Project: Sustainable Hydro Assessments and Groundwater Recharge Projects
Project acronym: SHARP

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APPENDIX: Long version of good practices

GP 5	Water Framework Directive Guidelines

Project Partner:
Regional Agency for Rural Development of Friuli Venezia Giulia (ERSA)

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The EU Water Framework Directive (2000/60/EC, WFD)

The EU Water Framework Directive (2000/60/EC, acronym WFD) introduced a new approach based on the desired quality levels of the receptors and thereupon requiring the adoption of an integrated set of measures which address all potentially impacting activities. The approach takes inspiration from the paradigm of sustainability: water policy aims at safeguarding water resources in order to pass them on intact to the next generations. The overall objective is to generalize the use of tools for economic analysis that support decisions concerning water resources management and to guarantee that the planning process takes place by means of democratic procedures which are open to different subjects interested in participating in the planning and the implementation thereof.

The economic analysis foreseen by the Directive must accompany the decision-making process from the beginning, thus integrating it with the components supplied by other disciplines.

The economic analysis serves to identify the following:

- Problems associated with water resources management;
- Critical issues that hinder problem solving: forces whereupon water demand depends are linked in various ways to social and economic trends and dynamics.

- Viable solutions – sorting out the best among these: each solution implies direct or indirect costs (in form of money expenditures or loss of earnings) that need to be evaluated.
- Stimuli and incentives exerting influence on social actors and on their likeliness to give consent to the decisions that have been made or to accept certain waivers: this behavioural pattern can be influenced and controlled with the use of economic levers.
- Reasons that trigger conflicts of use among different social actors and stakeholders, being these eventually responsible for the consent given to water policy strategies. Every kind of water policy requires sacrifice by different social actors and different sectoral and territorial components. The higher the perception that the effort required by everyone is equivalent to the effort put in by others the better the acceptance of the sacrifice.

The WFD identifies different interest areas for economic analysis to be performed, particularly:

- Economic analysis of water uses: Which subjects use (or would want to use) water? What value does the use of water have for these subjects? Which economic and social forces govern the evolution of these demands over time?
- Comparative analysis of strategies and solutions: Which solutions can be adopted? Who bears the costs? Which alternatives entail a better cost/benefit ratio?

Activities are being undertaken currently to support the application of the WFD in EU member states. Some examples hereof: public consultation, development of national guidelines, implementation of pilot activities to verify specific aspects of the Directive as well as the global planning process, conducting discussions about institutional contexts or the launch of research programmes centered on the Directive. The main goal of this strategy is to provide support for the correct application of the Directive by developping shared interpretations and clarifying its core elements. These elements comprise sharing information and experiences, the development of methodologies and common approaches, the involvement of experts designated by EU candidate countries and stakeholders interested in water related topics.

As an integral part of the common application strategy various working groups were established and joint activities were promoted with the aim of developping and testing non-legally binding guidelines.

The WATECO Working Group has been set up as a technical committee in order to specifically address economic components of the issue. The most important short-term goal of this committee known as WATECO (WATer and ECOnomics) consisted in the development of practical and legally non-binding guidelines to support the application of the economic components of the Directive.

ECONOMIC ANALYSES OF WATER USE ON A REGIONAL LEVEL ACCORDING TO THE GUIDELINES OF WATECO WORKING GROUP

Objectives of the WATECO economic analyses

The following analysis is paramount when carrying out an economic investigation of water use:

- current water use and its economic relevance
- differences in price-per-use of water resources and current levels of cost recovery for water services.

The WFD identifies different interest areas for economic analysis to be performed which pertain particularly to the economic analysis of water use, with the aim of determining which subjects use water and what value it has for them.

In order to find out whether there are any critical issues connected with the use of water the first step envisages a stakeholder mapping, with the aim of determining who assigns a value to a certain environmental function and for what reasons. In other words, the different scenarios of water use have to be re-enacted:

- areas that involve water withdrawal (irrigation, industry, public services, etc.);
- areas that require a certain in situ availability of water (e.g. navigation, recreational activities);
- areas that have an impact on water bodies as a consequence of certain activities (e.g. animal husbandry, domestic and industrial discharges);
- areas that are however susceptible to economic improvement (e.g. environmental benefits connected with river landscapes or the protection of ecosystems).

