Evaluating Economic Policy Instruments for Sustainable Water Management in Europe

PROJECT FINAL REPORT

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[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.
[2] The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

4.1 Final publishable summary report

Executive summary

The EPI-WATER (*Evaluating Economic Policy Instrument for Sustainable Water Management in Europe*) was a EU FP7 funded project (01.2011-12.2013) set to analyse the performance of economic policy instruments (EPIs) in Europe and beyond, and to produce recommendation for a better exploitation of the potential of these instruments for achieving the EU environmental objectives. Implemented by eleven European research institutes[3], the project team set out to review the recent experiences with the application of economic policy instruments (EPIs) in Europe and beyond, and the potential role of EPIs in meeting the European water-related goals.

First, the EPI-WATER project team conducted an in-depth review of empirical evidence, experiences and lessons learned from the practical application of some 30 economic instruments for water management in Europe and in the overseas countries (e.g. Australia, Chile, Israel, United States, and China). ***Second***, the team performed ex-ante assessment of several economic instruments (compensation payments for flood storage on agricultural land, nitrate tax, water pricing and insurance, water trading and payments for ecosystem services), the application of which was simulated to address different policy challenges (floods, droughts, water quality, or ecosystem services and biodiversity conservation) in five representative river basins (districts) across Europe (Tisza, Tagus/Segura, Seine-Normandie, Odense and Pinios). The comparative strengths, downsides, and potential side effects of the instruments were analysed in depth. Each ex-ante case study analysed the environmental challenges in the respective river basin area in a holistic way and proposed a reform of the existing interplay of the policy instruments. ***Third***, a set of synthesis reports were produced that summarise the research findings (Delacamara et al., 2013; Møller et al., 2013; Mysiak, 2013; Mysiak, Vollaro, et al., 2013). Mysiak et al. (2013) synthetized the design choices, pre-requisites, and potential environmental and economic outcomes of incentive water pricing and trading, (nitrate) pollution tax, payments for ecosystem services, water emission trading and transient flood storage; and discussed the role of environmental taxation and tradable environmental permits in Europe. Delacamara et al. (2013) developed Guidance to take stock of existing experiences in order to support the further use of EPIs. Møller et al., 2013 pay attention on the use of national accounts to support design, monitoring and evaluation of EPIs. They show how a national water resource accounting system can be drawn up, and discuss how the accounting system can be used in supporting policy making. Finally. Mysiak (2013) reviewed the contemporary water research and

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innovation agenda in Europe, shaped by the Horizon 2020, the European Partnership for Innovation (EPI) on Water; and the Join Programming Initiative (JPI) on Water; and suggested priority areas for further research on EPIs.

Description of project context and objectives

Introduction and motivation

Water *security* features prominently among the grand challenges of humanity in a quest for sustainable future (Bakker, 2012). Repeatedly, the World Economic Forum (WEF) has placed water *supply* crises, in the 2014 report reclassified from societal to environmental risks, among the global risks of highest concerns (WEF, 2014). In terms of potential impacts, water crises are second only to systemic financial/fiscal risks and, only in recent editions, to climate change. The inspirational report of the 2030 Water Resource Group (2009), echoed by other studies, estimated that under fairly conservative assumptions (average economic growth and no efficiency gains), global water demand could exceed the currently *accessible* and *reliable* water supply by 40 per cent by 2030. Worse, extreme weather and climate events connected to water risks, already classified among the most likely global risks by WEF, are likely to be further exacerbated by human-induced climate change (IPCC, 2012), threatening to undermine economic growth and development. Without a *step change* improvement in water resource management, informed by state-of-the-art science and driven by technological improvements, these challenges will not be effectively addressed (OECD, 2013).

The EU Member States, despite the sizeable improvements triggered by the *Water Framework Directive* (WFD, 2000/60/EC) and other environmental legislation, are off the track in achieving the ambitious EU water policy goals. At latest in 2012 it became apparent that the good ecological status would not be met as expected by 2015 for about a half of water bodies in Europe (EEA, 2012a). Next to eutrophication, for the most part caused by nutrients leaching from diffuse sources (EC, 2013b), morphological changes to the form and flow of natural bodies and quantitative status of water ecosystems rise concern (EC, 2012a; EEA, 2012a).

Failed water policy targets are not alone in the track record of the EU environmental underachievement. In 2010 the European Commission (EC) admitted that the biodiversity target (halting decline of biodiversity) has not been achieved as planned (EC, 2010d). Whereas nearly 18 percent of EU terrestrial environment, or 26.000 specific sites, have been designated to conserved under the NATURA 2000 network of the 1992 Habitats Directive (92/43/EEC), some 65 per cent of the analysed habitats and 52 per cent of assessed species are found in 'unfavourable' state of conservation (EEA, 2010). Major drivers of biodiversity loss include land consumption and habitat fragmentation, and unsustainable use of resources including water (*ibid*). The failure to recognise the economic value of the ecosystem services, including regulation of water flow and flood peaks, has contributed to

the above negative environmental status. Since 1950, some 50 per cent of wetlands in Europe were lost to development and agriculture (EC, 2006), while over the same time the land surface occupied by cities almost doubled (EEA, 2006). Urban sprawl and soil sealing have contributed to increased surface run-off and flood risk. During the recent decades, the average annual *direct* cost of floods have been estimated to amount to 3-4 billion Euro (Barredo, 2009; EEA, 2011) and *annual expected damage* (AED) to 5-6.4 billion Euro. These losses can increase by 7.7-15 billion Euro by the end of the century as a result of human induced climate change (Ciscar et al., 2011; Feyen, Dankers, Bodis, Salamon, & Barredo, 2012).

