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POLICY REPORT

ECONOMIC INSTRUMENTS FOR WATER MANAGEMENT IN GEORGIA

Authors:
Mariam Chachava
Maka Chitanava
Levan Pavlenishvili
Norberto Pignatti
Mariam Tsulukidze
Mariam Lobjanidze
Selam Petersson

Support staff:
Guranda Darchidze

Print design:
Ilia Zatuashvili

ACRONYMS

AA	Association Agreement
AGI	Adjusted Gross Income
AMA	Agricultural Management Assistance
BMP	Best Management Practices
BOD	Biological Oxygen Demand
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSP	Conservation Stewardship Program
DEP	Department of Environment Protection
ELV	Emission Limit Value
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
EU	European Union
FAO	Food and Agriculture Organization
FGBPN	Foundation Group Boticario of Natural Protection
FSA	Farm Service Agency
FWP	Farmable Wetlands Program
GA	Georgian Amelioration
GNERC	Georgian National Energy and Water Supply Regulatory Commission
GoG	Government of Georgia
GWP	Georgian Water and Power
HPP	Hydropower Plant
IFAD	International Fund for Agricultural Development
IHS	Integrated Household Survey
MAC	Maximum Allowed Concentration
MDB	Murray-Darling Basin
MEPA	Ministry of Environmental Protection and Agriculture of Georgia
MoESD	Ministry of Economy and Sustainable Development
NAM	National Agency of Mines
NCDC	National Center for Disease Control and Public Health
NEA	National Environmental Agency

NGO	Non-Governmental Organization
NRCS	Natural Resources Conservation Service
OECD	Organization for Economic Co-operation and Development
OFA	Organic Farming Associations
PES	Payments for Environmental Services
PSWA	Pollution of Surface Waters Act
PWES	Payment for Watershed Ecosystem Services
RBA	River Basin Authorities
RBMC	River Basin Management Committee
SANEPAR	Water Supply and Sanitation Company of the State of Parana
TMDL	Total Maximum Daily Load
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
US	The United States
USAID	United States Agency for International Cooperation
USDA	Unites States Department of Agriculture
UWSCG	United Water Supply Company of Georgia
VAT	Value Added Tax
WAC	Water Abstraction Charges
WAP	Water Abstraction Policy
WEC	Water Exchange Centre
WFD	Water Framework Directive
WIP	Watershed Implementation Plans
WRB	Water Resource Bureaus
WWTP	Wastewater Treatment Plants

VOCABULARY

- **Abstraction Charges** – a charge set on the abstraction of water from bodies of surface or ground water.
- **Beneficiary Pays Principle** – this principle supports transfers between the beneficiaries and agents responsible for the generation of positive externalities and/or the creation of public goods, to compensate them for the benefits they accrue for society.
- **Biological Oxygen Demand** – measures the amount of the dissolved oxygen required for aerobic microorganisms in order to decompose organic matter in water.
- **Cubic Hectometer** – a measurement of the unit of volume, one cubic hectometer equals one million cubic meters.
- **Charge** – a price required for goods or services.
- **Fee** – the amount of money charged for a service or for the use of something.
- **Full Cost Pricing** – the price includes all costs related to the consumption/production of a commodity, including those costs that can be imposed on society by the user.
- **Groundwater** – the water found underground in cracks and spaces between soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers. The EU WFD, Article 2 (1), defines groundwater, as: “all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.”
- **Payments for Environmental Services** – typically given to farmers and/or land users for using environmentally friendly practices that positively influence bodies of water.
- **Polluter Pays Principle** – pollution control costs allocated among polluters according to the amount of damage they cause.
- **Pollution Charges** – a charge set on the releases of effluents into bodies of water.
- **Positive Water Balance** – when water abstraction from a source is smaller than its sustainable level.
- **Socially Optimal Output** – when marginal benefits from the use of a resource equal marginal social costs.
- **Subsidies** – typically provided to encourage more efficient use of water resources and/or less effluent discharges.
- **Surface Water** – the water found on the Earth’s surface (not underground or in the atmosphere), for example in rivers, seas, lakes, reservoirs, etc. The EU WFD, Article 2 (1), defines surface water, as: “inland waters, except groundwater; transitional waters and coastal waters, except in respect of chemical status for which it shall also include territorial waters”.

- **Tax** – the obligatory extraction of money by a government for public welfare.

- **Total Maximum Daily Load** – is a regulatory term in the US Clean Water Act, describing a plan for restoring impaired waters, which identifies the maximum amount of a pollutant that a body of water can sustain while still meeting water quality standards.

- **Tradable Pollution Permits** – the pollution rights exchanged in a market in which potential polluters compete to buy the right to discharge effluents from a body of water.

- **Tradeable Water Rights** – the abstraction rights exchanged in a market where various abstractors compete for the ability to abstract water.

- **User Pays Principle** – a variation of the polluter pays principle that calls upon the user of a natural resource to bear the cost of reducing the natural capital.

- **Water Body** – a body of water forming a physiographical feature, for example, rivers, underground water aquifers, and the sea.

- **Water User** – a water abstractor or effluent discharger into bodies of water.

- **Water Scarcity** – the abstraction of water that can negatively influence the ecological status of a body of water.

EXECUTIVE SUMMARY[1]

Georgia has a number of laws and regulations governing water resources, dating back to the late nineties and partially amended after 2003. These changes, however, have not always followed a clear and coherent strategy. Consequently, in the words of the United Nations Economic Commission for Europe (UNECE), the current legislation is an "unworkable and fragmented system".The Government of Georgia (GoG) has instigated changes to the Georgian water management legislation to meet the obligations derived from the Association Agreement (AA) signed with the European Union (EU) in June, 2014. The implementation of the principles of the EU Water Framework Directive (EU WFD), are seen as a possible solution for the pressing challenges characterized by Georgia's water management sector, the main issues of which being water pollution and the inefficient use of water resources. Under the provisions of the EU-Georgia AA, Georgia must adopt national legislation in compliance with the EU WFD by the end of 2018. Under the AA, Georgia has nine years to implement the principles of the EU WFD.

Economic instruments have the potential to facilitate the achievement of optimal water resource management by providing proper incentives to water users[2], by ensuring that water users internalize all costs and benefits associated with their abstraction and/or effluent discharge. There are several principles which, according to economic literture, may help orient environmental policies and the implementation of economic instruments. In our work, we will focus on three main, complementary principles. The first principle is the "**polluter pays principle**". This notion suggests that pollution control expenses should be allocated among polluters, according to the amount of damage they cause. In such cases, the polluter would "internalize" the costs imposed on society and modify its behavior in line with the interest of society. A similar rationale is behind the second principle, the "**user pays principle**". The OECD defines the user pays principle as "a variation of the polluter-pays principle that calls upon the user of a natural resource to bear the cost of running down natural capital"[3]. The key component behind this principle is that users of a (scarce) resource should fully pay the related opportunity costs. The third principle is the "**beneficiary pays principle**". This concept, in general, supports transfers between the beneficiaries and agents responsible for the generation of positive externalities and/or the creation of public goods, to compensate them (and, therefore, help them "internalize") for the social benefits they accrue.

The economic instruments we have considered in this work can be grouped into three categories:

1. **Water Allocation Management** – these are instruments incentivizing the sustainable use of water, from both bodies of surface water and groundwater, by setting an appropriate price for the use of the resource and, thereby, affecting its demand. Typically, instruments used for abstraction management comply with the user pays principle. Such instruments are: Abstraction Charges and Tradeable Water Rights

2. **Water Quality Management** – these are instruments aiming to prevent the deterioration of water quality by setting an increasing cost of effluent discharge. Typically, the instruments used for the management of water quality comply with the polluter pays principle. Such instruments are: Pollution Charges and Tradable Pollution Permits

3. **Subsidies and Payments** – these instruments are normally monetary transfers to the water users. Subsidies are typically provided to users to induce a behavior that will ensure a more efficient use of water resources and/or less effluent discharge. Payments for Environmental Services (PES) are normally given to farmers and/or land users for utilizing environmentally friendly practices that positively influence bodies of water. Because subsidies and PES rewards generate positive externalities, or provide public goods and are paid by (or on behalf of) the beneficiaries, they comply with the beneficiary pays principle

Water abstraction charges (WAC) is the amount of money levied for the direct abstraction of ground or surface water (Roth, 2001). In practice, the purpose of WAC can vary across countries. Routinely, two of its main purposes are **environmental and financial.** When the environmental functions of WAC are of crucial importance, the rate must be determined to reflect the social costs of the negative externalities associated with water abstraction, including ecological, scarcity and opportunity costs. In contrast, when it is vital to raise revenues to cover the costs of water management (such as monitoring, planning, enforcement of environmental regulation, etc.) the main purpose of water charges are financial.

In most countries, water abstraction charges are calculated on a volumetric basis and consumers pay a unitary rate per

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2 For the purposes of this paper "water users" are regarded as both abstractors and effluent dischargers.

3 https://stats.oecd.org/glossary/detail.asp?ID=2827

cubic meter abstracted. The metering system incentivizes efficiency in water usage, as users pay for their exact water use. An alternative to volumetric WAC is to connect fees to abstraction permits. In such cases, water users pay for a permit specifying the maximum volume of water that can be abstracted at each point in time and it does not incentivize efficient consumption of water.

The overall aim of WAC is to represent the true value (opportunity cost) of water. For a proper valuation, several elements are required:

- Hydrological analysis of a body of water to identify a sustainable water supply
- Analysis of water users (types of industries and their potential demand)
- Identification of water demand
- Analysis of price and income elasticities of demand
- Identification of value of water that ensures sustainable water abstraction

An alternative manner of allocating resources among water users is the creation of water markets. Water markets produce incentives for users' efficient consumption of scarce water resources, and help reduce the risks in agricultural production decisions and minimize disruptions during periods of drought. A well-functioning market for water ensures the value of the resource is determined, while considering significant information, such as: quantity, quality, location, timing, consumption patterns, etc.

The creation of a water market requires the definition and attribution of property rights for bodies of water. There are number of mechanisms to create and transfer property rights for water, such as: (i) water banks, (ii) bulletin boards, (iii) double auction markets, (iv) options and forward contracts, and (v) environmental leasing and purchase programs.

There are three main steps essential for designing water markets:

1. **Background context** – which includes evaluating the original framework, including assessment of hydrological factors and system types

2. **Market evaluation, development and implementation** – which mainly focuses on the potential benefits of trade

3. **Monitoring and continuous assessment** – which highlights the role of monitoring and continuous assessment

Pollution charges (referred to in most European countries as Water Effluent Charges) are vital for achieving a good qualitative status for bodies of water. The notion is to ensure environmental costs are no longer paid for by society but are allocated to (and subsequently internalized by) the water polluters. In countries where water pollution charges apply, they are usually accompanied by a pollution permit. Any discharge into bodies of water require such a special permit from the relevant governing institutions.

In most EU Member States, the pollution charge rate is determined based on the characteristics of the effluent. Some countries (for example, Germany) allow tax deductions if the actual discharge is less than the amount officially permitted. In other countries, the charge is calculated based on a definitive measurement, which is determined by self or compliance monitoring systems. In contrast however, Belgium and Denmark have fixed rates for small discharges, while for larger discharges the rate increases,depending on the type of effluent.

Another method to control pollution in bodies of water is to create a **market for pollution permits.** Tradable pollution permits may be regarded as the transferable right to create pollution within a common resource, like water. The aim of a regulator is to determine the maximum level of allowable pollution in the watershed. Thereafter, permits may be allocated, and traded, among polluters.

Within such markets, polluters that do not dispose of sufficient permits and thus face huge pollution reduction costs, can choose to purchase additional permits from other polluters, rather than to reduce activities that cause pollution. While, polluters who have supplementary permits and/or a lower cost of reduction might profit from the sale of their permits.

Given the importance of local conditions, each country should develop its pollution permits trading system based on their desired environmental goals and on the specific characteristics of their river basins. It is possible, however to highlight some general requirements that are essential for the success of such systems:

- The regulator should have access to accurate data on emissions and pollution levels or abstraction and water usage, in order to discern the most relevant policy instruments
- Water rights assigning the water abstraction and discharge rights to stakeholders should be clearly defined. In addition, water rights should be enforceable and be secure for the benefit for the owner

- Water basins must be clearly identifiable
- All stakeholders (consumers, polluters, or the general public), must be identified in order to include them in the regulatory process
- The regulator should increase market competition and reduce entry barriers in order to ensure a significant number of participants, which would help prevent market power and support a more efficient allocation of pollution rights
- The differences in abatement costs can support the efficient allocation of tradable pollution permits
- Monitoring and enforcement mechanisms should be properly developed
- The allocation of permits through an auction system

Subsidies are instruments that can be used to internalize external benefits, just as environmental charges help internalize external costs. Subsidies, in this instance, can therefore be regarded as a reward to households, farmers, or to other stakeholders, for environmentally beneficial actions, which generate positive environmental externalities. Subsidies can also be given for different purposes. For example, **subsidies for water conservation** are aimed at encouraging practices that lead to water conservation, and **subsidies for the reduction of water pollution** reward a polluter for reducing emissions.

Payments for Environmental Services (PES) is an instrument in which beneficiaries of environmental services reward their providers through voluntary transactions. The main goal of this instrument is to make conservation of environmental services attractive for service providers, and private or communal landholders, by helping them internalize the positive externalities they generate.

In order to guarantee the effectiveness of PES, several issues should be considered (OECD, Paying for Biodiversity: Enhancing the Cost-Effectiveness of Payments for Ecosystem Services, 2010):

- PES should be incentive based
- Property rights over land should be clearly defined to identify those actors who affect the supply of environmental services
- PES goals and objectives should be clearly defined in order to design an appropriate program and enhance transparency
- Monitoring and reporting systems should be created and developed
- Buyers should be identified, and sufficient and long-term sources of finance should be ensured
- Payments should be based on performance and recognized according to the opportunity cost of the environmental service provision
- The joint provision of multiple services should be considered, since it might increase the benefits and transaction cost of a program
- The presence of leakages should be taken into account

The Current Situation in Georgia

Economic instruments for water resource management are not widely used in Georgia. Currently, Georgia applies only abstraction charges on a limited number of activities, connected with groundwater abstraction. While charges for surface water abstraction and discharge are not yet applied. According to the Law on Fees for the Use of Natural Resources, there are already provisions about surface water abstraction charges. However, these charges are not presently active due to a legal conflict within the legislation: the Law on Fees for the Use of Natural Resources surface water use requires licencing, although The Law on Licenses and Permits states that there is no need for licenses to use bodies of surface water. The introduction of the permit system for surface water abstraction would remove the existing conflict and surface water abstraction charges would, therefore, again be implemented. Currently, surface abstraction charges are specified, with differing fees, for two macro-basins, i.e. the Caspian Sea Basin, the Black Sea Basin and Black Sea water. After the reform, the country's water sources will be split among six river basins.

