and annual payments for creating flood storage are becoming more frequent across Europe, usually on a project basis but also through more established programmes such as payments for natural flood management via the Scottish RDP.

[1] There is a pending case at European Court of Justice (ECJ) (EC against Germany) on this issue and several MS including Hungary may be referred to ECJ specifically related to the cost recovery of flood risk reduction measures.

Can we find it outside Europe?	As in Europe, easements have been used across the world. Payments through voluntary agreements are less frequent and mostly targeted to water quality. PES schemes for watershed services are emerging, for example in the USA.
Where can it work best?	Opportunities for payments for flood risk mitigation exist where: ➢ **Available storage capacity** makes it possible to significantly reduce peak flood discharge; ➢ **Land value is low** and the overall impact on the farm business is limited; ➢ Land managers are **willing to participate**.
What are the benefits of using it?	Payments for flood storage can have the following benefits: ➢ **Avoiding the buying and management of land**, which may face opposition and may not be within the remit of the government agency in charge; ➢ For regular payments, **avoiding the potentially prohibitive cost of a single transaction**; for one-off payments, **avoiding fixed-term commitments**; ➢ Relying on **voluntary participation** of land managers, instead of coercion; ➢ **Enriching the range** of flood risk management measures in a particular area; ➢ Resulting in the provision of **multiple environmental benefits** (nature protection, groundwater recharge, sediments capture, etc).
What are its potential negative side effects? Can they be addressed?	Payment for flood risk mitigation can have the following negative impacts: ➢ Land managers are generally **against signing away rights** to their land, and so are often not willing to participate. Agreements can be accompanied with an up-front payment, the possibility of re-negotiation after a set period (e.g. 10 years), or, in rare cases, a threat of compulsory governmental purchase; ➢ **Payments can be high** where land value is high (e.g. agricultural productive areas, land development potential). Alternatively on-going maintenance and management costs can build up. A combination of an up-front and regular payment can spread the costs; ➢ **Liability** for flood damage stemming from erroneous operation (ineffective) and failure of the embankment, or from flooding due to high water tables; ➢ Difficulty to evaluate the real cost-effectiveness of measures due to **limited scientific knowledge** and **uncertainties** in catchment responses. Similarly, potential for non-accounted impacts due to limited scientific understanding.
Which pre-conditions are necessary for implementation?	Payments for flood risk mitigation can only work if: ➢ **Good hydrological skills** to design location and capacity of the storage are available; ➢ There is **sufficient space** for storage capacity; ➢ There is a **high variability in the land use value**; ➢ **Clear ownership of land**.
What are the key steps for designing it?	In terms of design, the key steps are: ➢ **Assessment of the full cost** of flood, and its distribution; ➢ **Identify suitable flood storage areas** (e.g. volume, peak discharge); ➢ **Clarify relevant stakeholders** including land ownership and nature of

	current relationships; ➢ **Evaluate the costs and benefits of using different combinations of flood storage areas**, taking into account the potential provision of additional (ecosystem) services for the opportunity of a bundled provision with flood storage; ➢ Evaluate costs and benefits of combining with **other flood risk mitigation measures**.
What are the key steps for implementing it?	In terms of implementation, the key steps are: ➢ **Setting up an institutional arrangement** regulate the easement and/or other forms of payments (i.e. legal reform, specific bodies within water authorities, official registry, arbitration procedures, etc.) to; ➢ **Build trust** by being transparent in purpose and decisions; ➢ **Make contact** with individual land managers to explore options, negotiate, and provide the possibility for the continuation of livelihoods on the impacted land; ➢ Setting up an effective **flood monitoring system**, and monitor flood storage performance in relation to the economic incentive.