Decades back, the European Union's policy makers have recognised the potential granted by economic incentives and/or disincentives for driving individual and business behaviour toward achieving sustainable development objectives, including protection of healthy environment and efficient use of natural resources. The 4th Environmental Action Programme (EAP) of the European Community (1982-86) (EC, 1987) addressed in detail instruments like taxes, charges, state aids, and tradable discharge permits; applied consistently with the *polluter pays* principle that became a cornerstone of European environmental policies in 1973 (Holzinger, Knill, & Schäfer, 2006). The economic policy instruments (EPIs) permeated environmental (including inland and marine water) legislation, with varying success. Simultaneously, efforts have been made to detect and remove environmentally harmful subsidies (EHS; OECD, 2005; Withana et al., 2012). Amidst the *unprecedented* recent financial and economic crisis in Europe, efficient use of natural resources became an integral part of the EU 2020 Strategy, a part of which is a budgetary-neutral shift of the tax burden away from labour and capital to consumption, property and environment (EC, 2011b).

Yet, the 2012 EU Water Policy Review (EC, 2012a, 2012b) has identified some but insufficient progress in application of the economic principles (e.g. cost recovery, water pricing) and encouraged, cautiously, use of market mechanism (e.g. water right trading scheme) where this represent a value-added improvement. The Review lamented '*insufficient use of economic instruments*' (EC, 2012a, p. 8), limited application of '*incentive and transparent water pricing*' (ibid, p. 10), contributing indirectly to increasing magnitude of economic effects of extreme events (such as droughts and floods) (*ibid*, p. 13). Besides, the Review concluded that '*not putting a price on a scarce resource like water can be regarded as an environmentally-harmful subsidy*' (*ibid*, p.10).

Project objectives and workflow

EPI-Water project[4] consortium responded to the 2010 call of the Seventh EU Framework Programme (FP7) Cooperation on Environment (including climate change)[5] programme

[4] EPI-WATER: Evaluating Economic Policy Instrument for Sustainable Water Management in Europe [January 2011 – December 2013].

(EC, 2009b), in quest of collecting supporting evidence for the '*current and future*' EU water policies. The project consortium was composed by eleven European research institutes[6] from nine EU member States. In addition, ten academic experts from Australia, Chile, China, Israel, and United States[7] joined the team and helped to expand the evidence about the performance of some economic policy instruments not commonly applied in Europe. Throughout the project life-span, close involvement of a group of water management practitioners and policy makers[8] ensured that the EPI-WATER research is conducted in a way that responds to the practical policy requirements and needs[9].

[5] Topic ENV.2010.2.1.2-1 Evaluation of effectiveness of economic instruments in integrated water policy.

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[7] Tihomir Ancev, University of Sydney, Australia; Ariel Dinar, University of California – Riverside, United States; Guillermo Donoso Harris, Pontificia Universidad Católica de Chile, Chile; Charles Howe, University of Colorado, United States; Iddo Kan, The Hebrew University of Jerusalem, Israel; Mark Kieser, Kieser & Associates LLC, United States; Carolyn Kousky, Resources for the Future, United States; Xiaoliu Yang, Peking University, China; Andrew Yates, University of Richmond, United States; Michel Young, University of Adelaide, Australia.

[8] Bernard Barraqué, l'Institut des sciences et industries du vivant et de l'environnement, France; Viviane André, EC Directorate General Environment; Kevin Andrews, Defra - Department for Environment, Food and Rural Affairs, United Kingdom; Robert Peter, Collins, European Environmental Agency; Cristina Danes, Ministry of the Environment, Spain; Jacques Delsalle, EC Directorate General Environment; Henriette Faergemann, EC Directorate General Environment; Sarah Feuillette, Agence de l'Eau Seine Normandie, France; Eduard Interwies, Intersus Sustainability Services, Germany; Mats Ivarsson, Agency for Marine and Water Management, Sweden; Lukasz Latala, EC Directorate General Environment; Xavier Leflaive, Organisation for Economic Co-operation and Development, France; Irene Lucius, World Wide Fund for Nature, Belgium; Tania Runge, European farmers – European Agri-Cooperatives, Belgium; Cristian Rusu, Waters National Administration, Romania; Moroz Sergey, World Wide Fund for Nature, Belgium; Stefan Ulrich Speck, European Environmental Agency, Denmark.

[9] While we gratefully acknowledge the contributions of the international academic and policy experts, the responsibility for any error remains ours.