Unlike surface water abstraction charges, groundwater abstraction charges have always been in effect in Georgia, and as such activity requires licensing thus no conflict arose within the legislation. Moreover, permits for groundwater abstraction can be issued for a maximum 25 years. A license is not required only if the groundwater is located on private land and is used solely for a household's own purposes. Charges for groundwater abstraction are also set within the law. However, there is no transparent methodology according to which they are calculated, and most of the fees are very low. Table 1 shows the tariffs and charges for groundwater abstraction.

For water quality management, at present, Georgian legislation relies on its command and control policy tools- applied in a very limited manner due to the lack of resourresources for its supervision and oversight - and which do not contain any provisions regarding economic instruments for effluent discharge within bodies of water. Nevertheless, several fines are defined by the Administrative Offence Code of Georgia (Table 2) for effluent discharge in freshwater resources.

Table 1. Charge Rates for Water Use

Bodies of Water and Their Use Categories	Fee Rates (GEL / m^3)
Bodies of Surface Water	
The Caspian Sea Basin rivers, lakes and other reservoirs	0.01
The Black Sea Basin rivers, lakes and other reservoirs	0.005
The Black Sea water	0.003
Use Categories	
Surface water abstraction for municipal and rural water supply	0.01
Water abstraction for thermal power production	1% of the base fee
Water abstraction for hydropower	0.01% of the base fee
Water abstraction for irrigation	1 % of the base fee
Bodies of Groundwater	
Freshwater for bottling	4
Freshwater for other commercial/industrial uses	0.005
Freshwater for municipal and rural drinking water supply	0.01
"Borjomi" Mineral Water Extraction	30
"Nabeglavi" Mineral Water Extraction	18
"Sairme" Mineral Water Extraction	6
"Utsera" Mineral Water for Bottling	4
"Utsera" Mineral Water for Spa use	0.04

Source: The Law on Fees for the Use of Natural Resources (2004)

Table 2. Fines for the Pollution of Bodies of Water

Offence	Rate (GEL)
The dumping of waste into bodies of water	200 - 300
The discharge of industrial and household wastewater and the discharge of drainage water into a drinking water source or a protection zone	400 - 600
The discharge of water pollutants in excess levels, determined by the technical regulations	400 (For households) 1000 (For legal entities)
Freshwater pollution exceeding the levels determined by the technical regulations	500
Pollution of the Black Sea, exceeding the levels determined by the technical regulations	1000

Source: The Administrative Offence Code of Georgia (1984)

Based on the theoretical characteristics of each economic instrument, considering the current situation in Georgia alongside the relevant international experiences (from Belgium, China, Australia, Spain, Germany and the Netherlands), this work has analyzed the feasibility of each instrument in the country (Table 3).

Table 3. Feasible Economic Instruments in the Short, Medium and Long-Term

Type of Instrument	Overall Assessment of the Instrument
Short-Term (1st Planning Period – 6 years)	
Water Abstraction Charges	The most feasible instrument in the short-term to address the "beneficiary pays principle", as earlier provisions are already given, and it is relatively simple to implement.
Water Pollution Charges	The most feasible instrument in the short-term to address the "polluter principle".
Medium-Term (2nd Planning Period – 6 - 12 years)	
Water Abstraction Charges	The most feasible in the medium-term, as further experience will have accumulated in the sector.
Water Markets	A water market can be introduced in the medium-term within different water bodies, conditional on large potential gains from trade.
Water Pollution Charges	The most feasible in the medium-term to incentivize a decrease in water pollution, and because experience will have accumulated after the 1st planning period.
Tradable Pollution Permits	Tradable pollution permits can be introduced in medium-term for different bodies of water, conditional on large potential gains from trade.
Payments for Environmental Services	Introducing such an instrument might be feasible in the medium-term, depending on the existence of a legislative framework enabling private actors to implement PES schemes. The feasibility of a "government-initiated" PES is unlikely, due to its data and funding requirements.
Long-Term (3rd Planning Period – 12+ years)	
Water Abstraction Charges	Always feasible. However, to ensure consistent operations, the instrument has to be refined periodically.
Water Markets	The feasibility of water markets increases in the longer term, as more detailed data and more experience is accumulated in water resource management and the number of potential traders increases.
Water Pollution Charges	In the long-term there is an opportunity to improve administrative and management practices of the instrument, thus refining its performance in decreasing water pollution.
Tradable Pollution Permits	Tradable pollution markets are more readily implementable in the longer term with increased data gathering, monitoring and supervision systems in the water sector and a potentially higher number of traders.
Tradable Pollution Permits	Introducing the instrument is likely to be feasible in the long-term, depending on the existence of a legislative framework enabling private actors to implement PES schemes. The feasibility of a "government-initiated" PES is more challenging, as it requires the availability of additional data and funds to effectively implement the scheme.
Subsidies	Giving subsidies for sustainable water use on a large scale might not be feasible, as potential gains from other instruments, such as water abstraction charges and water pollution charges, might not be sufficient to cover the costs. It is also unlikely that subsidies are desirable from an efficiency point of view, when revenues coming from charges are insufficient to cover the costs. However, if coupled with other instruments to provide additional incentives to adopt better water use practices, their use might be feasible and advisable.

INTRODUCTION

Georgia has several laws and regulations governing water resources dating back to the late nineties. The Water Law of 1997 is the central regulation which currently defines the main objectives and principles of Georgia's water policy, including its protection and rational use, prioritising the supply of drinking water, and the prevention and control of harmful influences. Other related laws specifically regulate groundwater (the 1996 Law on Mineral Resources) and coastal waters (the Marine Code, 1997, and the Law on Marine Space, 1998). Several provisions contained within these laws have been modified since their conception. In particular, several regulatory mechanisms deemed an obstacle to the economic development of the country were modified and/or eliminated after 2003[4]. While these steps enabled the country to address problems of corruption, excessive bureaucracy and other constraints limiting economic development during this transitional period, the gaps left in the legislation are now perceived as increasingly problematic from a long-term sustainable development perspective[5]. The UNECE Environmental Performance Review, 2016, deems the current legislation as an "unworkable and fragmented system, because of [the] questionable legal validity of most of its provisions." The existence of legal gaps between different legislative acts also create ambiguity and inefficiency in the management of many major facets of the water sector, such as surface and underground water use and pollution emissions in bodies of water.

To comply with international agreements, such as the United Nations Sustainable Development Goals (UN SDGs) as well as provisions in the European Union Associate Agreement with Georgia (EU-Georgia AA), the Georgian government has devised an Action Plan with a complementary strategy (from 2018 - 2030) with goals, objectives and actions. They are specially directed towards addressing the relevant activities taken, or planned for, by the Georgian government regarding the implementation of the Water Framework Directive (Directive 2000/60/EC). Table A1 in the Appendix highlights the most relevant initiatives, in connection with the introduction of economic instruments for water management, contained in the Action Plan for law-making in 2018.

Numerous works produced since 2014 have underscored the potential importance of economic instruments for the management of Georgian water resources. Economic instruments for water management are expected to play a crucial role in ensuring the Georgian water management system delivers results fully aligned with the WFD. The purpose of this work is to provide a review of the theoretical literature and of the empirical evidence concerning the application of economic instruments within the context of water management, and to rank the instruments according to their applicability to Georgia in the short, medium and in the long-term.

The preparation of this report has been accompanied by an extensive consultation process. The research team met representatives of government entities, Non-Governmental Organizations (NGOs) and of the business community/private sector. Each group of stakeholders discussed the current state of things and proposed direction for systemic change, which were taken into serious consideration while preparing this report. A summary of the ideas and of the opinions collected during the consultation process is available in Table A2, in the Appendix.

4 For example, charges for environmental pollution, including water pollution charges, together with the licensing system for surface water abstraction and for wastewater discharges were abolished. In addition, the number of activities requiring special environmental permits to be issued by the environmental authorities were reduced.

5 Sustainable development has many dimensions, the most significant being: economic, social and environmental.

ECONOMIC INSTRUMENTS FOR WATER RESOURCE MANAGEMENT

One of the main challenges in water resource management is providing proper incentives to water users[6]. The physical nature of water significantly complicates the process of designing and setting incentives. The value of water per unit of weight at the source tends to be relatively low, while its supply (i.e. storage and transportation) is often costly due to necessary extensive infrastructural investments. In order to support the efficient allocation of water among alternative uses, water prices should reflect these costs, as well as considering the impacts the private use of water has on the quality and availability of water available to the rest of society.

Defining and assigning comprehensive and exclusive property rights would offer a basis for establishing a properly functioning market for the supply, yielding more efficient prices and water usage. However, measurement and valuation of the resource and the very definition of property rights is complicated by its physical nature (flow, evaporation, seeping, etc.). Due to these complications, the prices individuals face often do not correctly represent the social cost of water use. As a result, individuals make incorrect consumption or production decisions. This frequently translates into the imposition of additional (uncompensated) costs on the rest of society, (i.e. the creation of externalities) in the form of pollution and/or the depletion of the resource. Economic instruments can help close the gap between the social and private costs of production or consumption by helping users internalizing the external costs they generate in their decision-making process.

Under full cost pricing[7], the socially optimal output is determined when the marginal benefit from the use of a resource equals the marginal social cost. In the presence of policy and/or market failures, when decision makers impose additional costs on third parties[8], (such costs are overlooked during the decision-making process, as the creators are not affected by them for example, lower quality of water further downstream) the private marginal production/consumption costs are below the marginal social cost. This ultimately leads to an excessive (sub-optimal) deterioration of water quality, and/or to its overconsumption. In these situations, private markets lead to an amount of production/consumption which is higher than the socially optimal level. Thus, water is inefficiently used. Where there is open and unregulated access to water, in which property right are not properly defined, this is likely to happen. In contrast, clearly defined property rights and the use of well-designed economic instruments can reduce the gap between social and private costs and lead to an efficient use of the resource. This can be attained by ensuring private agents face the full cost of their choices, including the costs to the rest of society (full cost pricing). Moreover, as fully defining and assigning property rights to water is an extremely complicated and controversial issue, there is a strong rationale for utilizing economic instruments to establish greater water use efficiency.

There are several principles that, according to the economic literature, should orient environmental policies and the implementation of economic instruments. In this work, we will focus on three main principles, complementary to each other. The first principle is the **"polluter pays principle"**. This principle suggests that pollution control costs should be allocated among polluters, according to the amount of damage they cause (in absolute terms or in excess of an "acceptable level" the standard of pollution)[9]. The polluter would thus "internalize" the costs imposed on the rest of society and modify its behavior in line with the interests of the collectivity. A similar rationale is behind the second concept, the **"user pays principle"**. The Organization for Economic Co-operation and Development (OECD) defines the user pays principle as "a variation of the polluter-pays principle that calls upon the user of a natural resource to bear the cost of running down natural capital"[10]. The consumers and producers are those benefiting from the use of the resource. However, these resources are not "free", even though they are not priced. Therefore, it is typically considered a fair distributional rule that control and conservation costs are covered by the user. The root of the principle is that the users of a (scarce) resource should fully pay its opportunity cost. The third principle is the **"beneficiary pays principle"**. This principle, in general, supports transfers between the beneficiaries and agents responsible for the generation of positive externalities and/or the creation of public goods, to compensate them (and, therefore, help them "internalize") for the benefits they accrue for society. This principle justifies transfers between agents (or society as a whole, through transfers from the public budget) and it benefits from offering a choice of potential polluters and/or users of natural resources. It also enables more "environmentally friendly", although less profitable, activities for potential polluters

6 For the purposes of this paper "water users" are regarded as both abstractors and effluent dischargers.

7 Full Cost Pricing – the price includes all costs related to the consumption/production of the commodity, including those costs that can be imposed on society by the user.

8 Third parties are regarded as those other than: households, other firms, public facilities, etc.

9 https://stats.oecd.org/glossary/detail.asp?ID=2074

10 https://stats.oecd.org/glossary/detail.asp?ID=2827

and users of natural resources, to compensate them, at least, for lost profits. To some extent, this principle is also relevant whenever a polluter is not easily identifiable, while beneficiaries from control, conservation and restoration activities are distinguishable. Furthermore, the beneficiaries could be asked to contribute to such activities.

There are several economic instruments to ensure that water users internalize all the costs and benefits associated with their abstraction and/or effluent discharges. These instruments can be grouped in three categories:

1. **Water Allocation Management** – these are instruments incentivizing the sustainable use of water, both from surface water and groundwater bodies, by setting an appropriate price for the use of the resource and, thereby, affecting its demand. Typically, instruments used for abstraction management comply with the user pays principle. Such instruments are:
   - Abstraction Charges – a charge set on the abstraction of water from a surface or ground water body.[11] The amount and typology of these charges can vary considering their context
   - Tradeable Water Rights – abstraction rights exchanged on a market were different abstractors compete for the right to abstract. Typically, the total amount of permits exchanged corresponds to the amount of the resource that can be sustainably extracted from the body of water

2. **Water Quality Management** – these are instruments which aim to prevent the deterioration of water quality by setting the cost of effluent discharge. Typically, these types of instrument in the management of water quality comply with the polluter pays principle. Such instruments are:
   - Pollution Charges – set on the discharge of effluents in bodies of water. The amount of such charges, as well as their typology, can vary based on both the physical characteristics of the body of water and the types of effluents. To ensure the full cost of the water management system is covered, the agency can set a minimum price for the permit
   - Tradable Pollution Permits – pollution rights are exchanged in a market in which potential polluters compete to buy the right to discharge effluents in a body of water. The agency administering a body of water issue permits to discharge effluents into the water, specified by type and amount

3. **Subsidies and Payments** – these instruments are normally monetary transfers to the water users. Subsidies are typically provided to users to induce a behavior that will ensure a more efficient use of water resources and/or less effluent discharge. Payments for Environmental Services (PES) are generally given to farmers and/or land users for using environmentally friendly practices that positively influence bodies of water. Because subsidies and PES reward behaviors generate positive externalities, or provide public goods and are paid by (or on behalf of) the beneficiaries, they comply with the beneficiary pays principle.

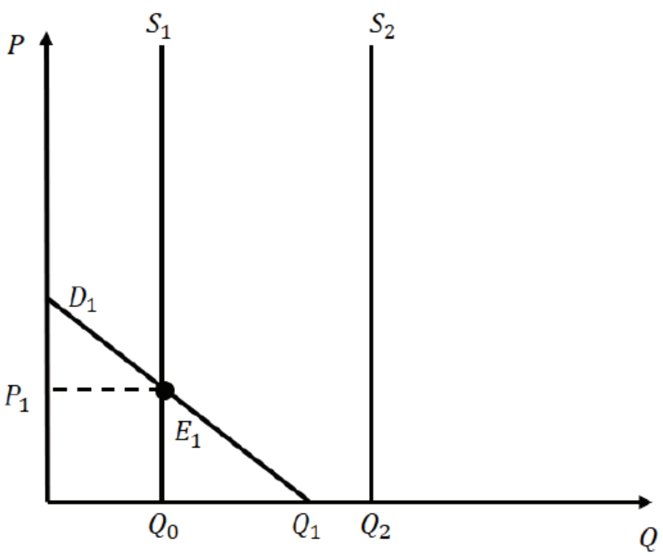
In this policy paper, we will discuss the properties of the economic instruments that comply with the requirements of article 9 of the Water Framework Directive (WFD), i.e. the "User Pays" and "Polluter Pays" principles (and, implicitly, the beneficiary pays principle). This work will further analyze the challenges associated with the implementation and the methodologies for the instruments' quantification.