EPI Template 6 - Water trading for water scarcity/drought

What is it?	Water trading essentially involves **the voluntary exchange of rights or entitlements to use water**. To achieve the desired status of water bodies, quantitative constraints on abstraction must be set and converted into property rights over the use of water. There is therefore an overall cap on rights to use water. Water users can then trade these rights within the limits defined by the water authority. Water trading is different to water transfers despite implying the diversion of water. Water transfers are seen as inter-basin major diversion projects. In some cases, water trades may need to use these infrastructures. At a local level, within the same basin, no major infrastructures would in principle be required. Water trading may adopt different forms: ➢ **Spot water markets**, both informal and formal (i.e. under legal arrangements), are common to transfer surface or groundwater resources for short-term trades in the context of a single basin. *Spot*, as opposed to long-term exchanges, stands for transactions in which water delivery is immediate or is meant to occur in the very near future; ➢ **Water banks** are central institutions acting as a clearinghouse mechanism for users willing to purchase or sell water. A clearinghouse is an organization that collects and gives out information on supply and demand of water rights. Water is then sold at a price with a mark-up (i.e. an amount of money added onto the price) to cover the operating costs of the bank, which are often borne by the buyer; ➢ **Bulletin Boards** are a type of water bank in which the price is not set by a central institution but rather the result of buyers and sellers posting bids and requests for water use rights at a central bulletin board (i.e. irrigation district authority) or through electronic platforms; ➢ **Auctions** are used to allocate rights between two or more users who compete for the same use right. Whereas in spot markets buyers and sellers occasionally interact, auctions allow as many trades as possible at a common price. In *double-auction markets*, buyers and sellers submit sealed bids for specific amounts of water right. In *all-in-auctions*, bids are ordered during the auction session so that bidders see when their offer is accepted and have the opportunity to enter more bids; ➢ **Derivative markets** are those based on long-term agreements (i.e. water is not to be delivered neither now nor in the near future). In the so-called *option markets*, one type of derivative markets, buyer and seller agree on the quantity of water and the date of delivery and both must comply. Under the so-called *forward contracts*, the buyer may decide to forego the purchase before the expiration date; hence a deposit is paid as compensation to the seller; ➢ **Environmental leasing and purchase programs** are usually meant to increase in-stream flows for environmental purposes. They include water trusts, governmental leasing and purchase of use rights, and buyback programs.
Which water management issues does the EPI address?	Water trading can be used to help address **water scarcity and droughts**. It is especially relevant at a local level, for example in river basins where long-term renewable resources are unable to meet actual water demand. The implementation of water trading schemes is also advisable, under certain conditions, as part of a

	policy mix aiming at regaining control over groundwater resources and harnessing the potential of water resources to provide higher levels of **resilience and adaptive capacity** for economic development. In water abundant basin districts, water trading may also be used to **enhance upstream competition** in water and sewerage services to secure benefits for customers and for the environment.
Which reference(s) in existing EU policy framework?	The recent **EU Blueprint to Safeguard Europe's Waters** emphasise on the importance of using water trading to tackle water scarcity and droughts (policy option 1a), but it could also be seen as a option for implementing the WFD Art 11 program of measures
Can we find it in Europe?	Water trading can currently be found in Spain (Central, South and Southeastern basins) and the UK.
Can we find it outside Europe?	Various places have implemented water trading schemes: ➢ US western semi-arid states (Arizona, California, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming) ➢ Australia (Murray-Darling basin); Chile (mostly in northern regions); Mexico; China ; South Africa.
Where can it work best?	Water trading can work best when there is **social acceptance and willingness to pay** for a higher or more reliable water supply, and to reallocate water among places and users. This may happen when **water shortages are recurrent**, and when the negative impacts associated with scarcity and droughts have been **demonstrated and perceived** as a social problem. There are significant **synergies with pricing and insurance schemes**. As to pricing, water markets can reduce information costs as well as the financial burden of water security. Regarding insurance, they can provide an alternative for water users to protect against droughts, thus allowing more efficient responses to risk.
What are the benefits of using it?	Benefits of using water trading include: ➢ **Re-allocating risks** so that the vulnerability of water uses exposed to scarcity and droughts is diminished; ➢ **Creating incentives for water saving and conservation**, and thereby providing an alternative to traditional supply-side approaches to water management, deterring, for instance, costly investment in water infrastructures; ➢ Indirectly, **creating incentives for research and development** in water technologies and processes; ➢ **Creating a framework** in which water users can take decisions based on local conditions, and can independently adapt their practices to new and emerging issues (without relying on government action); ➢ **Re-allocating water** to uses that value water more highly thereby allocating water more efficiently; ➢ Showing water users the **opportunity costs** (i.e. those associated to foregone alternative choices) of some of their decisions on water use.
What are its potential negative side effects? Can they be addressed?	Water trading can have the following negative impacts: ➢ **Leading to speculation** with water rights when they are accumulated and not used. This can be limited *via* charging permit fees for unused water and limiting applications for water use rights to the original needs; ➢ **Reinforcing social disparities and reducing spatial cohesion**, as water is re-