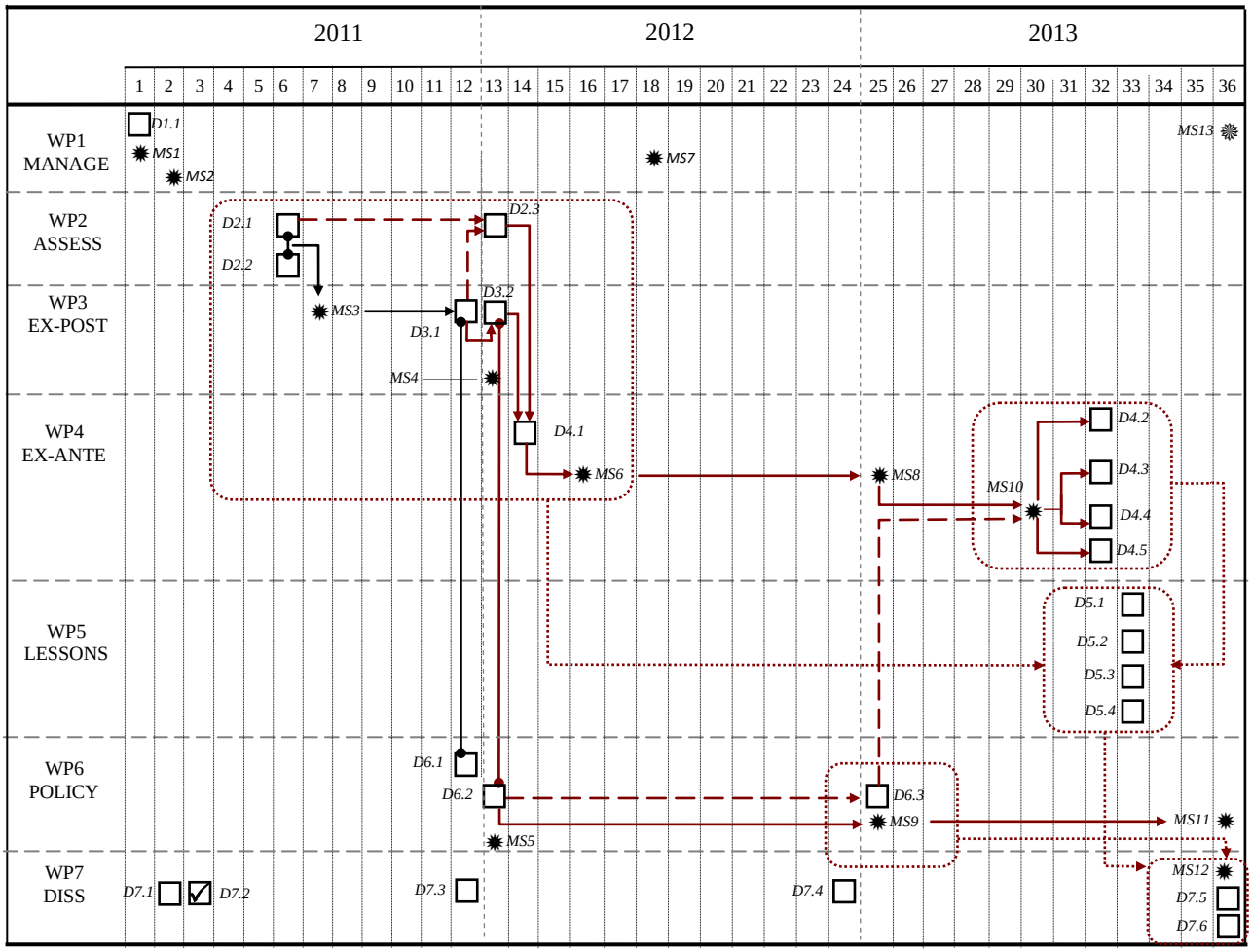

Figure 1 Workflow of the project including the major deliverables and milestones

The project was structured in 6 thematic WPs and the research activities were grouped into three consecutive steps. The WP2 (ASSESS) sets to develop a comprehensive assessment framework (D2.1) and toolbox (D2.2), based on and advancing the best practices for economic and integrated analysis in water policy and management. The framework was to be applied for, and revised (D2.3) in the context of the subsequent WPs. The WP3 (EX-POST) envisaged that around twenty-five ex-post performance reviews of existing EPIs in Europe and beyond Europe were to be completed (D3.1 and D6.1). WP4 was central to the EPI-Water proposes to undertake in-depth ex-ante assessments for 4 case study areas representing priority policy thematic areas: water scarcity/drought, flood and excess water management, water quality control, and biodiversity/ecology (D4.2-4.4). Overall, around the different case studies and river basins investigated in WP3 and WP4 cover a range of distinct geophysical, environmental, socio-economic, cultural and institutional conditions, making it easier to extrapolate the knowledge and insights gained to other countries/regions in Europe (D5.1). Building on the previous results, the WP5 aimed at the synthesis and extrapolation of key knowledge and insights gained, both in terms of policy making and in terms of scientific knowledge/future research issues (D5.4). WP6 was to

manage the two-direction links between EPI-Water research and the wider scientific and policy communities by establishing two advisory body for policy and academic experts: 'Policy Think Tank' and 'Inspiration beyond the EU'.

Description of the main S&T results/foregrounds

Concise synthesis of the results

The EPI-WATER team produced a large body of evidence about the different types, design features and outcomes of water-related economic policy instruments in place; and the practice guiding their choice and implementation. The assessment exercise is one of a few comprehensive and consistent (e.g. employing the same assessment principles) ex-post reviews of EPIs in water resource domain in Europe, and in many cases the first one to have shed light on the use of particular instances of economic instruments across the EU Member States. The project's main reports alone, without counting the ancillary knowledge contained in the supplementary material, comprise more than 2,000 pages. The collected knowledge has informed several major synthesis and advocacy reports in Europe (CEPS, 2012; EEA, 2012a, 2012b, 2013; OECD, 2013; Strosser et al., 2012) and provided timely input for the 2012 EU Water Policy Review (EC, 2012a).