11 Water Body - a body of water forming a physiographical feature, for example, a river, an underground water aquifer, a sea.

Instruments for Water Allocation Management

In general, the need for water abstraction management originates from water scarcity.[12] Its scarcity can vary at different points in time and depends heavily on the demand for water (Tisdell, 2010). To allocate water among different users, one can apply different pricing and/or charging mechanisms, so that the resource is eventually allocated its highest value. However, in some circumstances there may not be current or even potential water scarcity. Consequently, it is possible to provide open-access to water resources without any price or charge. Figure 1 illustrates the problem of water allocation.

Figure 1. Water Allocation in the Cases of Abundance and Scarcity (Tisdell, 2010)



As shown (Figure 1), when demand for water from the users is D_1 and water supply is S_2, the maximum amount of water potentially demanded is Q_1[13], while the total supply is of a higher volume Q_2. In this instance, there is no water scarcity and the resource can be given to users free of charge. In contrast, if the supply of water is S_1 and water is free, there is a shortage of water equal to Q_1-Q_0. To avoid the water deficit, under such circumstance, there are two options: introducing abstraction charges equal to P_1, or setting-up a market for abstraction permits, with the sum of the permissible abstraction quantities equaling Q_0. Theoretically both methods can ensure that:

1. The abstraction of water does not exceed its sustainable level
2. At the emerging price, sustainable supply and demand will balance
3. Water is allocated to its highest value of use

These results, however, are not guaranteed, as there are several conditions that must hold for this to happen.

ABSTRACTION CHARGES

Water abstraction charges (WAC) are the amount of money charged for the direct abstraction from ground or surface water (Roth, 2001). WAC is usually perceived as an environmental resource fee, rather than a charge to cover the full investment cost of water facilities. Ideally, WAC ought to apply the full (opportunity) cost pricing principle to water abstraction, creating incentives for its sustainable use. In the example demonstrated in Figure 1, the charge has to be equal to the price P_1. However, defining the price at which water demand equals a sustainable water supply is complex and requires the dispensation of a substantial amount of information (regarding price and income elasticities of demand, supply evolution, externalities associated with water abstraction, etc.). If the charge is set below P_1, it will cause an over-abstraction, or water deficit, although, the deficit would be smaller than if there were no charge. Alternatively, when the charge is set above P_1 the water resource will not be utilized at the maximum sustainable level (negatively affecting economic growth).

Abstraction charges are defined by the WFD in a way that is consistent with this interpretation: the charges have to send the correct signals to consumers about the real costs of the water they consume, thus member states should ensure that they reflect the true costs of the water (including environmental and opportunity/depletion costs). The EU WFD requires member states to achieve a good ecological status for bodies of surface water and good quantitative status for groundwater[14].

As mentioned above, although illustrating the idea of abstraction charges is simple, setting a water abstraction fee that will result in optimal water abstraction is complicated.

12 For the purposes of this policy paper, we define water scarcity as a situation in which abstraction of water can negatively influence the ecological status of a water body, as defined in Annex V of WFD.

13 The concept of water demand, in its broader sense, should also include (as an example) the amount of water that must remain in surface water bodies and in underground aquifers to ensure the ecosystem is not negatively affected.

14 Ecological, quantitative and chemical statuses of surface and ground water bodies are defined in Annex 5 of the EU Water Framework Directive.

This is due to the various characteristics of water users, and because bodies of water can differ significantly, which both result in various patterns of water supply and demand. Consequently, abstraction charges vary frequently among water users (i.e. households, industries, utilities, electricity generation, agriculture) and bodies of water (tributaries of rivers, lakes, underground water bodies, etc.). Evidently, defining the optimal level of abstraction charges can become a quite computationally demanding, and information-intensive, process.

In some cases, the abstraction of small quantities of water is exempt from taxation. For example, when bodies of water have a positive water balance[15]. There can also be reductions in the charge or exemptions for specific economic sectors and industries, depending on the priorities of a particular country. In such cases, although a sector or industry may require substantial amounts of water, their government can attempt to reduce the negative impact of WAC on its competitiveness (possibly compensating by increasing WAC for- and thereby reducing consumption from- other sectors and industries).

In practice, the purpose of WAC can vary across countries. Two of the main purposes it serves are **environmental and financial**. When the environmental function of WAC is of utmost importance, the rate must be determined in order to reflect the social costs of the negative externalities associated with water abstraction, including ecological damage, scarcity and opportunity costs. This can accordingly incentivize water users to decrease such behaviors which damage water and to invest in more environmentally friendly technologies. Whereas, when it is vital to raise revenues, to cover the costs of water management (such as monitoring, planning, enforcement of environmental regulation, etc.), the main purpose of water charges is financial.

The theory of double dividends from environmental taxation states that the de facto WAC can be used simultaneously as an incentive-based environmental regulation (environmental function) and as a source of government revenues, providing an opportunity to decrease other (distortive) taxes. Considering that a properly set water abstraction tax would not introduce any market distortion (although, it may reduce or eliminate one), when the double dividend hypothesis holds, water abstraction charges can have a positive impact on an economy in two ways: a higher environmental quality and a less distortive fiscal system. Existing evidence about the validity of the double dividend hypothesis is mixed. Some studies of developed countries show a small positive impact on output from the introduction of environmental taxes (Ekins et al., 2011; Bosquet, 2000). In contrast, studies from the US find that substituting existing taxes with environmental taxes can increase the gross cost of the tax system and decrease welfare (Goulder, 1992; Zhou et al., 2012). The mixed evidence reveals that while it is theoretically possible to receive double dividends from water taxation, several things have to be taken into account. Specifically, the calculation of WAC has to be done to create incentives for the sustainable abstraction of the resource. Furthermore, the total costs of administering water abstraction charges should be kept low, so that the overall costs of tax administration do not increase significantly.

Finally, WAC can also help level the playing field and rebalance competitiveness. Setting WAC properly forces the market to internalize the negative externalities and the true costs, associated with their activities, thus eliminating any unfair advantage enjoyed by market participants. Who limits their costs by imposing negative externalities on society and thus increase the (relative) competitiveness of those users who do not impose, or impose fewer, environmental costs on society.

Water abstraction charges, in general, should be fixed on both surface and ground water. In order for WAC to function properly, it is vital that the process and methodologies of setting these charges are developed jointly and follow consistent criteria from different sources. The overcharging of one source could otherwise have a negative impact on the abstraction patterns of another. Hence, the industry and the purpose of abstraction also has to be considered in order to create the most appropriate incentives[16]. Yet, the changing of circumstances in different industries and markets can cause over abstraction (for example, when the price of goods produced using abstracted water increases), or opposingly, a sub-optimal use of the resource. Thus, WAC, and the methodology used for its calculation, have to be updated periodically to avoid deteriorations in the incentive structures.

Methodology to Calculate WAC

The economic literature defines the different structures of water abstraction charges. In most countries, charges are calculated on a volumetric basis and consumers pay a unitary rate per cubic meter abstracted. The metering systems incentivize efficiency in water usage, as users pay for the exact amount of water consumed. Meters can also support the development of and/or investment in new technologies, which ultimately help in saving water. From an administrative perspective, volumetric charges require additional investments necessary to install the measuring devices, and thus requiring relatively higher investment costs from the regulators and/or water users.

15 Positive Water Balance – when water abstraction from the source is smaller than its sustainable level.

16 The simplest approach for surface water is to split water users by consumptive and non-consumptive use.

The implementation of volumetric abstraction charges is especially pressing in situations of substantial water scarcity and when water use patterns are highly inefficient. As is the case with gravity irrigation, a system utilized in many areas of Georgia, which leads to excessive water use and a possible reduction in agricultural productivity.

A cheaper alternative to volumetric WAC is to link charges to abstraction permits. In such cases, water users pay for a permit specifying the maximum volume of water that can be abstracted at each point in time. Although the implementation of WAC in this manner can be significantly cheaper for the government and water users, its proper monitoring might require many more resources compared to the volumetric system. Furthermore, it does not incentivize efficient consumption of water, as it gives stimulus for users to consume the maximum volume specified in their contracts.

As previously mentioned, the calculation of water abstraction charges in accordance with a theoretical framework requires a substantial amount of data and research. Methodologies for water abstraction charges depend on whether the primary function of WAC is environmental or financial (cost recovery for water management). When the aim is covering water management costs, the calculation of WAC requires an assessment of all costs for water management (i.e. monitoring, equipment, infrastructure and institutions, as well as their operation and maintenance costs). Furthermore, it also requires an analysis of the current and forecasted demands for water to identify demand patterns within different industries and to distribute the costs among them.

When the function of WAC is ensuring sustainable water abstraction (i.e. an environmental function), an analysis of greater depth will be required. The overall aim of WAC is to represent the true value (opportunity cost) of water. For a proper valuation number of things are required:

- Hydrological analysis of a body of water to identify a sustainable water supply
- Analysis of water users (types of industries and their potential demand)
- Identification of water demand
- Analysis of the price and income elasticities of demand[17]
- Identification of the value of water that ensures sustainable water abstraction

Water charges can be also set as a progressive tax, increasing with the amount of water abstracted. In such cases, one can define a set of standard charges for different industries and thresholds after which additional charges apply to the water users. Li et al., (2011) identify and discuss such a methodology. The authors provide a brief overview of China's Water Abstraction Policies (WAPs) and emphasize the importance of considering the proper variables when setting WAC. Most charges are based on the volume of water abstracted, on the type of the water source and on the type of user. In this instance, abstraction charges are calculated with this simple formula:

$$L_{ij}=V_{ij}*R_{ij} \text{ ,if } V_{ij} < P_{ij} \text{ (1) and}$$

$$L_{ij}=V_{ij}*R_{ij} + (V_{ij} - P_{ij}) * E_{ij} \text{ ,if } V_{ij} > P_{ij} \text{ (2)}$$

Where:

- **L** total value of levies
- **i** type of user
- **j** source of water
- V_{ij} total volume of withdrawn water
- R_{ij} unit charge rate
- P_{ij} the volume of abstracted water permitable based on abstraction licenses
- E_{ij} excess volume unit charge rate

Formula 2 implies that if the actual level of water abstraction exceeds the permitted amount of water, on excess volumes there is a progressively higher charge rate - E_{ij} is set. The local government determines both R_{ij} and E_{ij}. These two variables should represent the value of water under different abstraction patterns. When setting WAC, it is vital to consider such issues as the seasonality of water flows, water losses and the costs for the scarcity of water.

WATER MARKETS

Another way to allocate resources among water users and to enable a price at which demand equals supply at its sustainable abstraction level (i.e. P_1 in Figure 1) is to create water markets. With water markets, however, it is not necessary to define P_1. A crucial step is defining the maximum amount of water to be abstracted. For example, in the case represented in Figure 1, the total amount of tradeable water permits during water scarcity would be equal to Q_0.

17 Water is characterized by relatively low elasticity of demand. For example, in Australia the demand elasticity of water has been estimated to be -0.22. This implies that increasing the price by 10% will result in a 2.2% reduction in water demand (ICRC, 2003). As for the water income elasticity of demand, Havranek (2017) conducted a meta-analysis (the data sample comprised 307 income elasticity estimates taken from 62 studies). The reported elasticities ranged from -0.45 to 2.8 are characterized by a mean of 0.26 and a median of 0.16. Less than 3% of the estimates are larger than 1, which suggests that the demand for water is inelastic with respect to income. More than 94% of the estimates are higher than 0, which supports the intuition that water is not an inferior good. The income elasticity in developed countries are higher than in developing ones since water in some cases becomes a luxury good (for instance, used for filling up swimming pools, washing cars, and watering lawns).

In ideal conditions, water markets forces could be expected to direct optimal prices through a decentralized process, creating incentives for users to consume scarce water resources efficiently, thus helping reduce risks in agricultural production decisions and minimizing disruptions during a period of drought. A well-functioning market for water ensures that the value of the resource is determined, while considering a significant amount of information, for example: quantity, quality, location, timing, consumption patterns, etc. Water markets are currently working in some countries, such as the US, Spain, Chile, and Australia (see chapter 2).

Water permit trading could be regarded as the voluntary buying or selling of the rights to abstract water. In practice, there are three types of water trading:

- Short-term water trading associated with immediate use
- Medium-term water trading indicating that water users have secure access to water for a certain period
- Long-term water trading associated with property rights, which enables water user to consume either a proportion or a fixed quantity of the water from a certain source. The duration of such property rights are typically over 10 years

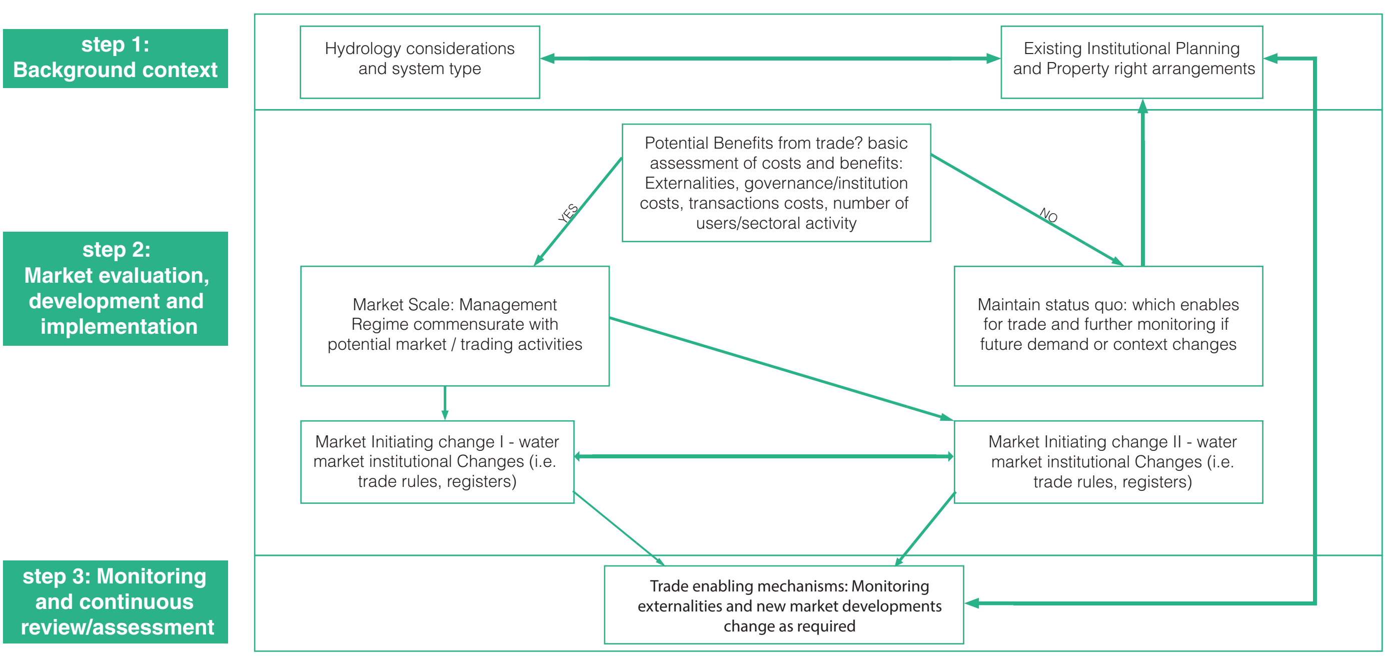
The creation of a water market requires the definition and attribution of property rights for water, as mentioned, a very complicated issue. There are a number of mechanisms to create and transfer property rights on water, such as: (i) water banks, (ii) bulletin boards, (iii) double auction markets, (iv) options and forward contracts, and (v) environmental leasing and purchase programs. In her study, Hadjigeorgalis (2009) summarizes these mechanisms (see Annex 1).