	allocated to more valuable uses. This can be addressed through the proper integration in water planning decisions and specific assessments of major water diversions; ➢ **Worsening overexploitation** and scarcity trends if water use rights do not match available water resources. This may occur (i) purposively, for example when rights are allocated in excess of available water resources in order to avoid social conflict, (ii) unknowingly, when the dynamics of the water resource is poorly known, or (iii) when monitoring and enforcement is poor, and non-controlled or illegal rights are put on the market.
Which pre-conditions are necessary for implementation?	Water trading can only work if: ➢ There is **high variability among marginal returns** from water among uses and places (i.e. profits obtained from water use), and when infrastructures can transfer water at a competitive cost; ➢ Water use efficiency and the contribution of water to social welfare can be **substantially improved**; ➢ There is a proper definition and enforcement of **water use rights**.
What are the key steps for designing it?	In terms of design, key steps include: ➢ On the basis of hydrological balances, **defining and quantifying quantities of water** (allowing for variance) that can be obtained from surface and/or groundwater, by time and place; ➢ **Excluding environmental flows** (e-flows) that are necessary to uphold or attain the good ecological status of water bodies, according to the WFD; that is to say, the quantity of water that nature needs for the good ecological status to be achieved and the provision of ecosystem services to be maintained; ➢ **Defining water entitlements and rights**. This includes how they relate to the physical resource and how to ensure a sustainable yield (temporally and spatially) that can be subject to trade.
What are the key steps for implementing it?	In terms of implementation: ➢ **Setting up an institutional arrangement** (i.e. legal reform, specific bodies within water authorities, official registry, arbitration procedures, etc.) to manage the legal entitlements; ➢ Setting up an **effective monitoring system**, including metering and other devices to measure individual water use; ➢ Ensuring the **enforcement** of water use rights over all water sources; ➢ Setting up appropriate **safeguard mechanisms** (i.e. legal provisions, assessment procedures, etc.) to (i) guarantee the environmental outcomes, (ii) protect third-party potentially affected interests, (iii) regulate the possibility to carry over water between years, and (iv) prevent hoarding and speculation.

EPI Template 7 - Water emission trading (WET)

What is it?	WET consists of **exchanging pollution permits** (*allowances* or *credits*, see below for the difference) **among similar and/or different pollution sources** (e.g. industrial, sewage treatment plants, agriculture holding). Each source can comply with the mandatory requirements either by reducing own emissions, up to or beyond the given limit, or by acquiring additional permits from other sources with lower marginal abatement costs. The WET schemes differ with respect to: ➢ **What and who is regulated**. Trading exists for fertilisers (nitrate and phosphorus), salinity, temperature, and biological oxygen demand. Persistent bio-accumulative toxics (e.g. mercury) are presently not traded (Willamette Partnership, 2012). Some schemes enable cross-pollutant trading. Trading exists between point sources (PS), between point and non-point sources (NPS), and to lesser extent between non-point sources. Most frequently the PS are regulated whereas the NPS are not. In such a case the NPS, characterised usually by low marginal abatement costs, generate emission reductions which are used to offset emissions of PS; ➢ **What is traded**. Credits can be based on emissions avoided or allowances for emission gene-rated. In a *baseline-and-credit* scheme, which is an extension of traditional regulatory approach (Ellerman, 2003), each pollution source is assigned specific emissions limits to be met. The sources may reduce own emissions beyond this limit (and hence over-comply with the mandatory limits) and sell the credits to other sources which face higher marginal abatement costs of meeting its own emissions limits. The certified *credits* are exchanged between sources that over-comply and sources that under-comply with the regulatory limits. In a *cap-and-trade* scheme, the pollution control authority determines an absolute *cap* (maximum allowable emissions) and allocates pollution *allowances* among the different sources so that the limit is not exceeded. The allowances can be allocated for free (grandfathering), based on the historical rates of emissions; or auctioned. Other allocation schemes are possible but rare; ➢ **Type of market structure**. The trading can take different forms. In *bilateral trades*, known for high transaction costs, each transaction is negotiated between seller and buyer individually. In the case of *sole-source offset* there is no trading in the narrow sense, the individual sources may relax the permit in some places while tightening it in other places. *Clearinghouse* is a single intermediary between sellers and buyers. It buys the pollution offsets and sells them to the potential buyer. *Exchange markets* are public fora with transparent bidding and price building. The trades can be facilitated by third parties (e.g. brokers, credit banks), which is sometimes seen as an additional market structure.
Which water management issues does the EPI address?	Water emission trading is instrumental for reducing the emissions of polluting substances into water bodies to a level which is compatible with **water quality objectives** (e.g. good ecological status under WFD). In doing so the WET helps to preserve and improve water quality and the overall integrity of water ecosystems.
Which reference(s) in existing EU policy framework?	The emission trading schemes in Europe would operate in the context of the **WFD**, Directive on **Industrial Emissions** (IED, 010/75/EU; which will in January 2014 repeal the Directive concerning **Integrated Pollution Prevention and**