Compared to other horizontal reviews of environmental EPIs in Europe (Bogaert et al., 2012; Bräuninger et al., 2011; Rademaekers, van der Laan, Smith, van Breugel, & Pollitt, n.d.), the EPI-WATER exclusive focus on water uses and services, and the breadth and depth of the analysis are unique both from the national and the international perspective. Some of the EPIs analysed have been repealed, modified or replaced, or plans have been declared to do so, during or shortly after the assessment exercise was completed. The Dutch national groundwater tax (GWT) (Schuerhoff, Weikard, & Zetland, 2011, 2013) and tradable renewable energy certificates (RES) in Italy (Mysiak et al., 2011a) are case in point. The GWT has been revoked for '*for being fiscally inefficient and environmentally unhelpful*' (Schuerhoff et al., 2013) while the Italian RES scheme has been phased out and replaced by feed-in tariffs and reverse auction mechanism after the market with green certificates literally stagnated and government intervened through floor prices which substantially increased the costs of the schemes, eventually paid by consumers. The frequent policy changes make difficult the maintenance of EPIs inventories such as the OECD/EEA database on instruments used for environmental policy and natural resources management[10] and the EC's DG TAXUD database[11]. The EPI-WATER efforts hence helped to improve and keep updated the existing knowledge base.

The ex-ante assessments drawing on a meticulous analysis of river basin-wide policy challenges and opportunities, paved the way for an improved regulatory impact

[10] http://www2.oecd.org/ecoinst/queries/

[11] European Commission -Taxes in Europe Database, ec.europa.eu/taxation_customs/tedb/

assessment and serve as pilot studies for the assessment of programmes of measures (PoM) compelled by WFD. Anticipating the enhanced guidance of European Commission on economic matters and assessment of policy intervention (EC, 2012a), the team has produced (and tested in practice) policy guidelines (Delacamara et al., 2013; Zetland, Dworak, Lago, Maziotis, & Viavattene, 2013) that have been brought into the attention of the EU Water Directors through the *Common Implementation Strategy* (CIS). Targeted briefing events were conducted at the *Organisation for Economic Co-operation and Development* (OECD) and the *European Commission* (EC), and additional events are planned at the *Food and Agriculture Organization* of the United Nations (FAO) and the *European Environmental Agency* (EEA). Besides, the EPI-WATER team has analysed and demonstrated advantages of combining the complementary strengths of several EPIs in a policy mix addressing water scarcity and droughts (Gómez, Delacámara, Pérez-Blanco, Ibáñez, & Rodríguez, 2013) and flood risk reduction (Mysiak, Amadio, Santato, Carrera, & Maziotis, 2013; Ungvári et al., 2013).

The EPI-WATER project energised academic and science-policy debates on the methodological and practical aspects of EPIs, and their role in meeting European water policy goals. Throughout the life-span of the project, the team has organised several major conferences (Berlin, January 2012[12]; Alcalá de Henares-Madrid, February 2013[13], Venice, November 2013[14]), targeted workshops[15], summer school[16], and numerous other dissemination events[17]. The consortium liaised with several European funded project addressing EPIs in water, biodiversity and energy fields, namely POLICY MIX (FP7, *Assessing the role of economic instruments in policy mixes for biodiversity conservation and ecosystem services provision*; policymix.nina.no), ENTRACTE (FP7, *Assessment and further development of the European climate policy*, entracte-project.eu), Water Cap & Trade (IWRM-NET, *Water Market scenarios for Southern Europe: new solutions for dealing with water scarcity and drought risk*), THESEUS (FP7, *Innovative technologies for safer European coasts in a changing climate*, www.theseusproject.eu) and GENESIS (FP7, *Groundwater and Dependent Ecosystems: New Scientific and Technological Basis for Assessing Climate Change and Land-use Impacts on Groundwater*, www.thegenesisproject.eu).

Major results

[12] *Understanding the application* of Economic Policy Instruments in water management (Berlin, January 26-27, 2012), http://www.feem-project.net/epiwater/pages/events/120126/

[13] *Anticipating the performance* of Economic Policy Instruments in water management (Alcalá de Henares - Madrid, February 6-7, 2013); http://www.feem-project.net/epiwater/pages/events/130206/

[14] *Paving the way for a better application* of economic policy instruments for water resources mana-gement (Venice, November 28-29, 2013) http://www.feem-project.net/epiwater/pages/events/131128/

[15] Economic instruments for water management: *Responding to expectations and supporting environmental policy objectives* (Strasbourg, December 17-18, 2013; Pricing Water – towards an effective, efficient and socially fair pricing schemes and financing arrangements (Venice, June 8, 2012), and many others.

[16] Belpasso International Summer School on Environmental and Resource Economics: *Financing Disaster Risk Reduction and Climate Adaptation* (Belpasso, September 1-7, 2013), http://www.biss2013.it/

[17] See also http://www.feem-project.net/epiwater/pages/events_past.html

Assessment Framework

The project team designed an *assessment framework* (AF), in order to ensure that all assessments are comparable in depth and breath, and follow the same assessment principles (Weikard & Zetland, 2013; Zetland et al., 2011, 2012, 2013). Policy instruments are typically analysed in terms of *environmental effectiveness* (i.e. capability to meet given environmental objectives or produce positive environmental outcomes), *economic efficiency* (i.e. extent to which the goals are achieved in an economic way), *distributional effects* (i.e. fairness and equity of cost and benefit sharing), and *institutional feasibility* (i.e. legitimacy and acceptance) (Gupta et al., 2007). The EPI-WATER's AF was designed with similar but more articulated scope. It compares the outcomes resulting from an EPI to the outcomes that would have resulted with from no action or an alternative policy intervention. The *outcome*-oriented criteria are discerned from *process* criteria, the latter describing the institutional conditions (legislative, political, cultural, etc.) affecting the formation and operation of EPIs, the transaction costs from implementing and enforcing the EPI, the process of implementing the EPI, and the impact of uncertainty on the EPI (Zetland et al., 2013).