Water markets can be either formal, managed by governments or communities, or informal and managed by neighbors. Formal water trading arrangements are strengthened by their respective legal system and require various rules and regulations to be implemented in order to protect a water users' interests. Informal market contracts, however, are generally enforced with social ties. The success of formal markets depends on the institutional framework adopted by the relevant authority. Though, informal markets, if they emerge, are potentially able to develop an institutional framework that suit the needs of the users. Due to the increasing scarcity of groundwater in the agricultural sector, informal water markets have emerged, and remain unregulated, in China, Thailand, Pakistan, and India.

Wheeler et al. (2017) suggests the three steps essential for designing water markets: 1. Background context, 2. Market evaluation, development and implementation, 3. Monitoring and continuous assessment.

This three-step approach to consider the readiness for establishing water markets is summarized in Figure 2:

Figure 2. Conceptual Assessment Approach to Consider Readiness for Water Markets (Wheeler et al., 2017)



The first step includes evaluating the background context, including an assessment of hydrological factors and system types. Furthermore, the institutional and legislative framework should be appraised before the establishment of water markets. It is evident that the effective implementation of a water market requires clearly specified property and arrangements for its allocation. It is challenging to establish such arrangements, in which water users clearly understand their entitlements and the mechanism with which to transfer them. Hence, clear and unambiguous rules should be established regarding the arrangements of property rights. Equally, a clear regulatory framework should be designed, including the necessary compliance and enforcement mechanisms.

The second step, market evaluation, development and implementation, is primarily focused on the potential benefits from trade. The assessment of costs and benefits; the number of individuals involved in trades; the homogeneity of water-use; the changes in behavior induced by policy reforms and transaction costs; limited competition; and externalities should each be considered in this step.

When large trade volumes and substantial gains are achieved, it may lead to economies of scale and to the possibility for broader market implementation, with additional increases to the net benefits for society. This could subsequently lead to further reforms associated with changes in registers and designing clear trade rules.

Nevertheless, with modest gains from trade (insufficient volume of exchange) it might be better for water managers to simply maintain the status quo. They may then decide to encourage the development of trade by allowing the existence of partially functioning water markets, with trade occurring between a small number of individuals.

The last step highlights the role of monitoring and continuous assessment. By means of monitoring and continuous assessment, one can assess market performance, understand factors that hinder the development of water markets and reveal the necessity for additional changes, including new planning requirements and legislative change. Thus, continuous monitoring is essential to determine potential future demand and the necessity of further development.

Instruments for Water Quality Management

Economic instruments for water quality management are used to produce incentives for decreasing or avoiding pollution in bodies of water. The instruments to control water pollution are similar to those used for the allocation of water resources. As in the case of water abstraction management, there can be **a charge** for water effluent discharge and/or **a market** for pollution rights. The aim of both such instruments are to incentivize discharging activities compatible with the permitted level of pollution for particular bodies of water.

WATER POLLUTION CHARGES

Pollution charges (referred to in most European countries as Water Effluent Charges) are vital for achieving a good qualitative status for bodies of water. The main concept is to ensure that environmental costs are no longer paid for by society as a whole, rather they are allocated to (and internalized by) the water polluters. Water effluent charges are also key instruments in the regulation of discharges in bodies of water. These fees ensure polluters internalize the costs imposed on society through their effluent discharge, and thus comply with the “polluter pays principle”.

In the countries where water pollution charges apply, they are usually accompanied by a pollution permit. Any kind of discharge into a body of water requires a special permit from the governing institutions. Polluters are able to get a permit only if the effluent discharged is kept at acceptable levels. Permits can be either temporary or permanent and can be withdrawn if new concerns regarding water protection arise.

The literature shows that there are two main principles that are used in different countries. In most EU Member States, the rate charged is determined based on the characteristics of the effluent. This includes the presence of chemical components such as nitrogen, phosphorous, organic halogen, nickel, Chemical and Biological Oxygen Demand (BOD), heavy metals, suspended soils, etc. Certain countries (for example, Germany) may allow tax reductions, provided the eventual discharge is lower than permissible amounts. In other countries, the charge is calculated based on the actual discharge measurement, which is determined by self or compliance monitoring systems. In contrast, Belgium and Denmark have fixed rates for small discharges, while the rate increases for larger discharges, dependent on the type of effluent.

Water pollution charges can serve various functions[18]. For instance, these functions can be: (i) decreasing the pollution associated with any given contaminant in the water, (ii) regulating the amount of specific pollutants in the water, (iii) generating revenues, (iv) covering administrative costs for licensing, and monitoring and control of the quality of the water.

From an environmental perspective, water pollution charges aim to encourage industries to invest in technologies which reduce water pollution and/or to switch to more environmental production technology. The main challenge therefore is to design a charge which deters polluters from generating large quantities of wastewater and, concurrently, discourages clandestine discharges, used to avoid taxation payments. These incentives typically have a greater impact on private companies than on municipal sewage treatment operators. As industries seek maximum profits, they are usually willing to invest in better technologies, providing the marginal cost of pollution abatement is less than the effluent charge. Unlike private companies, public sewage treatment operators are not frequently profit maximizers and are therefore not as motivated to invest in newer technologies. This is particularly true when regulators are willing to cover the budget deficit due to the introduction of pollution charges. If this situation were to change, and public companies were held accountable for their fiscal performance, even public companies might be incentivized not to exceed the threshold set by water authorities.

Given the availability of essential information, water pollution charges can be theoretically designed to lead to a (desired) reduction in the quantity of specific substances discharged into bodies of water at the lowest possible social cost. The level of reductions in discharges will depend on the elasticity of the discharge, with respect to the cost of the charge and the entity of the pollution charge. Regulators can meet their objective deductions in discharges by setting charges for the discharge of individual substances to a level which is deemed as high as necessary. This clearly implies the need to set specifically high charges for exceedingly damaging substances and/or for substances the discharge of which is characterized by a low-price elasticity.

"Revenue generating" effluent charges have (from regulators' perspectives) a purely financial function, and the generated revenues can be used to finance the costs of water management and water pollution control (as in Belgium, France, and the Netherlands). However, this system also provides incentives for polluters to reduce their discharges in order to lessen their expenditure.

Pollution charges can also be designed simply in order to recover the administrative cost of controlling discharge licenses. In comparison to the previously mentioned functions, such a system provides very limited incentives for decreasing the number of pollutants, in particular when there is only a fixed fee for the license for water discharge. In such cases, the disaggregation of the charges by the type of effluent, industry and the period of discharge can still be helpful in creating incentives for the adoption of more environmentally friendly technologies.

The EU Water Framework Directive states: "Member States shall ensure an adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services…." Considering this requirement, water effluent charges are levied on households, industries and municipal sewage treatment operators. However, the typology of the effluent charges might still vary across countries and depend on whether discharge is direct, or indirect, on the type of substance discharged and in consideration of the identity of the polluter.

Direct discharges include:

- Agricultural and industrial discharges
- Discharges from landfills
- Discharges from sewage treatment facilities
- Domestic sewage from decentralized sewage treatment plants
- Rainwater discharges

Indirect discharges are defined as non-domestic pollution discharged into a publicly owned local waste-treatment system.

Effluent charges can be set either only on direct or indirect discharges, or on both. Some countries provide certain exemptions for priority industries. For example, in Denmark fish farms are free from these charges, and in Germany rainwater from railways is exempt.

In countries where indirect dischargers (including households) pay effluent charges (as part of their water bill), operators of wastewater treatment plants are not obliged to pay the charge, to avoid double taxation.

In most countries, there are no differences between agriculture and other industries, with farms paying pollution charges under the same scheme as other industries. There are, however, some cases in which the treatment of farmers differs. For example, in certain regions in the UK, farms are not allowed to discharge directly into bodies of water, while farmers in Belgium are charged with lower rates than other industries.

18 This classification is quite artificial, as all pollution charges perform- simultaneously- each of the functions mentioned. We chose, nevertheless, to adopt it in order to highlight the different motives that can lead regulators to introduce them.

Calculation Methodology

Pollution charges are usually calculated based on the amount of pollution discharged into bodies of water over a certain period, which are measured using several parameters. These parameters typically refer to the volume of different effluents: BOD, heavy metals, nutrients, toxicity and suspended solids. If a government aims to reduce the discharge of a particular substance, the unit rate charged for this specific effluent increases correspondingly.

Table 4. Calculation Method of Effluent Charge

Country	Calculation Method	Charging Basis
Belgium (BCR)	**T=a*Vr+b*CP** **Vr** Volume **a** Volumetric factor for the use of the public sewage system (=0 for direct discharges) **CP** Pollution charge calculated based on the estimated water consumption **b** Monetary unit to be paid for each CP	Total charge (T) is based on the actual measurement parameters- pollution load (CP) and measured water consumption (Vr).
Denmark	Depends on the discharge volume and content[19]: DKR 20 per Kg N DKR 110 per Kg P DKR 11 per Kg BOD	The charge rate for major dischargers (industries) is calculated by multiplying the number of pollution units by the tariff based on the measured amount of pollution. Households pay based on their water consumption (pollution charge rate * amount of water consumed).
The Netherlands	Charges are based on the pollution units and vary across different water boards. The rates differ dependent on whether the discharge happens in regional or state waters. Charges are defined separately for: • Small dischargers (<5 inhabitants equivalent) fixed charge • Medium dischargers (5 – 1,000 inhabitants equivalent) based on a coefficient table based on the quantity of water used • Large Dischargers (>1,000 inhabitants equivalent) based on the amount of pollution measured	The basis is an actual parameter measurement and/or measured consumption.

Source: Hansen, Interwies, Bar, Kraemer, & Michalke (2001)

19 The effluent charge is calculated based on the following equation: EC=20DKR*x kg N +100DKR * y kg P + 11DKR * z kg BOD where a. y and z represent the total amount of N, P and BOD discharged per year.

The monitoring of water quality and the enforcement of pollution charges are generally the responsibility of various water management authorities. According to the literature, there can be different structures for monitoring effluents in bodies of water. Effluent monitoring is largely conducted by local authorities, while Environmental Agencies inspect their activities. In some countries (such as Austria and France), different authorities may inspect dependent on the type of discharge: individual or municipal; by size and type of installation. If polluters violate the standards or exceed the amount of discharge granted by the permit, they will be fined.

TRADABLE WATER POLLUTION PERMITS

The creation of markets for pollution permits can also help manage the levels of pollution in bodies of water. Tradable pollution permits can be regarded as the transferable right to create pollution in a common resource, like water. The aim of their regulators is to determine the maximum level of allowable pollution in the watershed. Thereafter, permits can be allocated and traded among polluters.

Setting an overall cap to the level of pollution and allowing the trading of permits among polluters has several advantages:

- It can reduce the chance of environmental policies failing to achieve their targeted level of water pollution (for example, if there is substantial uncertainty about the price elasticity of pollution)[20]
- By creating artificial scarcity, it causes the emergence of a market price for permits (and for pollution generation) leading to the minimization of the total cost of pollution abatement (given the permitted level of pollution)

In such a market, polluters that do not purchase sufficient permits and face huge pollution reduction costs can choose to purchase permits from other polluters, rather than reduce their polluting. Whilst, polluters who have excess permits and/or lower costs might profit from selling permits. As is the case with water markets, efficiency may be ensured, but the distribution of gains among applicants will depend crucially on the way in which tradable permits are initially allocated.

Asymmetric information, uncertainty, and the absence of regulatory and control instruments are considered the main limitations to implementing a tradable permit system. Information plays a key role in determining the optimal number of permits and the initial auction price. Under asymmetric information, difficulties might arise calculating the appropriate number of permits, especially when a central authority has insufficient evidence on the true extent of water pollution and/or consumption prior to the introduction of the tradable water permit instrument. The lack of information regarding tangible levels of emission and consumption (before the introduction of the permit system) will certainly make it more difficult for a central authority to determine the optimal number of tradable water permits to be distributed within a market. As for the uncertainty, it could also be associated with atmospheric events, which cannot be precisely foreseen. Likewise, as the body of scientific knowledge expands, it might be necessary to redefine the target levels of pollution and, therefore, the number of tradable permits in circulation. This, however, increases the uncertainty for polluting firms. In order to reduce this uncertainty, permits should be issued and withdrawn following clear rules, under a clear framework.

Regulation, monitoring and enforcement capabilities should be well-developed in order for an efficient implementation of the system. Along with establishing environmental objectives, the managing authority should also ensure the existence (and the application) of appropriate sanctions in the case of non-compliance. In addition, continuous monitoring of the market is necessary to achieve both the environmental goals and the permits' market efficiency. From an economic perspective, monitoring is also necessary to ensure the competitive nature of the market. Where there may be a lack of competition, associated with monopolies or oligopolies, an efficient solution may not be determined. It is possible that monopolies and oligopolies could potentially use the tradeable permit system to generate barriers of entry for new firms (refusing to sell their permits), thereby leading to sub-optimal outcomes.

20 Theoretically, both taxes and permits could lead to the internalization of pollution costs. However, due to uncertainty, tradable permits are the preferred instrument, since they require less information compared to Pigouvian taxes, in order to reach the determined environmental quality. For instance, in implementing water use, tax information about the marginal benefit curve of all users is necessary, whereas for implementing permits, users trade voluntarily for cost-effectiveness purposes. Similarly, information regarding the marginal cost and marginal damage to the environment is required for water pollution tax to precisely calculate the total amount of tax. Since tradable permits set the maximum allowable level of pollution or water use under uncertainty, this instrument is more reliable. Johansson and Moledina provide evidence in favor of tradable permits in the presence of uncertainty (2005).