	Control, 2008/1/EC IPPC, and other directives), Nitrate **Directive** (91/676/EEC) and the **Urban Waste Water Directive** (91/271/EEC), and the **EU Common Agricultural Policy**. Also as part WFD Art 11 program of measures emission-trading schemes is relevant.
Can we find it in Europe?	Experimentally water emission trading has been explored in Finland, Sweden and some other EU Member States. In the 1990s and as a precursor of MINAS scheme, a tradable permit scheme was in place in the Netherlands. It was later replaced by nitrate tax, which in turn was found not in line with the provision of the Nitrate Directive.
Can we find it outside Europe?	Australia, Canada, New Zealand, United States.
Where can it work best?	Water emission trading performs best in **larger river basins characterised by a variety of pollution sources and diverse marginal abatement costs**. To avoid the high concentration of pollutants in some parts of the basin, trading rules need to be carefully design and usually offsetting is permitted only between the sources at the same site or between up- and downstream sources.
What are the benefits of using it?	The benefits of using WET include: ➢ Reducing pollution emissions in a **cost efficient way**. Compared to traditional regulatory approaches, aggregate compliance costs are lower. This outcome is achieved independently of the initial allocation of the permits; ➢ In the case of cap-and-trade schemes, the regulator may not need to know the **marginal abatement costs** of the regulated sources. ➢ Assuring with reasonable certainly the **fulfilment** of the environmental (water quality) targets; ➢ Indirectly, **creating incentives for research and development** in water technologies and processes (dynamic efficiency).
What are its potential negative side effects? Can they be addressed?	The negative side effects of WET include: ➢ May lead to high concentrations of pollutants (**hot spots**) in some parts of water bodies, if the trading ratios are not designed with duly care; ➢ High number of allowances may be concentrated in the hands of few sources, **exercising market power** and obstructing entrance of new entities; ➢ The PS when buying credits from non-regulated sources, notably NPS, retain liability and **may face sanctions** in case the NPS do not deliver the expected reduction; ➢ May lead to **high prices** of emission permits. A cap on permit prices may reduce risk of disproportionate price levels; ➢ Initial allocation of allowances may constitute **state aid** and hence need to be communicated to the European Commission; ➢ **Speculation** may lead to increased emission of non-regulated sources or permit price volatility; ➢ May encounter **public resistance**, especially if the emission permits are conflated with secure property rights.