The AF makes it easier to systematically assess the effectiveness and impact of water policies. Standardisation makes it easier to compare policies, 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 (Weikard & Zetland, 2013). The Framework compares the outcomes resulting from an EPI to the outcomes that would have resulted with either a "business as usual" baseline of no action or an "alternative scenario" that would have resulted from another policy intervention. The outcome-oriented criteria describe how EPIs perform. They include intended and unintended economic and environmental outcomes and the distribution of benefits and costs among the affected parties. Process criteria describe the institutional conditions (legislative, political, cultural, etc.) affecting the formation and operation of EPIs, the transaction costs from implementing and enforcing the EPI, the process of implementing the EPI, and the impact of uncertainty on the EPI (Zetland et al., 2013). Based on the experiences from the assessment exercise, the AF has been revised (Zetland et al., 2012) and extended.

Ex-post assessment of existing economic policy instruments

The team selected representative economic policy instruments in Europe[18] (Lago, Möller-Gulland, & Dworak, 2011) and beyond[19], taking into account the geographical coverage, economic sectors and environmental pressures at which the instruments targeted. Each of

[18] Cyprus, Denmark, France, Germany, Hungary, Italy, the Netherlands, Spain, Switzerland, and the United Kingdom

[19] Australia, Chile, China, Israel, and the USA

the selected instruments was analysed separately using the AF as a guide. The team conducted an in-depth review of empirical evidence, experiences and lessons learned from the practical application of economic instruments for water management in Europe and in the overseas countries (e.g. Australia, Chile, Israel, United States, and China). The latter were chosen to address instruments not experimented with in the EU and/or as a way of transferring knowledge from countries with substantial experience in the field of policy innovation.

The review examined 30 EPIs in an ex-post mode, covering a range of different instruments operating under different environmental and socio-economic conditions (Ancev, 2011; Branth Pedersen, Ørsted Nielsen, & Skou Andersen, 2011; Defrance, 2011; Dinar, 2011; Donoso Harris, 2011; Dworak, 2011; Gómez, Delacámara, Pérez, Ibáñez, & Solanes, 2011; Gómez, Delacámara, Pérez, & Rodrígue, 2011; Hernández-Sancho, Molinos-Senante, & Sala-Garrido, 2011; Hernández-Sancho, F. Molinos-Senante & Sala-Garrido, 2011b, 2011a; Howe, 2011; Kan & Kislev, 2011; Kieser & McCarthy, 2011; Kossida & Tekidou, 2011; Kousky, 2011; Mattheiß, 2011; Möller-Gulland & Lago, 2011; Möller-Gulland, McGlade, & Lago, 2011; Mysiak et al., 2011a, 2011b; Rákosi, Ungvári, Mezősi, Kelemen, & Kaderják, 2011; Sardonini, Viaggi, & Raggi, 2011; Schuerhoff et al., 2011; Ungvári, Kaderják, Mezősi, & Kiss, 2011; Viavattene, Pardoe, McCarthy, & Green, 2011; Yang, 2011; Yates, 2011; Young, 2011; Zetland & Weikard, 2011).

Intermediate synthesis of the ex-post assessment exercise (Lago & Möller-Gulland, 2012) revealed substandard policy design and assessment practice. Only a few analysed EPIs contained a clear specification of what the instruments were meant to achieve. A comprehensive ex-ante assessment was conducted even in fewer instances and we have found no evidence of a continuing monitoring of the achievements or a periodic ex-post assessments. Some of the EPIs we analysed were reformed or replaced by other policy instruments during or shortly after we completed the assessment, without a plain explanation of the reasons leading to the policy change. Still more, the EPIs implemented after 2000 lacked a specification how they were supposed to contribute to the implementation of the EU Water Policy, embodied in the Water Framework Directive (Directive 2000/60/EC) and related water legislations. Whereas conflict resolution is a core of contemporary water management, EPIs are designed so as to enhance i) water use efficiency, that is avoiding wasteful use of water; ii) allocation efficiency, thus maximising overall society's benefits from water uses; and iii) financial viability, meaning ability to compensate capital, skills and technology needed to ensure water services; while paying due attention to social equity issues such as affordability and other distributional effects. The reviewed instruments displayed a partial contribution to one or more of the above goals.