The second step consists in the comparison of these demands with the availability, that is the capacity of the water system to provide water when and where it is needed. To evaluate the availability different dimensions have to be analyzed:

- the hydrological aspect stemming from the knowledge about the functioning of natural water cycles, about geographical and temporal profiles that provide natural availability, about components of variability and uncertainty that characterize them, etc.;
- the infrastructural aspect stemming from the knowledge about different collective and individual water-supply systems, sewage collection and disposal, wastewater treatment etc; differences in financing and management;

The third step consists in the selection of critical issues: these are connected with the inability – according to the current state-of-the-art – to meet the demand, especially some components that have been identified as priorities. Or it can be defined as the inability to contain forces or trends which could undermine current balances in the future.

Examples for critical issues could be:

- the ability of the water-supply system to cope with the deterioration of the resources (e.g. groundwater) and implementing suitable solutions;
- the compatibility between the pollution load generated by productive activities (net amount after their utmost pollution load removal) and quality goal achievements for surface and ground-water bodies;

Finally, the fourth step consists in evaluating the costs and the price of water in different areas of use as well as the trade-off that exists between various water demands.

To carry out the economic evaluation regarding importance and water use the following steps were undertaken:

- identification of anthropogenic pressures on water bodies and localization of water use;
- identification of water uses and water services with regard to the socio-economic sector (agriculture, industry, domestic and recreation areas);

- evaluation of the relative socio-economic importance of water use.

The following quantities can be used as importance indicators: revenues and the volume of water demand. The economic importance indicators of principal water use can be obtained through turnover, destination, income, number of beneficiaries.

The economic analysis of water use is carried out to assess the importance of water for the economy and the socio-economic development, and to set up a general economic profile of principal water use as well as for the most significant pressures related to the economic characterization of water use. For this purpose, for example information on significant water use according to gross income, turnover, number of beneficiaries, area of agricultural and industrial destination, and other relevant data are retrieved. At the same time, the economic analysis of water use must prepare the ground for the assessment of relevant water use as well as for conflicts arising between socio-economic development, environment and water protection. The latter need to be included in the public information and participation process dealing with the development of management plans for the catchment areas.

The analysis should mainly focus on conflicts and problems related to water management relying on relevant information about principal water use.

The assessment of current levels of cost recovery for water services is the basis for the application of art. 9 of the WFD and guarantees transparency of costs, tariffs, subsidies, cross subsidies, etc. This analysis is not directly linked with the identification of measures and the development of integrated plans.

Key elements to be analyzed include:

- status of the most important water services (number of persons related to services and/or that use the services);
- costs of water services (financial, environmental and resources costs);
- institutional context for cost recovery (prices and tariff structure, subsidies, etc.);
- incidence of principal water use on costs for water services (to be considered also in relation to pollution and water use information retrieved through pressure and impact analysis).

Table 1. Stakeholder mapping

Analysis level	Data	Information inferred
QUANTITATIVE MONITORING AND IDENTIFICATION OF PRESSURES		
1. Water captation	➢ Type of use. ➢ Number of concessions. ➢ Authorized discharge (l/s).	Knowledge about (determinant) human activities that could have negative outcomes (pressures) on water resources.
2. Estimated withdrawals based on discharge concessions	The data of the diversion census	• rational management of water resources; • reporting on the hydrologic balance of the basin; • determining the pressures on water bodies for qualitative and quantitative evaluations; • distribution of the withdrawals according to the specific use.
3. Pressures and quantitative impacts	Type of concession and withdrawal quantity.	Negative anthropogenic impact.

Table 2. Availability

Analysis level	Data	Information inferred
QUANTITATIVE MONITORING AND IDENTIFICATION OF PRESSURES		
1.Catchment areas	Most important catchment areas of the Friuli Venezia Giulia region.	Area, minimum stream flow, average river flow rate.
2. Territorial information system for hydraulics	• Water network; • catchment areas; • lakes and impoundments; • quantitative monitoring network (weather stations, hydrometric stations, groundwater and flow gauging stations); • weirs.	Actual situation of surface and ground-water exploitation. This tool allows us to analyze water resources in their entireness, be it from a geological viewpoint (determining and characterizing aquifers and aquitards/aquicludes) or according to hydrogeology/hydraulics (discharge of watercourses, recharge, outflows, location of intake points, consumption). For every registered aquifer system the main hydrogeological properties were identified and the quantity of water reserves contained in every system was estimated.
3. Mean water resource availability and intakes	Hydrogeological balance.	• sustainability of water intakes for different uses and with regard to water availability; • global amount of intakes.