Which pre-conditions are necessary for implementation?	Water emission trading requires: ➢ **Flexibility** to permit fulfilment of European and national legislation through exchange of allowances and credits. This is not granted as the Directive concerning Integrated Pollution Prevention and Control (IPPC), and now the Industrial Emission Directive (IED) require individual standards for each source based on the best-available-technology. It is generally believed that although some space for WET exists, a greater deployment necessitates a revision of European legislation; ➢ **Binding and enforceable regulatory limits** on pollution levels are to be specified. There is evidence that WET may perform also in cases in which the regulatory targets have not yet been determined. Voluntary schemes however suffer from negative selection and do not lead to cost efficient solution; ➢ Sufficiently large **differences** exist in the marginal pollution control costs among the sources; ➢ Effective **trading rules** have to be established and overseen in order to prevent potential side-effects of the scheme.
What are the key steps for designing it?	The key steps in designing WET are: ➢ The **geographic scope** of the scheme has to be determined, the **pollutants specified**, and decided which **sources** will be regulated. A reliable inventory of pollution sources and understanding of the propagation of the pollutants is critically important for this end; ➢ The initial relative or absolute **pollution limits** have to be determined, and the permits allocated among the sources. The economic efficiency of WET, in theory, is achieved independently of how the permits are allocated. In practice there is evidence that the efficiency is compromised by the nature of uniformly mixed water pollutants and the design criteria preventing hot-spots pollution; ➢ Effective **trading rules** have to be worked out in order to guarantee inter-temporal and spatial trades.
What are the key steps for implementing it?	In terms of implementation: ➢ To facilitate the trades, the pollution control authority may create **favourable** legal and market arrangement; ➢ An effective water quality **monitoring system** is important for the success of the scheme.

EPI Template 8 - Insurance for addressing drought risk

What is it?	The insurance for addressing drought risk is a **financial mechanism that covers the loss of or damage to crops** caused by an insufficient amount of rainfall. It is designed to pool risks associated to the provision of water to farmers during dry periods. Insurance firms offer coverage to farmers who join the pool voluntarily and contribute by regularly paying a risk premium. Agents in the pool are entitled to receive full or partial financial compensation in case a drought is officially declared, based upon observable drought indices such as the reduction of water stored in dams and aquifers or of river flows below a predetermined threshold, and contingent reductions in water supply come into force. Drought insurance can be designed to include full or partial coverage, or a set of alternatives to allow agents to choose the desired coverage subject to the payment of different risk premia. Payments of indemnities might be linked to water delivery or to observable crop failures, revenue losses or income reductions.
Which water management issues does the EPI address?	In drought-prone river basin districts, **uncontrolled and informal abstractions have traditionally played the role of insuring yields** (and not costs or prices) during dry periods. This is an important driving factor of aquifer depletion, in particular when shortages make water more valuable. These problems could be avoided if the financial sector could provide a **proper insurance system to stabilize agricultural yields** as well as removing existing incentives to deplete groundwater sources. The informal, spontaneous and individual insurance system consisting of illegal water abstractions can be replaced by a **coherent and formal collective risk-sharing scheme**. Insurance systems also have the potential to be used as signaling devices reducing the cost of information and enforcement. In order to be entitled for compensation farmers **must prove they have not used excessive water**, water tables have not been affected, yields are lower, etc. This information can help the water authority regain the control over groundwater resources.
Which reference(s) in existing EU policy framework?	Linked to the 2013 **EU Strategy on adaptation to climate change**, the **Green paper on the insurance against natural and man-made disasters** fosters the use of insurance and other financial mechanisms to enhance resilience to drought (art. 8). In addition, two draft EU regulations tendered as part of the **Common Agricultural Policy** reform, contain guidance for the development of agricultural insurance schemes in relation to extreme events, such as droughts: the EC proposal for a regulation on support for rural development by the European **Agricultural Fund for Rural Development** (EAFRD) and the EC proposal for a regulation establishing a common organization of markets in agricultural products (**Single CMO Regulation**). Finally, drought insurance can contribute to align the objectives of the recently approved **Drought Management Plans** in Europe with the individual decisions made by farmers.
Can we find it in Europe?	Single-risk insurance for non-systemic risks (hail, fire) prevails in the EU. Drought insurance for irrigated agriculture does not exist so far. Only Spain has made significant advances towards its implementation. In the short-medium term, implementation of this insurance system can build over three different types of insurance schemes that have been implemented so far in the EU: yield insurance,