Ex-ante assessment of selected economic policy instruments in representative river basins in Europe

Third, the team performed ex-ante assessment of several economic instruments (compensation payments for flood storage on agricultural land, nitrate tax, water pricing and insurance, water trading and payments for ecosystem services), the application of which was simulated to address different policy challenges (floods, droughts, water quality, or ecosystem services and biodiversity conservation) in five representative river basins (districts) across Europe (Tisza, Tagus/Segura, Seine-Normandie, Odense and Pinios). The comparative strengths, downsides, and potential side effects of the instruments were analysed in depth. The inception report (Mysiak et al., 2012) of these case studies explained motivation for choosing the case study area, and the specific policy challenges experienced. The case study addressed different water policy issues: floods and excess waters in the Tisza river basin district (RBD) sub-unit (Hungary), droughts and water scarcity in the interconnected Segura and Tagus RBDs (Spain), and in Pinios river basin (Greece); nitrate pollution in the Seine-Normandie RBD (France) and Odense (Denmark); and restoration of good morphological conditions in in the Seine-Normandie RBD (France). The analysis resulted in five comprehensive reports (Defrance et al., 2013; Delvaux, Mattheiß, Mysiak, Maziotis, & Lago, 2013; Gómez et al., 2013; Kossida et al., 2013; Skou Andersen et al., 2013; Ungvári et al., 2013). Each ex-ante case study analysed the environmental challenges in the respective river basin area in a holistic way and proposed a reform of the existing interplay of the policy instruments.

Synthesis of the results

A set of synthesis reports of which this document is a part summarise the research findings (Delacamara et al., 2013; Møller et al., 2013; Mysiak, 2013; Mysiak, Vollaro, et al., 2013).

The deliverables D5.1 Synthesis report (*Mysiak et al.,* 2013) summarised the key lessons learned and role/potential of the selected EPIs for the European water policies. The extensive body of knowledge collected is ill-suited for a synthesis in general terms. Hence, the deliverable is organised in two parts. PART I focussed on the principal EPIs analysed by the team, including incentive water pricing and trading, (nitrate) pollution tax, payments for ecosystem services, water emission trading, and transient flood storage. Each instrument is described in terms of *policy challenges to which it contributes to respond*, *design principles and criteria*, *prerequisites for a successful implementation*, and *potential environmental and economic outcomes*. The latter is based on the empirical research conducted by the EPI-WATER project consortium, complemented by a literature review. PART II focused on issues relevant for *choosing an EPI or building a policy portfolio*; *matching the chosen instrument to the existing institutional framework and the opportunity for change*; and ensuring that the *EPI contributes to the integration of water and other sectoral policies*, or does not produce negative side-effects to these sectors. Moreover, an innovative proposal for designing EPI so as to

address *water security* is presented. Moreover yet, the role of *environmental taxation* and *tradable environmental permits* is explored in depth.

The deliverable D5.2 Guidance on the design and development of EPI in European water policy (*Delacamara et al.,* 2013) 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. This guidance aims to i) 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 ii) raise awareness of EPIs, so that stakeholders can engage effectively with decision-makers and experts on the development and implementation of EPIs. The Guidance is structured so as to respond to the following key question: What are EPIs? Why considering EPIs? Which EPIs are relevant to a given context? What to do when designing EPIs? What (else) needs to be kept in mind during implementation? What are the key prerequisites of the selected instruments?

The D5.3 Special Report on the Environmental Accounts (*Møller et al.,* 2013) shows, on the one hand, how a national water resource accounting system can be drawn up, and on the other hand discusses how the accounting system can be used in supporting policy making. Hence, the report is a methodological report and does neither intend to present the numbers and empirical data that form the water resource accounts nor to make policy analysis based on the accounts. Methodically the accounts are in line with other parts of the national account system and they can be integrated into this system. This makes the account very applicable for economic policy analysis at national level. The accounts are drawn up in accordance with the principle of nature as supplier of a number of ecosystem services that society demands. The basis for the analyses in this report is a separate part of the SEEA system which is related to water resources and is called System of Environmental Economic Accounting for Water (SEEAW). The extensions are worked out in a way which means that the whole national account system preserves its consistency - i.e. the extensions are built up around supply and use accounts, division of supply into industries is preserved as well as the use categories, while the basic valuation method based on marginal values is maintained as far as possible.

The D5.4 Research agenda for the design and implementation of economic policy instruments (*Mysiak,* 2013) reviews the contemporary water research and innovation

agenda in Europe, shaped by the Horizon 2020, the European Partnership for Innovation (EPI) on Water; and the Join Programming Initiative (JPI) on Water; and suggest priority areas for further research on EPIs. To this end the document addressed the recent European policy changes that affected the assessment and use of EPIs: *First*, in March 2010, the European Commission (EC) disclosed the Strategy 2020 which includes the flagship initiative Resource-Efficient Europe. This initiative builds upon decoupling resource use from economic development, increasing water security, and promoting adaptation to likely impacts of climate change. The initiative also emphasised the role of economic policy instruments (EPIs) for the above goals, while using the generated revenues for reducing the tax burden on labour. *Second*, the late 2000s economic and financial crisis revealed the high exposure of the EU to economic shocks exacerbated by fiscal and 'other macro-economic imbalances'. The EC responded by promoting a better coordination, surveillance and enforcement of the EU and Members States' economic and fiscal policies. *Third*, in the late 2000s the EC intensified the efforts related to *better regulation*. The key tools in the new approach includes an *ex-ante* and *ex-post* evaluation of the legislation, and a strategic assessment of the '*fitness for the purpose*'. The proposed agenda is structured around six thematic areas comprising the variety of economic policy instruments and their interplay; synergies and dissonance between water, land and energy resources; design choices and trade-off between multiple goals; improving the economic and environmental knowledge base; framing the assessment; and regulatory and governance environment.

The potential impact

Changing policy environment

The EPI-WATER project set to inform the implementation of the WFD, the European Union's flagship legislation for protection of ground- and surface waters and depending ecosystems; the *European Marine Strategy Framework Directive* (MSFD); the EU Floods Directive (2007/60/EC on the assessment and management of flood risks); and the EU Drought Policy[20]. Since the late 2009, when the EPI-WATER project had been designed, the EU policy *environment* underwent some important changes. These changes have extended considerably the scope (breadth and depth) of the EPI evaluation to which the EPI-WATER project was ill-suited to fully respond.