Tradable water pollution permits should be set based on the specific characteristics of a river basin. The sources of pollution, location, geographic and biological characteristics, and the existing rules and regulations should be considered. Generally, there are two types of pollution source: point and non-point. Point sources are fixed and easy to recognize once they have entered the watercourse, such as industrial waste. Difficulties might arise though in the identification process of non-point sources, such as agricultural and urban waste. For non-point sources, a regulator would be required to monitor different, independent and smaller pollution sources. Consequently, it is harder to identify the effect that each non-point source has on the environment. The central authority, furthermore, will have difficulties in differentiating the market structure for the different type of actors involved and will face the huge transaction costs associated with the identification of polluters, and the establishment and monitoring of the tradable water pollution permit instruments related to non-point sources.

Given the importance of local conditions, each country should develop its pollution permit trading system based on their desired environmental goals and on the specific characteristics of its river basins. It is possible, however to highlight some general requirements that are essential for the success of such systems:

- The regulator should have access to accurate data on emissions and pollution levels or abstraction and water usage in order to discern the most relevant policy instruments
- The water rights attributing water abstraction and discharge rights to stakeholders should be clearly defined. In addition, water rights should be enforceable and be secure for the benefit of the owner
- Water basins must be clearly identifiable: their location, volume of water, volume of abstracted and polluted water, and other characteristics should be known
- All stakeholders (consumers, polluters, general public), the potential users of the basin, must be identified in order to include them in the regulatory process
- The regulator should increase market competition and reduce entry barriers in order to ensure a significant number of participants, which helps prevent market power and supports a more efficient allocation of pollution rights
- Differences in abatement costs support the efficient allocation of tradable pollution permits actors with low abatement costs could sell their permits to those with high abatement costs
- Monitoring and enforcement mechanisms should be properly developed
- The allocation of permits through an auction system (which guarantees permits will be obtainable to those paying the highest prices)

Subsidies and Other Payments

Subsidies and payments are two further forms of economic instruments policy-makers can use to improve the allocation of water and its quality for environmental services.

SUBSIDIES

Theoretically, subsidies are instruments that can be used to internalize external benefits, just as environmental charges can help internalize external costs. Subsidies can therefore be regarded as a reward to households, farmers, or to other stakeholders, for environmentally beneficial actions that generate positive environmental externalities.

However, this is just one method subsidies can be applied. In this subsection we will be reviewing only subsidies that are utilized in the context of water management, namely, for water conservation or to incentivize polluters to reduce their levels of contamination.

SUBSIDIES FOR WATER CONSERVATION

The practices that lead to water conservation can be subsidized either by direct cash payments or by providing some form of tax relief. The tax relief itself could take two different forms, either direct, a reduction of income taxes, or indirect, when tax relief takes the form of an indirect reduction (for instance, lower import tariffs and/or Value Added Tax (VAT)).

In general, water conservation subsidies have two core objectives. The first is to partially cover the costs water consumers incur due to required actions or prohibitions. The second employs subsidies to create incentives for achieving certain specific, non-obligatory, actions. For example, companies could be subsidized for the use of appliances which recycle water or use water more efficiently. Whereas households could be encouraged, by means of subsidies, to substitute old appliances with more modern and water-efficient appliances. Subsidies could also incentivize farmers to establish better, water-efficient irrigation practices.

Subsidies for water conservation might at times lead to the desired results, they might likewise prove inefficient and ineffective. For instance, the introduction of better and more water-efficient practices in agriculture may encourage improvement in a cultivated area and/or the introduction or more water-intensive crops. The inefficiency here derives from the fact that the subsidy does not directly target water consumption (as a volumetric water charge would), but attempts to achieve an indirect desired results, by changing how efficiently water is consumed. If such consumption generates a negative externality, the subsidy is not truly helping it to internalize. Another drawback of these subsidies arrives with the adoption of the desired behavior by the targeted agents, who may encourage the onset of additional agents seeking further profit, which in turn, could lead to a higher than desired water consumption. While they are potentially in line with the principles contained in the WFD, the introduction of subsidies thus should be subject to a thorough preliminary analysis. This examination should assess whether we are facing a positive or negative externality, alongside discerning the potential, and unintended, behavioural distortions associated with the introduction of subsidies.

SUBSIDIES FOR THE REDUCTION OF WATER POLLUTION

Subsidies for the reduction of water pollution reward the polluter for reducing their emissions. The subsidy system incentivizes water users to reduce pollution, providing the marginal cost of reducing pollution is lower than the subsidy. Subsidies for the reduction of water pollution, while ordinarily politically more acceptable, clearly violate the polluter pays principle enshrined in the WFD. The government entity providing the subsidy (using taxpayers' money) is helping bear the costs, which ultimately should be the responsibility of the polluter. In addition, as with water conservation, subsidies present another major drawback: even though they provide incentives to the incumbents to reduce pollution, they might also attract new market participants seeking higher profits associated with subsidies. Finally, the provision of subsidies alters the price signals consumers face, which no longer reflect the full costs of production. This ultimately leads to an overconsumption of the product, causing harm to the environment and/or excessively high costs for public finances. Examples of subsidies for the improvement in water quality are tax and tariff reductions for pollution control and wastewater treatment equipment.[21] As previously noted, the incentive function of the economic instrument is lost here, as the polluters and the consumers are not facing the true opportunity cost associated with their choices. Therefore, the use of subsidies for reducing water pollution cannot lead to the most efficient outcome. A possible way to overcome the serious limitations associated with the implementation of subsidies for the reduction of water pollutions is to combine them with pollution taxes, where the revenues from such taxes (providing proper incentives) would fund the subsidies.

PAYMENTS FOR ENVIRONMENTAL SERVICES

Payments for environmental services are regarded as a more interesting, relative to subsidies, market-based solution that encourages the sustainable use of natural resources.[22] PES is an instrument through which beneficiaries of the environmental services reward providers through voluntary transactions. Hence, a polluter/user of environmental services pays for a protector/provider of the service. The main goal of this instrument is to make the maintenance of environmental services more attractive for the service providers, and private or communal landholders, by helping them internalize the positive externalities they generate. PES offers life to a self-interest system, which assumes that economic agents will change their behaviour and attitudes according to the incentives they attain, as long as those who benefit from the externalities are willing to pay.

21 According to a 2004 report from the Environmental Protection Agency of the United States (EPA 2004) several Asian countries – Indonesia, China, the Philippines, Thailand and Taiwan – reduced or eliminated tariffs for pollution control and wastewater treatment equipment.

22 PES may be considered as subsidies for activities producing positive externalities and/or public goods.

PES schemes can be classified and defined along several dimensions:

STAKEHOLDER INVOLVED:

- **Buyers** are beneficiaries of the environmental services who are willing to pay in order to ensure the provision of environmental services. Several types of buyers may be involved in PES schemes, such as private/public users, firms, Non-Governmental Organizations (NGOs) or governments and international agencies
- **Sellers** are mainly resource owners and managers, whose behaviour affects the supply of environmental services and whose actions could potentially safeguard the secure provision of environmental services. Individual landholders, private conservation groups, communal landowners, informal users of public land, NGOs (who manage protected areas) might each be regarded as service providers
- **Intermediaries** are groups or institutions bridging the gap between buyers and sellers. NGOs, donors, government groups, and trust funds and user associations could provide help with PES scheme design and implementation
- **Knowledge providers** are agents who offer essential information and appropriate management practices for the implementation of PES schemes. Such agents are resource management experts, valuation specialists, land use planners, regulators, and business and legal advisors

SOURCE OF FINANCING:

- **Public payment schemes** involve the government, which pays service providers on behalf of the wider public to enhance environmental services
- **Private payment schemes** include self-organized private deals, in which beneficiaries of environmental services directly contact service providers
- **Public-private payment schemes** involve both the government and private funds to compensate service providers for the delivery of environmental services

POSSIBLE FUNDING SOURCES:

- Tax collection
- Royalties from hydropower generation, oil and natural gas
- Water resource funds
- Resources from fines and other non-compliance charges
- Private funds

PAYMENT TYPE:

- **Output based payments** are made based on the actual environmental services provided. For instance, payments made for a certain level of water or for forest conservation
- **Input based payments** will emerge when beneficiaries are aware that certain land or resource management practices will indeed deliver the required environmental services. For example, a beneficiary might pay a service provider for implementing the best agricultural practices to prevent nutrient disposal into water sources

Payments could be ex-post, ex-ante, continuous (dependent on service provision), or at a fixed time in order to support the transition towards improved practices. Payments could occur in kind, in cash or as a combination of both.

Problems and Challenges Associated with Water Funds

The payment for watershed ecosystem services (PWES) can be done directly by the donor or with the help of an intermediary. Direct financing from the government might face issues such as lack of independence, which means that while the governing party decides the distribution of financial resources, a bias might arise in the decision-making process. Furthermore, the lack of a long-term vision might create issues, such a lack of foresight derives from the fact that governing parties periodically change, and their priorities might change accordingly. Finally, any kind of political instability and disturbance might threaten the reliability of the program. Consequently, the most common form of payment for ecosystem programs is through trust funds. Trust funds are financial, institutional and biophysical mechanisms that can connect water service users to providers with payments.

In the water sector, trust funds are usually represented as water funds. They accumulate money from different sources, such as voluntary contributions, fees collected from water users, and/or private donations from international agencies. The funds invest in conserving and enhancing the quality of water sources and their ecosystems. Water funds are usually reserve funds and a means of financing water conservation projects.

There are several challenges which should be considered before the implementation of a water fund: Firstly, as funds depend on external payments, there is a high risk of underfunding. A crucial step in setting up a water fund should be, therefore, the creation of a coherent and effective fundraising strategy. Secondly, there is the potential problem of overpayment (excessive payments for environmental services), which alone can negatively affect the efficiency of PWES schemes. To minimize this risk, payments should focus first on interventions with the lowest costs of negative externality abatement (or of positive externality generation). This will allow for the achievement of the greatest environmental benefits given the available financial resources.

Moreover, as water fund boards may consist of both water users and community representatives, sometimes there might be discrepancies during the decision-making process, regarding the optimal resource allocation of the funds among various projects. Each representative might support a project which most benefits their group. For example, if a hydropower company has a member on the board, they might care more about sedimentation issues, while representatives from farms are more concerned about the quality of drinking water. As great a diversification of the board members as possible is a solution to this problem, for example, the inclusion of representatives of watershed communities, to help avoid the board being dominated by one group of stakeholders.

Finally, large, non-refundable payments should be avoided, as they do not create incentives for long-term program provisions. Incentives can be strengthened by developing a well-structured monitoring system and well-defined regulations, which penalize noncompliance. Social pressure can also be an effective tool against the violation of rules. If the responsibilities, and the sanctions, are shared among members of a community, there are fewer incentives to break the rules (Goldman-Benner et al., 2012).

Methodology for Calculating Payment for Environmental Services

In the best practices according to PES, there are several aspects that should be considered when defining a payment structure, among them:

- Differentiated payments: payments should be defined proportionately to the action taken or the service provided
- Spatial targeting: priorities should be determined according to the expected benefits, the probability of loss and opportunity costs
- Limiting side objectives: the objective of the payment should be precisely defined and there should be few if any additional or complementary objectives
- Additionality, which indicates that only actions which would not otherwise take place should be compensated (Goldman-Benner et al., 2012)

For PES to work successfully, it must create benefits for both parties. From a buyer's perspective, PES might be positive if the payments are less than those incurred by employing alternative mechanisms in order to secure a desired service. Whereas for a seller, PES might be constructive when the level of the payments received is higher than the returns necessary for the construction and conservation of environmental services. Thus, a lower and an upper bound exist on a PES payment. The minimum payment should cover, at least, any forgone returns, whereas the maximum payment is in the cumulative value of the additional environmental services which benefit the buyer(s). In practice, PES payments range between the minimum and maximum values and reflect the supply and demand for particular environmental services.

There are precise methodologies which can be used to calculate PES payments. One of them is discussed in a paper by Young and Bakker (2014), in which the authors evaluate positive and negative aspects of the Oasis Project and suggest a new methodology for calculating PES payments for watersheds.[23] The main idea of this new methodology was to include environmental, economic and social aspects in a PES payment determination scheme. According to this methodology, the value of PES depends on several variables, such as water protection,[24] conservation of natural ecosystems,[25] and agricultural practices.[26]

The new methodology appears in the following manner:

$$\text{Value of PES} = Z*X*[1+ G_1 + G_2 + G_3]$$

Where, G_1[27], G_2[28], and G_3[29], are scores for water protection, conservation of natural resources and agricultural practices respectively. While, X is a reference variable which determines the opportunity cost of land. In this case, the reference variable X corresponds to the minimum compensation value which would be received for the conserved area. For instance, X could be 25% of the rental value of land. However, X could change according to the characteristics of municipalities. Variable Z refers to the area devoted to forest conservation and restoration practices, measured in hectares, for each property. Variable Z plays an important role, since the payments are made based on the conserved and restored areas.

23 For a short discussion on the Oasis Project, see the section on International Experiences.
24 Protected springs, protected rivers, streams and lakes.
25 % of conserved area, existence of private reserves, formation of corridors.
26 Certified organic agriculture, rotation of cultivations, land with increased productivity, contour ploughing/farming.
27 G_1 ranges between 0 and 1.
28 G_2 ranges between 0 and 2.5.
29 G_3 ranges between 0 and 1.5.

According to this formula, if a landholder follows only the minimum requirement of the project, they would only receive the minimum value, exactly 25% of the rental price per hectare of the conserved area. Whereas, if a landowner receives the highest scores for each variable, they could gain six times over the minimum value. Thus, there is a clear incentive for landholders to increase not only the size of their conserved areas, but also to improve the quality of the conservation and to adopt better agricultural practices in order to receive higher payments.

In conclusion, in order to guarantee the effectiveness of PES several issues should be taken into account (OECD, Paying for Biodiversity: Enhancing the Cost-Effectiveness of Payments for Ecosystem Services, 2010):

- PES should be incentive based
- Property rights over land should be clearly defined to identify the actor whose actions affect the supply of environmental services
- PES goals and objectives should be clearly defined in order to design an appropriate program and enhance transparency
- Monitoring and reporting system should be created and developed
- Buyers should be identified, while sufficient and long-term sources of finance should be ensured
- Payments should be based on performance and distinguished according to the opportunity cost of environmental service provision
- The joint provision of multiple services should be considered, since it might increase benefits and increase transaction cost of a program
- Presence of leakages should be taken into account

INTERNATIONAL EXPERIENCES

In this section we review the international practices to better understand the possible opportunities and challenges associated with the use of economic instruments for water management. We separately discuss each of the main categories of economic instruments, as identified in the previous section. The cases discussed are chosen either based on their specific relevance to Georgia or for their general validity.

WATER ABSTRACTION CHARGES

Bulgaria

Bulgaria is one of the countries which has successfully reformed its water abstraction policy in line with the WFD. There are some similarities between Bulgaria and Georgia, which make the comparison interesting. Like Georgia, Bulgaria started implementing environmental legislation immediately after shifting from a centrally governed economy to a market economy. In 1999 they adopted the Water Act as the main work governing management and ownership of water resources in the country. However, their legislation at the time could not fulfil the cost recovery principle, could not guarantee the availability of an adequate water supply to consumers, and lacked precise definitions for the value of water. In 2001, Bulgaria implemented water abstraction charges, which were defined as "Tariffs for water abstraction, water use and those that are subject to contamination" (Sharkov, 2016).