Table 3. Selection of critical issues

Analysis level	Data	Information inferred
1. Possible rationalization measures for the distribution and use of water.	Hydrologic balance drawn up for macro-areas of the region.	Estimate the sustainability of water use we have to consider the congruity between recharge and actual intakes.
1.1 Measures to increase recharge capacity.		
1.2 Measures to reduce water consumption.	Prevailing uses in artesian aquifer systems.	Actions aiming at the rationalization of water use and resource "savings".
1.3 Measures to safeguard water quality.		
2. CURRENT CRITICAL ISSUES AND FUTURE SCENARIOS		
2.1 Analyzing the availability of water resources and the intake	*Demands* that have been requested - *availability*	Identify current critical issues.
2.2 Evaluation of priority problems in water management.		

Table 4. Evaluating the costs and the price of water in different areas of use

Status of the most important water services	**DOMESTIC WATER**	Consumption
		Providers
		Tariffs
	IRRIGATION WATER USE	Consortia
		Irrigation methods
		Tariffs

DOMESTIC WATER: TARIFFS AND CONSUMPTION

The main tariff regulations include the provisions CIP 45/1974, CIP 46/1974, CIP 26/1975, CIPE from 1995 to 2002 for the Waterworks Service *(Servizio acquedotto)*, Law 319/1976 (DLgs 152/99, D.Lgs 152/2006), D.P.R. 24/5/1977, regional regulations and CIPE provisions from 1995 to 2002 for the Sewage and Depuration Service *(Servizio fognatura e depurazione)* and the Decree D.M. 1/8/1996, implementing Law 36/94 ("Normalized Method") for the Integrated Water Service *(Servizio idrico integrato)*.

For domestic use these regulations foresee the following application scheme.

Tariffs for domestic use are based on consumption and are applied as follows:

- **reduced tariff** (basic domestic use-CDE): it is applied on the amount of water consumed in the first consumption category;

- **regular tariff** (from CDE to minimum level or 1,5 * reduced tariff): it is applied on water consumption exceeding the first category;
- **excess tariff**: from 1 to 3 levels. Important for compensating the minor income of the reduced tariff. It is applied on water consumption exceeding the second category.

Normalized Method (Decree, 1 August 1996)

The *normalized method* was introduced by Ministerial Decree on 1 August 1996 and envisages a temporal tariff adjustment mechanism based on a *price-cap method* implying a correct assessment of actually incurred costs and serving as stimulus to improve technical efficiency.

Furthermore the tariff increase must comply with the forecasted inflation rate and parameter K (related to the year of application and the level of TMP (weighted average tariff) or TRM (real average tariff))

The tariff is composed as follows:

- operational costs:
  - generated by the management model of the cost plan and compared to the operational costs of an econometric model that has been specified in the Method;
  - reduced by mandatory efficiency ("X");
- return on capital:
  - tangible and intangible fixed assets;
  - fixed rate of 7% (pre-referendum 2011, Italy);
- amortization:
  - assets transferred to the provider;
  - assets made by the provider;
- supplied volume:
  - estimate of future resource demand.

$T_n = (C + A + R)_{n-1} * (1 + \Pi + K)$

Tn is the current year's tariff
C is the operational cost component
A is the amortization cost component
R is the component for return on invested capital
Π is the forecasted inflation rate of the current year
K is the price limit

The tariff increase must be contained within the range of the forecasted inflation rates (Π) and parameter K. To respect the limit of the tariff increase the Territorial Water Authorities (Italian acronym: ATO) must correctly distribute their planned measures over time.

The TMP (weighted average tariff) is calculated on previous management results and is defined as total revenue coming from services for waterworks, sewage and depuration, in relation to the water volume that has been charged. The following entries are to be considered:

- total revenue of waterworks service;

- revenue of sewage service;
- estimated revenue of maximum fees (sewage service);
- revenue of depuration service;
- estimated revenue of maximum fees (depuration service);
- fees for public water use;
- cost of water purchased from third-parties;
- concession fee for integrated water service;
- charges for safeguard areas;
- charges for existing loans.

Total (from 1 to 10)/Charged volume = weighted average tariff €/m^3

The operational costs that have been considered are modelled costs, obtained by applying standard formulas (COAP, COFO and COTR), actual project costs, balance costs (profit & loss statement) and operational costs applied to the tariff (after comparison and including the efficiency rate).