First, in March 2010, the *European Commission* (EC) disclosed the **Strategy 2020**, a decadal plan expected to put the EU on the pathway of '*smart, sustainable and inclusive economy delivering high levels of employment, productivity and social cohesion*' (EC, 2010a). The Strategy 2020, initiated not at least as a way out of the *unprecedented* (EC, 2009a) economic crises the

[20] Communication from the Commission to the European Parliament and the Council - Addressing the challenge of water scarcity and droughts in the European Union (COM/2007/0414 final)

EU faced since the summer 2007, embraces a clear commitment to *smart*, *green* and *inclusive* growth, based on knowledge and innovation; efficient resource use; high employment and cohesion, both social and territorial. The Strategy sets bold goals including the so-called 20/20/20[21] climate/energy targets and the 75 per cent employment target (population aged 20-64), while reiterating other commitments such as the target of investing 3 per cent of the EU's GDP in research and development. The Strategy comprises seven flagship initiatives including the *innovation union* and *resource-efficient Europe*. The latter was further explicated early in 2011 (EC, 2011a, 2011b) as a way to decouple resource use from economic development through technological innovation, improved management of natural resources (including water), and changes of consumption pattern. At the same time, the flagship initiative *resource efficient Europe* is expected to increase security of supply of main resources and help to tackle the impacts of climate change. With other words, the initiative reiterated the commitment to protect water resources throughout the European Union and beyond, while creating enabling conditions for *green(er)* growth. The initiative also emphasised the role of economic policy instruments (such as environmental related taxes) for the above goals, while using the generated revenues for reducing the tax burden on labour. In doing so, the EC reaffirmed its earlier calls for a budgetary-neutral shift of the tax burden away from labour and capital to consumption, property and environment. The *environmental tax reform* (ETR) is expected to benefit job creation and economic growth. The ETR was outlined as early as in 1993 in the *White Paper on Growth, competitiveness, employment* (EC, 1993) and further reiterated in a number of occasions (EC, 2005a, 2005b), including the *Green paper on market-based instruments for environment and related policy purposes* (EC, 2007). The stated goal of the 2020 *resource efficiency roadmap* (EC, 2011a) includes '*a major shift*' away from labour to environmental taxation and '*a substantial increase*' of the share of public revenues from environmental taxes.

Second, the late 2000s economic and financial crisis revealed the high exposure of the EU to economic shocks exacerbated by fiscal and 'other macro-economic imbalances'. The EC responded by promoting a better coordination, surveillance and enforcement of the EU and Members States' economic and fiscal policies (EC, 2010b). The *European semester* (ES) is among the new instruments adopted in 2010 to this end. The ES stands for an improved *ex-ante* review and coordination of economic and budgetary policies along the agreed principles of the Strategy 2020 and the EU framework for coordination of national fiscal policies - the *Stability and Growth Pact* (SGP). Following the publication of the annual economic survey by the EC at the beginning of each year, the Member States (MS) submit reports displaying their current public financial situation (*Stability or Convergence Programmes* SCPs) and outlining measures they intend to apply to sustain growth and employment along the Europe 2020 strategy (*National Reform Programmes* NRPs). The

[21] 20 per cent reduction of greenhouse gas emissions compared to 1990 levels, 20 per cent energy produced from renewable sources, and 20 per cent increase in energy efficiency.

Commission reviews both reports until June and offers country-specific recommendation and guidance. The *European Semester* is followed by *national* semester during which the MS translate the EU guidance into current-year public budget and policy making, and prepare the next year's reports. The first cycle of the ES was completed in 2011 (EC, 2011c). Whereas the ES is an opportunity to promote environmental tax reform, the reform of water policy has been rarely addressed. Withana et al. (2013) analysed the extent to which the *European Semester* stimulated changes in environmental policies and found *little* emphasis on other than energy and climate policies. The 2012 *Tax Reform report* (EC, 2012d) stresses the scope of an improved environmental taxation in about a third of the EU MSs. Taxes should play a role where the existing policies are not sufficient to ensure that the agreed environmental objectives are met. However, the taxes are also recognised as an instrument for fiscal consolidation. Hereafter the environmental taxes should be designed so as to provide appropriate incentives to reducing emissions and increase resource efficiency, through broadening the tax base and tax indexing (e.g. adjusting for inflation).

Third, in the late 2000s the EC intensified the efforts related to *better regulation*. A step-change of policy practice towards a *smart* regulation ('*getting legislation right*') was outlined in the 2010 Communication (EC, 2010c), building upon the principles of *whole policy cycle* analysis (including design, implementation, enforcement, evaluation and revision), *shared responsibility* (of EU and MS institutions), and making policy efforts *accountable to those mostly affected*. The key tools in the new approach includes an *ex-post* evaluation of the legislation (*ex-ante* impact assessment was established in 2003; EC, 2005c) and a strategic assessment of the '*fitness for the purpose*' (fitness check, FC). Conducted for a set of pilot studies including water legislation (EC, 2012b) between 2010 and 2012, the FC addressed the regulatory burdens, gaps and overlaps, as well as inconsistencies and/or obsolete provision, while contributing to the assessment of the cumulative impact of a legislation. Based on the collected experiences, the EC has launched the *Regulatory Fitness and Performance Programme* (REFIT) focusing on simplifying existing legislation and '*reducing the regulatory cost for businesses and citizens without compromising public policy*' (EC, 2012c).