In years immediately after their introduction, the charges were different for the two separate types of water: (i) general sources and (ii) mineral water sources. In 2006, Bulgaria adopted the EU WFD and incorporated its requirements into the national legislation. In 2012, a new tax system was approved[30], according to which the country set different tax rates for ground and surface water abstraction. In addition, tax rates varied among the various types of consumers. The main purpose of implementing abstraction charges was to reduce the existing level of water abstraction and protect water resources. As a result of the reform, charges increased, despite protests from the business sector.

Bulgarian charges are volumetric users are charged based on their consumption level therefore saving water is encouraged. The data from the National Statistical Institute of Bulgaria reveals that there was a huge increase in the number of enterprises from different sectors of the economy, starting from 2008. However, total abstraction of freshwater (excluding the production of hydropower)[31] has decreased significantly,most notably after the tax rate increased in 2012. Equally, the total loss of water has decreased (Sharkov, 2016)[32]. These facets help prove the effectiveness of the water abstraction charges used in Bulgaria.

There were several factors behind the successful Bulgarian implementation of water abstraction charges. Firstly, government consultations with different industry representatives enabled them to calculate the precise charges for specific industries, periodically revised in line with inflation. Secondly, the decision-making process on implementation was inclusive, including several stakeholders such as industry representatives, municipal water workers, etc. in addition to public officials from the relevant ministries.[33] Lastly, the revenues generated have been used to fund projects and initiatives in the field of environmental protection and management (Sharkov, 2016).[34]

Despite the successful implementation of water abstraction charges, several challenges remain. These are related to the lack of institutional capacity, resulting in an insufficient monitoring of water resources and the loss of data.

30 An increased tax rate was justified by the concurrent increased rate of inflation.

31 Because the government subsidized energy production from small and medium hydropower plants. However, adverse effects of hydropower plants are not considered in the legal framework.

32 Total loss is reported by water supply and sewerage operators and includes physical losses during transportation, unauthorized consumption, measurement errors, etc.

33 The Ministry of Environment and Waters; The Ministry of Economy and Council of Ministers.

34 To finance projects in the field of water and waste management.

China

In comparison to Bulgaria, China does not provide an example of a successfully implemented water abstraction policy. However, their situation is particularly relevant to Georgia, as it demonstrates the risks in the failure of a reform due to overlapping functions and responsibilities among water management institutions. Furthermore, China's case identifies how an inadequate approach when calculating water rates can result in insufficiently low charges.

After the 1980s, industrial demand for water resources increased dramatically in China, mainly because of their strong economic growth. Other factors contributing to the increase of water demand from households, were population growth and increasing levels of urbanization. In order to balance the increased water demand and relatively unstable supply, and to manage the existing resources effectively, the Chinese government chose to implement market-based instruments.

China introduced the Water Abstraction Policy (WAP) with the Water Law of 1988. The most probable reason behind the choice of introducing water abstraction charges, was that they were the easiest to fit within the existing institutional framework, in comparison to other instruments such as taxes or permit trading schemes (Li, 2011). Before introducing the new abstraction policy, water was considered an open access resource. The main benefit of the new law was that it made water a state-owned resource, subject to management from the government.

The Chinese WAP is focused on water abstraction licenses and water abstraction charges. The 1988 Water Law stated that all consumers wishing to withdraw water from surface or groundwater sources should first apply for a license and then pay a corresponding fee.[35] Water abstraction permits are used to prevent the unsustainable withdrawal of water. The main function of water abstraction charges is to manage water demand and tensions in its supply, and to reduce existing abstraction levels. In 2002, the government of China implemented changes to the Water Law in order to strengthen the institutions responsible for issuing water abstraction licenses and to define abstraction charge policies.

Abstraction charges proved to be an ineffective instrument for water management in China, as water continues to be overdrawn in many regions characterized by water shortages. The principal causes for the failure to implement water abstraction charges in China were problems in institutional arrangements, methodological issues and the way charge rates were defined (including exemptions from charges for irrigation purposes).

According to the Water Law, the Ministry of Water Resources and its Water Resource Bureaus (WRBs) are responsible for the implementation of water abstraction policies. However, their responsibilities are not fully detached from other ministries, which creates overlaps and conflicts of interests which inevitably hinders the decision-making process. Furthermore, China's water management system lacks clearly defined abstraction targets. Initially, seven River Basin Management Committees (RBMCs) were required to formulate water allocation plans for their basins. They also determined provincial targets, for which the involvement of the local governments was essential. Such a centralized system requires perfect co-operation amongst all levels of the government and its ministries. In addition, it requires reliable monitoring and hydrological data. In such a system, if any actor fails plans simply do not materialize. Unfortunately, Chinese targets for water allocation plans at a basin level have often been set without consultation with local representatives.

Moreover, methodological aspects of Chinese water abstraction charges were also problematic: (i) factors like seasonal fluctuations in supply and demand, and water losses were not considered, (ii) the adopted methodology yielded very low charge rates, which did not address issues of unsustainable water abstraction.

Finally, their decision to exempt water used for irrigation, coupled with the low-level tariffs did not create sufficient incentives for consumers to reduce water abstraction in any significant manner.

35 Water use for irrigation purposes was exempt from the charge.

WATER MARKETS

Australia

Finding a country with similar characteristics to Georgia, which has also successfully established water markets, is not easy. Because water markets are not widely utilized efficiently to allocate scarce water resources around the world. However, as water markets function in some developed countries, such as Australia and Spain, their cases will be reviewed over the subsequent paragraphs.

The Murray-Darling Basin (MDB)[36] in Australia is regarded as one of the most successful cases for the utilization of water markets. For countries aiming to design a sustainable water management system, the MDB experience is a valuable source of insight towards the challenges and respective lessons learned. In order to develop a sustainable water management plan, Australia first introduced the Murray-Darling Agreement (Young, 2010), which, to ensure that states would not issue excess licenses, imposed a volumetric limit on the quantity of water that could be abstracted. In addition to the MDB agreement, Australia has also developed a National Competition Policy (Young, 2010) to separate water supply institutions from water policy and development, and to introduce full cost pricing- including externalities- for water delivery.

The MDB market functions according to specific rules. According to Grafton and Horne (2013), two types of transaction might take place between a buyer and a seller in the MDB. The first is the exchange of water access entitlements that grants owners permanent or temporary access to the indicated share of water from a specific consumptive pool. The second, water allocation, assigns the entitlement to a volume of water, which should be consumed within a given water season under a specified plan. From a management perspective, Australia's Basin-wide plan is implemented by an independent authority,[37] where states have a right to control water use and issue entitlements. The authority is responsible for setting standards, monitoring, evaluating and enforcing regulations and the Basin plan, and for determining water allocations.

Several difficulties arouse while establishing water markets in the MDB. Initially, ground and surface water were managed separately, and the effects of forestry, farm dams, and other forms of water interception were not considered. In response to these problems, the Australian government introduced the National Plan for Water Security, which ensured that surface and ground water would be managed as an integrated source.

Another serious problem Australia faced was caused by the tradability of water entitlements and allocation arrangements. The opportunity to trade unused water resulted in over-allocation complications. In order to address this issue, the government established the Sustainable Water for the Future Program (Young, 2010), which enables the government to purchase water entitlements for environmental purposes. It should be noted that Australia still has to cope with over allocation problems, as many states continue to issue more entitlements than the system capacity allows.

Yet positively, water allocation trading has become a common practice, especially for irrigators in periods of water shortage. Hence, the adverse impacts of droughts have been dramatically mitigated. Although the benefits of these reforms are considerable, convincing government entities to implement these reforms in a timely manner turned out to be problematic.

Overall, the creation of water markets in the Murray-Darling Basin was successful due to the large number of buyers and sellers, and to the limited number of barriers to trade and the low transaction costs. These factors resulted in vast numbers of transactions, which are a necessary requirement for the development of water markets. Remarkably, after the introduction of water markets, water allocation prices followed an increasing trend (ABARES, 2016). However, after a time water allocation prices became more volatile. The implementation of the reform, including the attribution of responsibility for the Basin-wide plan, and the definition of tradable water entitlements alongside arrangements with the central authority, improved the management of scarce water resources.

Spain

Another interesting example comes from Spain. Palomo-Hierro et al. have described the operations of the Spanish water market, highlighted the main challenges that appeared during the implementation process and suggested valuable recommendations for its improvement (Palomo-Hierro, Gómez-Limón and Riesgo, 2015). Due to increases in water demand and intense competition for water, and given the existence of their outdated water storage and delivery infrastructure, Spanish water basins became unable to meet water demand. This created the need for a change in water policies. The Spanish government identified two options that could help improve the allocation of water resources and eliminate the excess demand. The first option was to develop a new water infrastructure, thereby increasing water supply. The second was to reallocate water supplies among users, namely to those for whom the value of water was the highest.

36 Negotiations about Murray-Darling Basin Agreement started in 1980 and all the necessary requirements to bring the agreement fully into force was ready by 1994.
37 The Murray-Darling Basin authority was established in 2008.

Rather than building new infrastructure (water supply policy), it was preferable to reallocate water supplies among the users (demand management policy).

Spain formally introduced water markets and their regulatory framework by means of the Spanish Water Law, in 1999. This law instituted spot water markets and water banks, permitting only the temporary trading of water rights. Users water rights have generally been granted for 75 years, while buyers and sellers together determine the price and the duration of formal contracts. However, the Spanish government reserved the right to set a price limit according to the market. While, water banks typically operate in periods of water shortage or droughts. The River Basin Authorities (RBA) might temporarily purchase water use rights at a fixed price and then redistribute the corresponding amount of water among consumers, either free or at a fixed price. Only in extreme cases, for environmental purposes, is the Water Exchange Centre (WEC) allowed to permanently acquire water use rights.

Relatively few water transactions have taken place since the implementation of formal water markets and water banks. Most transactions occurred among agricultural users during a period of severe drought from 2005 until 2008. The narrowness of the market, excluding periods of drought, is a major problem that characterizes Spain's water market and hampers its development. Deficiencies in the market could be associated with several factors, like legal, administrative, psychological, technical difficulties and geographical barriers. These factors highlight the existence of high transaction costs, which prevent mutually beneficial transactions in water trade from taking place.

A lack of information and the market's activity significantly affects farmers' involvement in water markets. Unfortunately, in Spain only few farmers have experience in the trading the rights of water use. Farmers equally lack information regarding formal contracts. Farmers are not aware of water prices, water volumes transferred, nor of other general conditions included in the contracts, since such information is not publicly available. This unsurprisingly creates uncertainty among farmers about the role of water markets. In order to cope with the lack of information and low market activity, Palomo-Hierro et al. recommend that Spain launches information campaigns, which would help farmers to understand water markets and stimulate farmers' participation in these markets (Palomo-Hierro, Gómez-Limón and Riesgo, 2015). Another problem discerned by the Palomo-Hierro et al., is associated with cultural barriers among farmers. Some consider water as a non-tradable, common good and believe that water rights should not be separate from the land ownership. Thus, certain barriers should be taken into account in advance, as farmers' perceptions and preferences play a key role in the successful functioning of water markets (Palomo-Hierro, Gómez-Limón and Riesgo, 2015).

Palomo-Hierro et al. highlights the high fixed transaction costs in Spain, revealed as only users who experience significant differences in the marginal productivity of water use formal contracts. Additionally, in most cases the volume of water transferred is more than the one cubic hectometer,[38] indicating that only by signing large volume contracts can users participate in water markets. According to the same authors, in order to reduce transaction costs, Spain should also reduce information asymmetries, and details about potential buyers and sellers should become readily available to interested parties (Palomo-Hierro, Gómez-Limón and Riesgo, 2015).

In contrast to markets, water banks function effectively, since water authorities have successfully coped with environmental problems by purchasing water use rights during problematic periods. The functions of water banks could expand, and they could become intermediaries for buyers and sellers, as is the practice in California. Water exchange centres might increase transparency of water markets, and reduce transaction costs and uncertainty regarding the availability of water, as they would offer better access to information regarding supply and demand, and on water transfers and prices.

Even though water right holders should have the ability to consume a predetermined amount of water, in periods of scarcity they might not be able to do so. When the total amount of available water is lower than the aggregated volume of water indicated in the water rights, the water authority can limit the quantity of consumption by the right holders and implement an alternative water distribution system. The Spanish water law states that in periods of water scarcity a priority system should determine the ranking of the water users and then allocate water accordingly. Domestic users are ranked first, followed by senior agricultural users. Within each specific category of user, water resources are distributed uniformly following a proportional rule. However, this rule can also be modified during severe droughts. Clearly, this system of ranking water right holders can be harmful to certain users. Palomo-Hierro et al. thus recommend improving the system by means of water banks and introducing monetary remuneration for those users who give up part of their water (Palomo-Hierro, Gómez-Limón and Riesgo, 2015).

In Spain the overall performance of water markets is far from the theoretical ideal. Water markets only work during

38 Cubic hectometer is a measurement of unit of volume, one cubic hectometer equals one million cubic meters.

periods of scarcity, and even during these periods, the water traded amounted to less than 5% of the total used. The narrowness of the markets, high transaction costs and other barriers should be dealt with in order to improve the functioning of Spanish water markets. It is evident that there is considerable room for improvement of the water market in Spain and that the water market's depth is a crucial factor for the success of such markets.

WATER EFFLUENT CHARGES

Germany

In Germany, after World War II, high growth in pollution-intensive sectors caused substantial environmental problems,[39] including issues associated with wastewater discharges into bodies of water. In 1976, Germany adopted the Federal Water Act, under which the minimum national requirements for wastewater discharges were defined. However, direct regulations of effluent discharges were not effectively implemented and administrated by the federal states. In addition, command and control regulations did not lead to the internalization of the external costs for untreated effluent charges.

In 1987, the federal states of Germany (Länder) introduced water effluent charges. The main concept behind the introduction of these effluent taxes was the "polluter pays principle". The idea was to create incentives to efficiently reduce the quantity of discharged effluent (Moller-Gulland, 2011). To reduce administrative, monitoring, and measurement costs, rather than using the quantity of the emitted effluents as a basis for assessing the discharge for taxation purposes, the authorities decided to use the volumes specified in the permits. Permits are issued only if the effluent to be discharged is kept as low as possible for the required process and with the best available technology. The tax is thus based on these permits, rather than on actual measurements. If the discharged quantity or concentration exceeds the level defined under the permits, the polluter will be fined.

One of the main factors for success in the implementation of effluent charges in Germany was their level, which was set high enough to incentivize effluent abatement efforts in several industries. When tax rates were defined, regional differences and levels of quality for bodies of water were also considered. The revenue generated from effluent charges returns to the budget of the Länder and the federal government does not have any access to those funds. The revenue is earmarked for investments in municipal sewage treatment facilities and the administration of water quality programmes. The administrative costs relating to effluent charges are subtracted from the revenues.