	rain-fed drought insurance and combined insurance for natural risks. Alternatively, drought insurance could be developed in the framework of the CAP 2013-2020, which advocates for the development of comprehensive income insurance in the medium-long term.
Can we find it outside Europe?	➢ Unlike the EU, single-risk insurance does not exist in the US. Income insurance prevails. Multi-peril (combined) yield insurance for almost all risks is also offered; ➢ Canada offers comprehensive risk coverage in agriculture based on income insurance.
Where can it work best?	Drought insurance can work best when: ➢ There are **previous insurance schemes** in place covering natural risks like plague infestations, fire, hail, frost and other natural risks that make the institutional set-up more easily adaptable to cover risks of water provision and eventually to pack them into a multi-risk insurance product. This would guarantee lower transaction costs and forming wider insurance pools; ➢ **Water is scarce** and probabilities of shortages are higher so that farmers have a measurable willingness to pay for reliability in water supply; ➢ Places with **spare production capacities** in need of investments to modernize irrigation infrastructures and where income security has the potential to foster capital investment and innovation.
What are the benefits of using it?	Insurance can have the following benefits: ➢ Setting an **opportunity cost** for groundwater overexploitation; ➢ Setting up an **alternative way** to stabilize farmers' income in dry periods; ➢ Creating conditions for a **collective control of aquifers** (as compensations in dry periods might depend on the proof that no overdraft happened in the irrigation district); ➢ Making **information** about current trends in groundwater **available** for the water authority; ➢ Reducing the negative outcomes of reduced income over local expenditure and fiscal revenue and acting as an automatic **stabilizer of the local economy**.
What are its potential negative side effects? Can they be addressed?	Water insurance can have the following potential negative impacts: ➢ **Promoting crops that use more water** and that are more affected by drought risk. This can be addressed in the design stage by setting appropriate risk premiums (and public subsidies to these premiums) and deductibles; ➢ **Transferring risks** from individual users to the government and adding to fiscal imbalances. This can be controlled by limiting the role of the government and by a transparent negotiation with the insurance firms, farmers and third parties over the exact role of the public authority. This problem needs to be addressed through a more selective subsidizing mechanism (localizing subsidies on highly exposed and/or low income areas/farmers) and the transfer of a larger share of the insurance costs to the farmers with the capacity to afford it. This requires an in depth knowledge of

	both insurance costs and farmers' true willingness to pay for agricultural insurance; ➢ Providing yield stability **without reducing water overuse**, that would happen if the insurance were more attractive to those farmers that doesn´t have access to uncontrolled water sources while being unattractive to those having it. A proper design could be based on a combined insurance system that increases risks coverage maintaining incentives for all kind of farmers to join the insurance pool; ➢ Insuring farmers but **not discouraging over-abstractions**. This moral hazard problem might arise if insured farmers can sell water illegally to non-insured farmers. This can be controlled by linking compensations not to the lack of publicly delivered water but to observed reductions in crop yields and by increasing the number of farmers in the insurance pool; ➢ **Financial exposure** due to the systemic nature of drought insurance. All farmers would be entitled for compensation at the same time and this may increase the cost of the insurance in the short term, making it unaffordable for some farmers and compromising the financial sustainability of the scheme. This can be controlled by proper reinsurance mechanisms already available in the financial system and by public support in the early stages until the pool is built and enough resources are accumulated to cope with systemic risk in the long term.
Which pre-conditions are necessary for implementation?	Drought Insurance can only work if: ➢ Responses to drought are **planned, anticipated and conditional** to public observable indicators. Drought Management Plans might be already in place and governments may commit to apply contingent constraints on the amount of water delivered so that emergency and discretionary responses are excluded and water delivery is perceived as an objective risk; ➢ **Farmers are risk averse**, they know the consequences of drought and the crops they plant are valuable enough for them to be willing to pay to reduce income risk; ➢ **Farmers' decisions are observable** to a certain extent that payments can be made conditional to current rather than to estimated losses.
What are the key steps for designing it?	The key steps include: ➢ **A risk assessment model** to measure the losses associated to different drought scenarios and to calculate the so-called fair risk premium or the average loss and the minimum price at which the insurance could be provided by the financial market in the absence of any other transaction costs; ➢ An evaluation of the farmers' **willingness to pay for income stability**, in order to dimension the demand of insurance and the margin to implement the scheme; ➢ **Defining the potential insurance contracts** (risk premium and coverage or deductibles) that can be offered for a profit by the insurance firms and bought by individual farmers;