Fourth, the EC Climate Adaptation Strategy and the accompanying documents have further stressed the role of EPIs. The 2013 EC Green Paper (GP) on the Insurance of Natural and Man-made Disasters (EC, 2013a) examined the scope for improving market conditions for insurers in the EU. Acknowledging the scarce market penetration rates and coverage, the GP questioned the EU and MS roles in conquering market barriers which limit the services provided by private sector. Likewise, the 2014-2020 Common Agriculture Policy (CAP) regulation promotes farm risk management though insurance schemes, mutual funds, and income stabilisation under the Rural Development Plan.

The EPI-WATER contribution to advancing the research on EPIs

The EPI-WATER team collected knowledge that informed several major synthesis and advocacy reports in Europe (CEPS, 2012; EEA, 2012a, 2012b, 2013; OECD, 2013; Strosser et al., 2012) and provided timely input for the 2012 EU Water Policy Review (EC, 2012a). Compared to other horizontal reviews of environmental EPIs in Europe (Bogaert et al., 2012; Bräuninger et al., 2011; Rademaekers et al., n.d.), the EPI-WATER exclusive focus on water uses and services, and the breadth and depth of the analysis are unique both from the national and the international perspective. Water security, energy security, and food security are intimately connected, and inappropriate use of policy instruments, economic or regulatory ones, in one area may exacerbate the risks in the other areas. Several European and national projects have made complementary efforts recently in analysing the performance and comparative strengths of the EPIs, having similar scope but responding to different environmental concerns.

Many of the instruments analysed by the EPI-WATER team singled out agriculture, or agricultural land management, as having a large potential for sizeable water efficiency gains, pollution control, and flood damage reduction. These gains need to be wisely weighed against food security and prices; income and social protection of rural communities. With growing acquaintance with and emerging acceptance of the EPIs, the attention should be shifted to a better appreciation of both ancillary and harmful side-effects across policy domains.

Not only recent floods have demonstrated the ambivalent role of agriculture in altering surface water run-off. Ill-targeted agricultural subsidies, either not sufficient to steer intended behavioural change, or worse, rewarding soil management practices with detrimental impacts on flood risk, soil erosion, and pollution load should be identified and ended. On opposite side, farm income stabilisation instruments and payments for genuine ecosystem services should be targeted so as to reduce and halt land abandonment where this is associated with biodiversity losses and increased risk. Similarly, the EPIs fostering development of renewable energy sources (RES) such as biofuels and hydroelectricity exercise additional pressure on water resources which have to be better understood. Arguably, biofuel policies have provided incentives for increased water abstraction, extending farming on marginal lands and occasionally withdrawing land from the existing nature conservation programmes. Much of the recent upward food price trend have been attributed to large-scale biofuel production. On opposite side, the EPI-WATER research has shown that incentives for RES can in principle be reconciled with good ecological status of water bodies.

The EPIs in the meaning used in the EU policy documents are designed to serve multiple goals, including (more) efficient use of resources, with implicit effect on innovation; re-allocation of resources to higher value uses; reduction of policy compliance costs; costs

recovery and hence financial viability of water services provision; fiscal transformation; and shifting risk to entities best suited for coping with it. Attempts to satisfying multiple goals with single instrument often results in reduced efficiency gains. Not only, design features of EPIs are bowed so as to gain acceptance and respond to concerns of regulated entities or public resentment. To make EPIs politically palatable, policy makers often react by narrowing the tax base, introducing tax relief incentives, or allocating initially the environmental permits or entitlements free of charge. As a result, the actual outcomes of the EPIs differ from text-book theory. Yet, the multiple expectations and interests to which the design choices have to respond compromise the EPI outcomes, while trading off economic efficiency against applicability.

The EPI-WATER assessment exercise has shown the uneven quality of knowledge readily available or accessible to demonstrate the environmental and social outcomes of the revisited EPIs. Frequently, the environmental performance was masked by temporal conditions such as droughts, or compound effects of other policies, or did not yet fully materialised at the time of assessment. Worse, the outcomes of the EPIs were neither analysed beforehand nor critically reviewed in hindsight. We have shown the counter-productive outcomes of EPIs that neglected some important environmental factors. For example the tradable water entitlement schemes the design of which neglected the return water flow (Young, 2011) lead to water over-allocation, subsequently corrected by costly bay-back schemes.

Good policy analysis and decision making are informed, but not solely determined, by scientific and economic knowledge. Rather than arguing for the larger use of some particular EPIs, we argue for a thoughtful policy analysis capable to single out credible and viable solutions to the water management challenges faced. Cost benefit analysis (CBA) is an essential tool to inform public policy choices. A thoughtful policy assessment ought to examine all practical options and compare their performance. The EPI-WATER Assessment Framework (AF) embraced *process-oriented criteria* (such as institutional fit and policy feasibility) in addition to the economic, environmental and distributional outcomes.

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- Università di Bologna (UNIBO), Italy, http://www.unibo.it/; http://www.deiagra.unibo.it/
- Wageningen University (WU), The Netherlands, http://www.wageningenuniversity.nl/uk/
- National Technical University of Athens (NTUA), Greece, http://www.ntua.gr/en_index.htm
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