Tariffs for integrated water service (S.I.I.)

To show the current pricing levels, we chose the basic tariffs paid by a single household as an example. It is the equivalent to the S.I.I. The tariff is established in relation to water quality and the service that is provided. The tariff must contain the overall service costs including interventions and planned investments.

Since 2009 ATO Centrale Friuli has rationalized the tariff system introducing a tariff calculated according to the principles and criteria contained in the Ministerial Decree for public works No. 01/08/1996.

For each year the REAL AVERAGE TARIFF (TRM) is calculated:

FORMULA $TRM_n = [(C+A+R)_{n-1} \times (1+ \pi + K)_n] / V_n$

TRM_n = real average tariff for year n (m^3);

V_n = forecasted supply of water volume for year n (m^3);

C = operational costs of the provider (personnel costs, supplies, services etc.; financial management is not included): the provider must guarantee a continuous improvement in efficiency, thus constantly reducing the operational costs over time.

A = amortization costs of fixed assets;

R = return on invested capital (it should cover also financial costs of the provider);

π = forecasted inflation rate for the current year (percentage);

K = price limit (maximum increase of the tariff in percent, e.g. for major investments);

n = related annuity;

n - 1 = previous annuity

The tariff system must on the one hand guarantee the financial balance of the S.I.I. management *("Servizio Idrico Integrato")*, but on the other hand it has to be sustainable for the whole population.

Total annual revenues will therefore depend on revenues originated by domestic use and revenues from non-domestic use.

Annual revenues referring to domestic use are obtained by adding single entries and performing calculations as indicated in the table below:

$TRM_n \times V_n$	**$(C+A+R)_{n-1}$**	multiplied by	**$(1+\pi+K)_n$**
REVENUES DOMESTIC USE	volumes reduced category		reduced tariff
	volumes regular category		regular tariff
	volumes excess category		excess tariff
	fixed amount		
	volumes		tariff sewage and depuration

Similarly for non-domestic use

$TRM_n \times V_n$	**$(C+A+R)_{n-1}$**	multiplied by	**$(1+\pi+K)_n$**
REVENUES DOMESTIC USE	volumes regular category		regular tariff
	volumes excess category		excess tariff
	fixed amount		
	volumes		tariff sewage and depuration

The TARIFF applied to customers consists in a FIXED AMOUNT and a VARIABLE AMOUNT, the latter being proportional to consumption.

The tariff is applied according to the following scheme:

- service used: waterworks, sewage, depuration;
- type of use: domestic (normal or subsidized), agriculture, animal husbandry, big users and other uses (commercial, industrial, artisanal);
- consumption level: (different tariff levels based on increasing consumption ranges).

BINOMIAL TARIFF

The regulatory framework

As main objectives for public water management the EU Water Framework Directive (WFD 2000/60/EC) indicates the protection of environmental quality and the **efficient use of water resources** providing indications for **water tariffs and a billing system, which should be directly connected to the water volume that has been used by the consumer.** These payment criteria would stimulate an efficient use of water resources.

With regard to the price level that should be paid by the consumers the WFD refers to **full cost recovery**. In the calculation of the full cost the Directive also calls for the inclusion of resource costs and several other external

costs like social and environmental costs on top of overall costs for water distribution, water management and fixed costs.

Water pricing policies should:

- stimulate the water resource user to implement water savings and water reuse measures, thus contributing to the achievement of environmental objectives;
- adapt the cost recovery of water services to different categories of water users, divided at least into the following groups: industry, private households and agriculture. The polluter pays principle is to be enacted (art. 9).

The main reports on guidelines regarding economic aspects in the implementation of the WFD have been published by the WATECO group (WATer and ECOnomics), a technical committee that analyzes economic parameters introduced by the WFD and develops practical guidelines for their application.

Costs for the supply of irrigation water

The water price must cover all costs associated to its use. Every user has to pay the amount corresponding to the quantity he actually uses; accessory costs for water services have been classified as follows:

Table 5. Structure of accessory costs for water services.

FULL COST • full supply cost • opportunity cost • externality	**ENVIRONMENT**	Direct environmental costs
		Indirect environmental costs
	RESOURCE **(full economic cost)**	
	SUPPLY **(full supply cost)** Accessory costs for water supply	Direct costs
		Administrative costs
		Costs for existing infrastructures
		Operating and maintenance costs

The *cost* of water differs notably from the *price* of water (though for farmers costs are equivalent to price) and it must refer to the amount directly spent for providing water service like: operating and maintenance costs, capital depreciation and replacement as well as opportunity costs and environmental costs. We identified three cost categories: full supply cost, full economic cost and full cost.