	➢ **Design combinations of contracts** that can be accepted by different types of farmers within the same or different cropland areas and that have the potential to increase the number of users voluntarily accepting the scheme so that costs and adverse selection problems can be minimized; ➢ **Design risk packages** that can be sold together in order to increase the size of the pool and to reduce insurance costs; ➢ **Prospective analysis of the financial risk** involved in the early stages where resources collected through insurance premiums are not still enough to cope with systemic risk.
What are the key steps for implementing it?	In terms of implementation: ➢ **Building of a transparent agreement** between the government, the insurance companies and water users associations defining the purposes of the insurance, the commitments of each of the parties in improving drought responses, and the role of the government; ➢ Setting up of the **information system** required to make insurance payments conditional to observed behaviour through yields, market prices and other variables; ➢ Setting up of a **monitoring system** over the status of the groundwater bodies allowing making payments conditional to no further deterioration of water tables; ➢ **Define situations where exceptional support from the government might be required** in order to cover poor farmers or in order to increase the size of the pool so that moral risk can be controlled; ➢ **Agreeing on a sequence to implement the insurance**, starting with permanent crops where exposure to risk is easier to control, and extending coverage to new crops and areas. This will allow progress through learning by doing as gaining political and market acceptance under the basis of previous success. A proper sequencing will reduce insurance firms' incentives to engage in rent seeking and regulatory capture and will link the development of the market to its own performance; ➢ The water administration must take advantage of the insurance system **to regain the control of groundwater resources** both promoting awareness and independent evaluations and showing the positive impact of the instrument. Should the instrument fail this can pave the way to other interventions to safeguard the environmental objectives of water policy.

Glossary

Economic Policy Instruments (EPIs): Incentives for individual water users to decide why and how much water to use and are purposely designed in such a way that decisions taken by any individual are compatible with the overall objectives of water policy.

Environmental Costs: Welfare losses linked to the actual or potential deterioration of natural assets due to economic activities.

Externalities: Positive or negative welfare variations derived from the production or consumption of goods and services that impose costs or benefits on others. They are both unilateral (those affected by third-party effects can neither decide whether to be affected neither to what extent) and non-compensated.

Good ecological status: According to the EU Water Framework Directive, it is the status of a water body in accordance with its Annex V, and defined on the basis of biological, hydromorphological and physic-chemical characteristics similar to those expected under nearly undisturbed conditions.

Institutions: Formal rules and informal norms that define and modify the choice sets of individuals and their interactions by affecting the cost of exchange (transaction costs) and production (transformation costs).

Opportunities (to introduce EPIs): Favourable economic, social, and physical conditions under which an EPI may be most appropriate and perform best.

Opportunity costs: The value of water in alternatives foregone when allocating water to any use and not others.

Packaging incentives: A combination of instruments that once in place provide the adequate incentives to achieve the collectively agreed objectives of water policy.

Policy mix: A combination of economic policy instruments (EPIs) with command and control policies (e.g. regulation), other instruments (e.g. information) and traditional supply policies (e.g. construction of infrastructure).

Pre-conditions for implementation: Absolute economic, social, and physical conditions for an EPI to perform adequately.

Resource costs: The cost linked the economic or relative scarcity of water once it is used.

Sunk costs: Expenses that, once committed, cannot be (easily) recovered. Sunk costs arise because some activities require specialized assets that cannot readily be diverted to other uses.

Transaction costs (TCs): Costs or resources used to define, establish, maintain, use and change institutions and organisations, and define the problems that these institutions and organisations are intended to solve.

Water bodies: Discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water. Also a distinct volume of groundwater within an aquifer or aquifers.

Water entitlements: A specified long-term interest or right to a share of any water allocated to a water resource. Different levels of security or reliability of property rights generate different yields or allocations.

Water policy challenges: The combination of environmental, social and economic issues and objectives for improving sustainable water management.

Water rights: Legal entitlement awarded to anyone for the beneficial use of a reasonable amount of water (either from surface or groundwater sources) necessary to accomplish the purpose of the appropriation, without waste.

Water uses: General, non-specific term that describes any action through which water provides a service.

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