Despite the significantly positive environmental impacts of effluent charges, there are still challenges preventing even greater gains from the policy. For instance, the best available technologies are constantly changing. However, these changes are not matched by a corresponding increase in the effluent tax rate, which maintains incentives in innovation for abating residual pollution. In addition, charges are not adjusted to inflation, while the costs of mitigation and avoidance increase along with it, which also negatively effects their incentive function.

The Netherlands

The water management system in the Netherlands is characterized by comprehensive water quantity regulations linked with water quality regulations. The Netherlands water resources are under the control of the Ministry of Transport, Public Works and Water Management, and 12 provinces are responsible for water policy. State waters[40] are under the responsibility of the ministry, while regional water bodies are delegated from municipalities to water boards.

Problems related to water quality have become one of the major concerns in the Netherlands since the 1960s, due to the increased discharges of wastewater from industries, agriculture, traffic and households. Large amounts of heavy metals, pesticides, hydrocarbons and organic chlorine compounds were being discharged, causing the loss of indigenous species, the deterioration of water quality and the pollution of sediment (Warmer, 2002).

Actions to reduce water pollution in the Netherlands started in 1970, when the Pollution of Surface Waters Act (PSWA), came into force. According to the PSWA it was forbidden to discharge waste matter, pollutants or other hazardous substances into surface waters without a permit. For indirect discharges (via the sewage system) no PSWA permit was required. All direct discharges (industrial and household) to surface water bodies are subject to water pollution charges. These water effluent charges have been in place since 1971.

In general terms, effluent charges are calculated by multiplying the pollution load expressed in pollution units with the unit tariff. The charge rate differs across regions and varies for households, industries and defuse discharges.[41]

39 Especially in the construction, energy and chemical sectors.

40 Sea, rivers and large lakes.

41 The main causes of diffuse pollution of surface water are the extensive use of agricultural fertilizers and pesticides, and the corrosion of building materials.

In comparison with Germany, the main function of water pollution charges in the Netherlands was revenue-generating. Before 2000, revenues collected were used to subsidize the building of urban wastewater treatment plants. Since 2000, the revenues have been used to finance general water management.

Although, the main aim of water effluent charges was not environmental, Dutch water pollution policy is nevertheless considered one of the most successful in terms of environmental outcomes. Warmer (2002) indicates two main impacts of effluent charges. After setting the charges, in the period between 1971-1987, the pollution of oxygen-binding substances was reduced by 80 percent, despite increased economic activity. Reductions were especially significant for companies discharging in state waters. This can be explained by the significant share of generated revenues earmarked for pollution control. Furthermore, the Dutch system was cost-efficient, as it caused the industry to control more pollution at the source, and thus reduced the need for costly end-of-pipe treatment at public sewage plants.

Effluent charges in the Netherlands are considered some of the highest in Europe. The collected revenues are mainly used for the management of water resources, which also includes the monitoring of water quality and tax administration. The charges are set according to the "polluter pays principle", which provides incentives for polluters to reduce the level of their discharges. These factors can be regarded as crucial reasons behind the successful implementation of water pollution charges in the Netherlands.

TRADABLE POLLUTION PERMITS

There is a large list of substances that cause water pollution. It is a mistake to consider these pollutants as a single entity, as it is to employ a system for tradable water pollution rights for a combination of these substances. Since these substances might have different effects on a body of water and considering that together they will not maintain the necessary incentives for dischargers. Thus, the differentiation of substances generates the correct incentives and, furthermore, it becomes more flexible in controlling the amount of each pollutant discharged.

That is why tradable water pollution rights are generally differentiated according to the pollutant's substance or the class of substances. Oxygen depleting substances and nutrients (i.e. nitrogen and phosphorous) are regarded as the main sources of pollution that are controlled by the tradable water pollution permits. Only a few countries have experience in water pollution trading, and America is a key pioneers.

Fox River, in Wisconsin, US, is an interesting example, which points out the challenges and problems that are associated with the implementation of BOD control mechanism.[42] In 1981 the trading of rights to discharge at point sources that increase BOD was approved by the Wisconsin Department of Natural Resources (Kraemer, Kampa and Interwies, 2004). The aim of this program was to provide flexibility to paper mills and wastewater treatment plants (point sources), while meeting with state water quality standards (Kraemer, Kampa and Interwies, 2004). The polluters able to reduce discharges containing BOD below the capped amount, could sell their excess reductions to others, whereas plants which were unable to meet the cap were only allowed to purchase extra pollution amounts if they satisfied certain preconditions: (i) they were new and growing, or (ii) were unable to meet the cap due to working efficiency.[43]

Among the main challenges to establishing a market at Fox River Basin were the limited trade volumes. A lack of a compliance mechanism[44] is one factor which explains their restricted trade. Compliance mechanisms play a key function in trading schemes, without a proper evaluation, monitoring and non-compliance punishment mechanisms, polluters have a lack of incentive to reduce pollution levels or even to purchase extra pollution permits when unable to reduce their pollution levels. Hence, compliance mechanisms develop the correct incentives for stakeholders and encourage them to meet their cap. Stakeholders who are not able to meet their cap typically have to trade for additional pollution permits. However, at the Fox River Basin, due to the lack of compliance mechanisms, stakeholders were not encouraged to trade for extra pollution permits (Kraemer, Kampa and Interwies, 2004).

Restrictions to commerce are another factor that explains the limited trade at the Fox River Basin. Moreover, the limited number of participants (a few pulp and paper mills and two municipalities) and the uncertain nature of the benefits from trade, might also explain why the program was unsuccessful (Kraemer, Kampa and Interwies 2004).

42 BOD is a significant index, which measures the amount of the dissolved oxygen required for aerobic microorganisms in order to decompose organic matter in the water.

43 Working Efficiency is a measure of effectiveness, specifically it measures whether firms are performing in the best possible way, with the minimum resource waste. Hence, firms who experience low working efficiency use many more resources for producing a certain output than firms with a high working efficiency. Consequently, less efficient firms need permission for extra pollution.

44 Compliance mechanisms includes evaluation and monitoring of pollutants (whether pollutants comply with the rules or not), it also incorporates measures for non-compliance detection and punishment.

The Tar-Pamlico Basin in North Carolina (US) is one of the most positive examples of the successful implementation of pollution permits (Gannon, 2005). Fish deaths due to algal blooms made it necessary to control the level of nutrients in the Tar-Pamlico Basin. This was the principal reason the program was initially introduced. Different from standard programs, in which polluters only directly trade emissions from point sources, this program considers non-point sources. Specifically, economic incentives are created for farmers to reduce emissions of non-point sources. In this instance, the water quality trading scheme has a considerable advantage compared to other programs, as non-point sources are regarded as the main pollutants of water. The Tar-Pamlico Basin program consists of standard credit trading and funding of non-point source reduction. This program was implemented in three phases. In the first phase, point source dischargers created an association in order to meet a collective and declining cap for nutrients (1991-1994). During the next phase the collective declining cap was substituted for a steady collective cap, and concurrently requirements regarding non-point source reductions were also set (1994-2014). The last phase maintained the steady cap and reflected changes in association membership.[45]

In contrast to other schemes, trading at the Tar-Pamlico Basin includes credit trading among industries who discharge pollutants (point sources) into the water body. The collective cap is set by the regulatory authority and members of the association are allowed freely to trade in order to meet the collective cap. There are separate permits for association members indicating the collective cap instead of an individual limit. Thanks to the trading scheme, dischargers have the flexibility to discover cost-effective ways for meeting the cap and reducing nutrient discharge. When the association exceeds the collective cap, it has an obligation to finance the control of non-point sources. Therefore, there is a clear incentive that encourages association members to meet the collective cap.

One of the main advantages of the pollution control program at the Tar-Pamlico Basin has been the formation of the association to help meet the collective nutrient cap (the "bubble" approach). This method has encouraged informal trading between point source dischargers (Gannon, 2005). Even though very little trade occurred (because dischargers did not exceeded the cap), from 1991-2003 the overall nutrient loading declined by 33%. Furthermore, the cost of reducing the total nutrient loading was lower than expected. The cost of the program implementation was less than $2 million, while the estimated cost of the cap and trade approach ranged from $50 to $100 million (Gannon, 2005).

Members of the association have progressively installed nutrient removal equipment as they expanded, due to the significant penalties for non-compliance (Gannon, 2005).[46] In addition, members discharging effluents are responsible for weekly sampling and annual reporting to the Department of Environmental Management.

The cost of permits amounted to $56 per kilogram of nutrient during the first phase and declined to $29 per kilogram of nutrient during the second phase. The value needs to be revisited every two years (Gannon, 2005). Unfortunately, there are still challenges associated with the calculation of credit costs, since inflation and other factors have not been taken into account.

Overall, the Tar-Pamlico River Basin Program can be regarded as successful (during the first and second stages) as, even though too little trade has occurred, the nutrient load has been reduced. Unfortunately, due to a lack of available information, the results from the third phase cannot yet be judged.

SUBSIDIES AND PAYMENTS FOR ECOSYSTEM SERVICES

In this subsection we will present the various international experience associated with subsidies for water conservation and PES. We will omit the subsidies for pollution control funded by government budgets, because of their violation of the "polluter-pays principle", which is highlighted in the review of the economic theory. However, we will present a case in which pollution charges and subsidies can be combined.

45 The Tar-Pamlico Basin Association was established in 1989 to meet state goals. The association includes 15 members, who are responsible for approximately 99% of the point sources which flow into the river.

46 Initially, there was a consideration that if association members did not meet the cap they would only have to finance agricultural non-point sources. The program also aimed to expand the area of non-point sources and make it obligatory to finance not only the agricultural non-point sources control, but additionally those of other industries.

SUBSIDIES

Chinese Pollution Charge-Subsidy System

Hua Wang and Ming Chen (1999) discuss the charge-subsidy system used in China at the end of the 20th century. This system forced polluters to pay for the pollutants discharged into water sources. Charges were calculated for each pollutant discharged and the emitter had to pay the highest amount of those calculated. The levy collected was later used to subsidize firms' pollution control projects and other activities aimed at increasing environmental quality. If a firm, who paid levies to the levy fund, decided to invest in pollution abatement, a maximum of 80% of the levy paid by the firm could be returned as a subsidy to the investment proposed by the firm. The subsidy scheme included treating a variety of pollutants, with wastewater treatment taking the largest share in the total expenditures of pollution abatement projects.

Wang and Chen (1999) analysed the factors affecting the incentives of a firm investing in wastewater treatment facilities. As the authors could not obtain the exact subsidies granted under the Chinese pollution charge-subsidy system, they modelled subsidies as a function of different explanatory variables:

$$S = F\,(I_F,\ L,\ Z_g,\ Z_{F1})$$

Where:

S is the subsidy

I_F represents investments in wastewater treatment at year t

L is the levy paid

Z_{F1} represents firm's own characteristics

Z_g represents regional characteristics

The researchers showed that the combination of charges and the subsidies system together were indeed effective in providing incentives to industry firms for adopting the best management practices. By 1999 the real data showed that government subsidies were decreasing over the years, while firms were using their profits extensively for implementing the best management practices (Wang and Chen, 1999). The success of this policy can be ascribed to the fact that companies faced a cost for generating negative externalities and felt the need to reduce their level of pollution. Subsidies in this case were not additional resources paid to the companies (they were, in fact, amounts already paid by them), nor did they help increase the profits of incumbents or those of new entrants, therefore they were overcoming the main limitations of subsidies in fighting pollution.

Financial Incentives for Water Quality Protection and Restoration on Agricultural Lands in Pennsylvania

In 2010, the Environmental Protection Agency (EPA) published an historic clean-up plan to reduce pollution and restore clean water to the Chesapeake Bay and its watershed by 2025. This plan, the Chesapeake Bay Total Maximum Daily Load (TMDL), specifies pollution reduction goals for the seven jurisdictions in the watershed: Pennsylvania, Maryland, Virginia, Delaware, West Virginia, New York, and the District of Columbia. In Pennsylvania, by 2025, they are obliged to reduce nitrogen pollution levels by 34 million pounds per year; phosphorous levels by 0.7 million pounds per year; and sediment levels by 531 million pounds per year. As with the other jurisdictions, Pennsylvania is required to develop a series of three "Watershed Implementation Plans" (WIPs). In 2010, Pennsylvania expounded on its Phase 1 WIP, in 2012 its Phase 2 WIP, while Phase 3 WIP is currently under development.[47]

The agricultural sector remains one of the main polluters of water in Pennsylvania. In 2013, according to the analysis of the Chesapeake Bay Foundation, the leading source of nitrogen, phosphorus and sediment pollution to the Chesapeake Bay from Pennsylvania was agriculture activates.[48] Several strategies have been implemented for incentivizing agricultural operators to adopt the best management practices (BMPs) for water conservational purposes in their operations. The subsidies and cash incentives scheme constitute one of three strategies[49] used in Pennsylvania to promote the implementation of BMPs aimed at increasing water quality in the field of agriculture. The scheme includes grants, cost share programs and rental payments. These support measures directly link conservation activities to the disbursement of incentive payments. The main challenge with these subsidies is defining the precise amount that satisfies both sellers and buyers, and clears the market.

There are two groups of programs offering different types of assistance to their participants, in order to foster BMPs in the Pennsylvanian agricultural sector.

The first group is the Unites States Department of Agriculture (USDA) Farm Bill Programs, which has been offered to different American states since 2008 and was renewed once again in 2014.[50] This group includes three programs:

- Environmental Quality Incentive Program (EQIP)
- Agricultural Management Assistance (AMA) Program
- Conservation Stewardship Program (CSP)

47 www.dep.pa.gov

48 The Chesapeake Bay Foundation, October, 2013. Manure: Not the Leading Cause of Nitrogen Pollution to the Chesapeake Bay.

49 Subsidies and cash incentives, tax incentives, lending tools and insurance products.

50 www.nrcs.usda.gov

The US Department of Agriculture Natural Resources Conservation Service (NRCS) is the entity which governs these three financial and technical assistance schemes.

EQIP provides farmers financial and technical support to adopt conservational practices to "improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland." To be eligible for this support, farmers should not earn a yearly adjusted gross income (AGI) exceeding $900,000 and they must develop a plan which promotes the conservation of one of the natural resources mentioned above. Subsidies are transferred only after the plan is approved and the practices are adopted. The payments can reach a maximum of $450,000 per contract.

The AMA offers financial and technical assistance to operators in the agricultural sector to construct or improve water management or irrigation structures; plant trees for windbreaks; or, in order to improve water quality and mitigate risks; diversify their operation and conservation practices including soil erosion control; integrated pest management; or transition to organic farming. Persons or legal entities cannot receive more than $50,000 in AMA program payments per fiscal year. The requirement for this program is also to have a yearly AGI less or equal to $900,000.

While CSP adopts a "pay for performance" approach that means that annual payments are paid proportionally to the environmental benefit directly resulting from the implemented BMPs. By paying for performance, this program has greater potential than other cost share programs to result in actual reductions in pollution.