In the European Union the wording **"full cost recovery"** includes values like water shortage and external environment factors, whereas "cost recovery" refers only to the full supply cost (which can easily be defined). The term "efficient resource allocation" when applied to a national context or catchment area refers to opportunity cost and externalities. The definition and estimate of the opportunity cost are important in planning the allocation of the resources among the categories, but, on a practical level, they rarely play a role in defining price and "tariff" structure for a user group. The reason being that it is extremely difficult to actually assign a monetary value to different consumption values.

Also externalities have to be considered; they can be defined as "indirect consequences or collateral effects of water supply for a specific group and are not directly included in costs pertaining to the billing system".

The total cost of water supply consists in variable costs (VC) and fixed costs (FC).

Variable costs include those costs that are directly linked to the water supply like pumping stations, channelization, temporary work and other components of operating and maintenance costs.

Fixed costs are the actual costs – regardless of water supply – including capital depreciation, interest payment for infrastructures, permanent work, wages for administrative workers and other cost items.

The WFD suggests to carry out cost recovery with tariffs that are explicitly linked to the type of service rendered. In agriculture the tariff calculation should take into account how much water is actually consumed, so that a more efficient use of water resources is stimulated.

Calculation scheme for surface water supply.

The contribution for surface water used for irrigational purposes can be calculated with the help of the incurred costs. These operating costs are recorded as follows:

NAME	TYPE OF COST	UNITS OF MEASUREMENT
fixed costs	Depreciation charge for hydraulic works and irrigation canals as well as maintenance costs for the infrastructures.	
	Costs that are not related to the water volume actually used.	
	In the case of a public investment these costs are recorded as a water “concession fee”.	
variable costs	They include: costs for personnel and workforce (administration, surveillance and maintenance), energy costs (electrical power, fuel and lubricants) for water pumping and general expenditures (e.g. remote control or emergency management).	COST PER UNIT (m^3)

Depreciation charges are calculated with a financial depreciation formula; technical depreciation and interest rates are included and the recovery value equals zero.

Maintenance costs are generally calculated as a percentage of the installations' value. Among the variable costs the expenditures for electrical power are usually the highest, because they are linked to energy prices.

Binomial tariff

Envisaging the need to contain operating costs in the consortia's installations, but also to save water resources especially for installations equipped with pumps and having thus remarkable energy costs and to introduce a fair charging system for the amount of water actually used we suggest to link the charge to the actual needs of the customers. This entails a two-part or binomial tariff which consists in a fixed fee that does not depend on the water quantity being used and a variable fee, which is linked to the amount of water being used or needed.

A binomial tariff is made up of two components: a fixed fee and a fee that is proportional to actual water intake. The latter can be quantified only if pumping stations are installed, because these determine fluctuations of the total operating costs of each district as they are linked to operating times and rising energy costs. In the case of surface irrigation we do not have proportional costs as operating costs are not linked to the actual water volume that is withdrawn by the customers.

In the Consortia's installations for the distribution of pressurized water the volume of water that each district customer withdraws can be easily measured with volume meters that are installed on the delivery hydrant.

These water measurements allow for a "binomial tariff" to be put in place, as the tariff is based on a contribution that is linked to the extent of the irrigation area and the actually needed water volume. The contribution for the irrigation service contains a fixed fee to cover maintenance costs for the water conveying network and a variable fee for pertaining expenditures (mainly electrical power) that has been calculated with regard to metered water consumption. For the fixed fee all the hectares that can be irrigated with pressure installations are considered, whereas the variable fee is proportional to the amount of water that has been withdrawn.

Table 6. Fixed fee calculation criteria for the binomial tariff

FEE	COSTS COVERED	ASSIGNMENT CRITERIA
Fee for **fixed costs**	maintenance of water conveying network	applied to all the hectares that can be irrigated with the pressure system
Fee based on pertaining **variable costs**	electrical power costs calculated for metered water consumption	proportional to withdrawn water volume

Example for a REAL BINOMIAL TARIFF

Fixed fee

The fixed fee covers fixed irrigation costs, planned maintenance, ordinary personnel costs, investment costs, research studies, assistance and energy costs. The fixed fee quantifies direct benefits; it is linked to the cadastral area.

Variable fee

The variable fee is linked to actual water consumption (and hence indirectly to a distribution system) underpinning the importance of discouraging water consumption that exceeds the optimum amount allocated. The fee also stimulates the adherence to a rational irrigation program based on water balance and the evaluation of effectiveness, penalizing water use that is not compliant with rational irrigation criteria. This fee covers variable irrigation costs (energy costs corresponding to the amount of water actually distributed, personnel costs for overtime pay due to the distribution of irrigation water).

Fixed costs and variable costs are used for the calculation of the contribution charged to each customer:

Ci = contribution charged to each *i-th* customer = (Sf * B*i* / ΣB*i*) + (Sv * V*i*/ΣV*i*)	
Sf = total amount of fixed costs pertaining to the cost center	
Sv = total amount of variable costs pertaining to the cost center	
B*i* = irrigation benefit for the *i-th* customer	B*i* =*Endowment index* x *Limited use index* * *Delivery index* * Cadastral area of this specific *i-th* customer
V*i* = irrigation volume supplied to customer "*i*"	Calculation for V*i* (irrigation volume supplied to customer "*i*") is generally performed on the basis of direct measurements of the conveyed water (starting from the Consortium's canal) and the supply time. These parameters are recorded by the Consortium staff.

According to the **indexes (with the function as Q factor)** we proceed with the cost distribution on the basis of actual benefits for the land due to following criteria:

- Endowment with efficient irrigation equipment; this determines the *specific endowment index*.
- Water availability based on existing infrastructures and canal systems; this determines the *supply indexes*.
- Soil attitude (agropedological characteristics) to increase productivity with the supply of water; this determines the *limited use index*.

The specific fixed cost is calculated by applying different Q factors to the amount of the fixed cost that is linked to the cadastral area:

SPECIFIC FIXED COST =
FIXED COST * *specific endowment index * delivery index * limited use index* * **cadastral area**

Table of technical indexes with regard to irrigation benefits

ENDOWMENT INDEX		
code	type	index
1	Land with full endowment, rota delivery less than 10 days	1,00
2	Land with full endowment, rota delivery between 10-15 days	0,95
3	Land with limited endowment, rota delivery between 15-20 days	0,90
4	Land with insufficient endowment for crops, rota delivery over 20 days	0,80
5	Land with efficient devices and equipped with own water reservoir or a reservoir shared with other farms	0,80
6	Land with limited endowment because of missing infrastructures	0,70
7	Land that uses only water from the river	0,55
8	Land that uses only groundwater distributed by the consortium's canal systems	0,50
9	Land with no water supply	0,00

Endowment indexes indicate the level of water availability with regard to existing waterworks and canal systems.

The consortium area is thus divided into districts according to the level of limited use which is particular important in case of areas with high soil colloids.

LIMITED USE INDEX		
code	type	index
1	Suitable for different crops	1,00
2	Suitable for different crops but with limitations for some tree species	0,95
3	Suitable for herbaceous species but with permeability limitations	0,90

DELIVERY INDEX		
code	type	index
1	Land that can be irrigated directly with the consortium's canals or that is located less than 250 m from these.	1,00
2	Land that can be irrigated with private canals or shared ditches. This is land located further than 250 m away from the consortium's canals.	0,90
3	Land that can be irrigated only with drainage water from private canals.	0,80
4	Land that uses only groundwater distributed by the consortium's canal systems	0,30

CONCLUSIONS

An accurate analysis that is to be used for tariff setting of irrigation water should examine production costs for irrigation services very attentively and indicate the benefits of such a service. The reforms in water management have brought the issue to the fore and the EU Water Framework Directive has given considerable stimulus to the proceedings. Today we must re-evaluate our tariff schemes for irrigation water in order to improve cost recovery in this field and at the same time provide a stimulus for farmers so that they are willing to optimize the use of infrastructure-based resources as well as natural water resources. In-depth knowledge of net benefits associated to the introduction of a new tariff system is crucial before taking any steps in this direction. An appropriate tariff system should analyze beforehand the benefits in terms of demand and supply, water delivery and irrigation services.

There is still a great need for calibrating the management of water resources used for irrigation; economical and political objectives need to be achieved in order to reduce water wasting and efficiently allocate the resources. The management of water resources will definitely play a key role in the future, notably due to recent findings and observations on global climate change which predict scenarios where increasing water shortage is accompanied by modifications in weather variability – the latter being the basis for water availability.