The issue of fund deployment in a reasonable manner, to serve actual conservational goals, has been identified as a crucial challenges in a program's implementation. In 2016, Pennsylvania's department of environment protection (DEP) released a strategy document, in which they explained their cooperation with the state Department of Agriculture, county conservation districts, local non-profits and outreach organizations, to monitor whether NRCS funds are truly used for the installation of BMPs in the watershed.

The document also mentioned that encouraging farmers in targeted regions to access these funds requires additional attention. Their recommendation was either to ensure assistance to farmers in preparing their NRCS applications, or to offer additional state funding coupled with NRCS grants.

Another group of programs go under the title Lease agreements and conservation easements. One of which is the Conservation Reserve Program (CRP), directed by the USDA Farm Service Agency (FSA), which transfers annual rental payments to farmers who ensure the enhancement of water quality by eliminating environmentally sensitive land from plantation and the production process. An expanded version of the program, the Farmable Wetlands Program (FWP) promotes wetland restoration. Under this scheme, farmers are compensated in return for planting native species to restore wetland buffer zones.

An extension of CRP is the Conservation Reserve Enhancement Program (CREP). The CREP program functions in Maryland. This federal-state partnership program "pays top dollar to landowners who agree to take environmentally sensitive cropland out of production for 10 to 15 years" and to implement BMPs in different areas of agriculture (for example, establishing watersheds, protecting highly erodible lands, etc.). Farmers have access to five types of payment: a signing bonus (up to $250 per acre), annual rental payments (significantly higher than the rates offered by traditional CRP), cost share assistance (up to 87.5% of the cost to install eligible BMPs), a one-time practice incentive payment (worth 40% of the total cost of establishing qualifying BMPs, in addition to the cost share), and mid-contract management payments (up to 50% of the cost to implement practices). Farmers are also helped with achieving regulatory compliance, which creates even larger incentives for participating in the program.

The main challenge in this case is connected with the lack of an appropriate tracking and reporting system. Such a system is required to account for experience and the instruction from the Chesapeake Bay Model, which could later be used to address existing problems or to install appropriate conservation practices in other locations.

In 2012, Pennsylvania achieved a reduction of 27% nitrogen, 31% phosphorous and 50% of the total suspended sediments from their 2025 TMDL goals.[51] Moreover, according to Pennsylvania's DEP report[52] the state has significantly reduced its nutrient discharges from point sources such as wastewater treatment plants and is also on track to meet its phosphorus reduction goals. However, Pennsylvania is still behind in achieving the federally-authorized TMDL goals for nutrient and sediment pollution (The Environmental Finance Center at the Univesity of Maryland, 2016).

51 The Pennsylvania Department of Environmental Protection. March 30, 2012. Pennsylvania Chesapeake Watershed Implementation Plan Phase 2.

52 The Pennsylvania Department of Environmental Protection. January 21, 2016. A DEP Strategy to Enhance Pennsylvania's Chesapeake Bay Restoration Effort.

The Oasis Project

The Oasis Project was established in three municipalities in Brazil, Apucarana, Sao Paulo, and Sao Bento do Sul. Although, the study we are going to discuss mainly concentrates on the Apucarana municipality due to the availability of data (Young and Bakker, 2014). The Oasis Project involved a PES for watershed protection through forest conservation. The main aim of the project was to create benefits for landholders who protected springs and forest on their properties. This project was coordinated by an NGO, the Foundation Group Boticario of Natural Protection (FGBPN) in association with sponsoring partners, like the Mitsubishi Foundation and the Water Supply and Sanitation Company of the State of Parana (SANEPAR), alongside municipal governments. SANEPAR was providing financial support, transferring 1% of the earnings obtained in a municipality, which accumulated in the Environmental Municipal Fund. Using the resources provided by the SANEPAR, municipalities were able to pay landowners. While technical support was provided by FGBPN.

The methodology that was used to calculate PES payments for watersheds was problematic because of various reasons:

- A lack of proportionality to forest conservation areas: Payments were paid based on the size of the property, without considering the different characteristics of a land. Moreover, they were paid equally to various stakeholders, even though the area dedicated to conservation was distinct
- The opportunity cost of the land was not taken into account. In the payment determination process, the value of land, when it was not dedicated to conservation, was not considered

Since there was no direct link between conservation areas and opportunity costs, distortions in the payment values have arisen. As a result, the program became very expensive, paying the highest possible values per hectare in comparison to other PES programs in Brazil. There were changes necessary therefore to the methodology. Since 2012, a new methodology (discussed in the theory section) is employed for PES payment calculation.

The Vittel Case

One of the most successful examples of a PWES program was initiated in 1992 by Nestlé Waters, a world leader in the mineral water sales. They faced the crucial threat of nitrate contamination threatening water quality in an aquifer in the Vittel area of France. The main objective of the PWES scheme was to encourage hay-based dairy farming without pesticides or chemicals. In this instance, Nestlé Waters are the buyers of the ecosystem service, and the intermediary body is Agrivair, which is responsible for negotiating and implementing the program, while farmers are the sellers. The scheme has been effective, and still functions successfully in the region.

Farmers participating to the program sign contracts with Agrivair covering18-30 years, and they are obliged to follow the conditions set by the program in order to benefit. Farmers receive up to 150,000 euros per farm to cover the cost of new farm equipment and building reconstruction. In addition, Agrivair pays farm workers to compost their fields every year. Free technical assistance is also offered to farmers to help them form annual plans and to join new social and professional networks. According to the contract, Nestlé Waters covers any of the farmers' potential land debts. However, the land obtained by Nestlé Waters is usufruct for up to 30 years, which means that they retain property rights on the land for a specified period. Besides which, farmers receive a subsidy of approximately 200 euros per hectare per year over a period of five years. This is a guaranteed income during the transitional period, which facilitates switching to the new practice of farming. The details of the contract such as the time horizon, the amount of guaranteed income during the transitional period, and the investment in farm equipment are negotiated with each farm independently.

To ensure compliance, Agrivair monitors farmers' activities and reviews their accounts, while Nestlé Waters controls water quality daily in their laboratory in Vittel. As the Vittel program was successful, it has expanded from the agricultural sector to the urban and industrial sectors around Vittel, Contrex and Hepar aquifers.

There are many significant explanations behind the success of the program. Firstly, in France, unlike in other developed countries (the USA, the UK), the treatment of bottled mineral water is prohibited. Therefore, no alternative solutions existed to address their nitrate pollution problems. Secondly, the number of farmers, and the catchment area, is small, thus the transaction costs are low (FAO, 2013), which ensures the cost effectiveness of the PWES scheme. Thirdly, an accompanying research program entitled 'learning by doing' considers farmers' long-term maintenance plans and helps stimulate farmers involvement in the process of identifying acceptable conditions for new production systems. Concurrently, the PWES program also assures participant farmers' all-time income, which includes guaranteed income from the company during the transitional period and also the further proceeds from hay-based dairy farming. As Nestlé Waters is a major employer in the region, various stakeholders' benefit from the scheme. Moreover, the establishment of Agrivair, as the main mediator and business partner in the implementation process, determined much of the success of the program. Finally, its success was also contributed to by successful participation and cost-sharing among the different stakeholders, who each shared a common vision.

The main challenge the scheme faced was opposition from farmers unwilling to participate in the program. Nevertheless Nestlé Waters, with the help of local farm communities, managed to persuade the opposing farmers to become a part of the scheme.

However, a Vittel-like scheme is likely too costly for public institutions to replicate, because PWES aimed at larger catchment areas can lead to substantial transaction costs and thus limit its applicability. Likewise, the success of the scheme is connected to its financing body, Nestlé Waters. In order to guarantee the quality of their product, they have their own interest in ensuring compliance with the water sectors' legislation and with EU standards, which is reflected by a subsequent increase in profits.

A Case Study of Munich

As a result of a slow but significant increase in the quantity of nitrates found in groundwater in Munich in 1991, the local water company, together with three Organic Farming Associations (OFAs), introduced a PWES scheme to farmers. They included compensation for lost income and for the investments required to switch to organic farming. To finance the scheme, the water company charged water users 0.005€ for each m^3 consumed. The company was responsible for preparation and contracting in the scheme, while the task of monitoring was allocated to OFAs.

The participating farmers signed an 18-year contract. For which, as financial incentive, the city offered farmers 280€/ha/year for agricultural land during the first 6 years, regardless of whether the land was owned or leased, with the amount declining to 230€/ha/year for the following 12 years. Those farmers interested had to register at one of the three OFAs in order to acquire an organic farming certificate and to receive their compensation (Escobar, Hollaender and Weffer, 2013).

Because of the high homogeneity of farms, the transaction costs associated with identifying, persuading and supporting the participating farms were relatively low. The positive results received from early adopters of organic farming helped expediate the process. Though, organic farms were not implemented in the whole targeted area immediately. Farmers who could not totally satisfy the requirement of organic farming, but were willing to start changing their practices, were given the status of "supporting members" and paid 200€/ha/year. The scheme was further supported by government incentives for the purchase of organic products.

The success of the program is reinforced by the fact that farmers involved in organic farming cannot move to conventional farming without facing substantial opportunity cost, therefore the resilience of the program is guaranteed. Moreover, there is a strong demand for organic products in Germany, so the idea of converting to organic farming is attractive for farmers. The increasing popularity of organic products has also helped reduce the transaction costs associated with finding and convincing farmers.

The outcome of the project is impressive: 80% of the targeted agricultural area was under contract, and by 2006, it had become the largest organic farming area in Germany, with a significant increase in water quality, with the level of nitrates decreasing from 15 mg/l to 7mg/l between 1992-2005. Notably, sufficient preliminary development and adequate time were clearly necessary to reach such a mutually beneficial result (Grolleau and McCann, 2012).

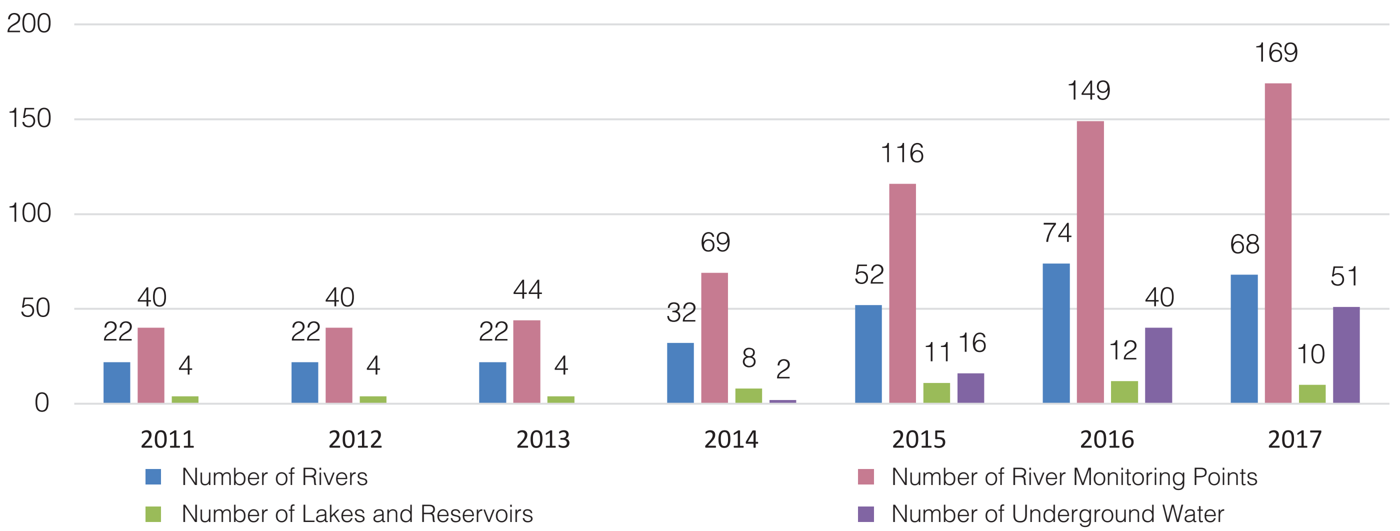
THE CURRENT SITUATION IN GEORGIA

Economic instruments for water resource management are not widely used in Georgia. At present, Georgia currently applies only abstraction charges on a limited number of activities, in connection with groundwater abstraction. Charges for surface water abstraction and discharge are not yet applied. Having signed the association agreement with the European Union in June, 2014, the country is now obliged to move towards integrated water resource management and to adopt the provisions of the EU Water Framework Directive (WFD). This entails a full-scale reform of the water management system, including the introduction of economic instruments for water resource management. Currently, Georgian water sources are grouped into two basins: the Caspian Sea basin (Eastern Georgia) and the Black Sea Basin (Western Georgia). After this reform, water sources will be split among six river basins. This section reviews the situation in Georgia's current water sector from the perspective of monitoring, availability of data, resource use patterns (abstraction and discharge), institutional structure and the supervision of existing regulations.

MONITORING OF WATER RESOURCES AND DATA AVAILABILITY

The systematic monitoring of water quality is a crucial aspect in the management process of water quality and quantity. It is vital for all activities of water management, starting from the planning of investments to the enforcing of regulatory framework. From the 1990s until 2012, there was a dramatic decrease in the scale and scope of monitoring water quality. Though, the situation has been gradually improving since 2012. However, insufficient monitoring remains a major challenge for Georgia's water management sector. According to the annual report of the National Environmental Agency (NEA) of Georgia only 68 large rivers are monitored out of more than 300. Furthermore, groundwater is monitored only at only 51 points (Figure 3). The proper implementation of economic instruments for water management will require a significant increase in water monitoring both for surface and underground bodies of water.

Figure 3. Water Quality Monitoring



Source: NEA. Annual Report, 2017

WATER USE

Georgia is well endowed with water resources, with an average water availability of 3,144 m^3 of accessible per capita per year (EPIRB/OECD, 2016). The overall quantity of water is not an apparent cause for concern, yet the existing resources are not equally distributed across the country. Georgia is divided into two river basins by the Likhi Range: the Black Sea Basin and the Caspian Basin. The Black Sea Basin is significantly richer with water resources than Caspian, with 75% of renewable water resources within the former. Due to the unequal distribution of resources, and to inefficient allocation and use of surface and ground water, consumers in the eastern part of the country currently still face water shortages.

According to the data provided by the Ministry of Environmental Protection and Agriculture of Georgia (MEPA), the current water use in Georgia is below its theoretical availability. The largest water source user (excluding hydropower production) is agriculture (41%), followed by households (33%), industry (25%), and fisheries (1%) (MEPA, 2016). Water extraction, use and discharge statistics are summarized by year in Table 5.

Table 5. Water Extraction,Water Use and Water Discharge (per mil. Cubic Meters)

	2012	2013	2014	2015	2016
Water extraction from natural water bodies, total	**29209.5**	**28632.1**	**32080.8**	**30615.9**	**37003.74**
from groundwater bodies	367.8	403.2	399	498.5	479.9
Water use, total	**28570.9**	**27436.8**	**30407.8**	**29831.5**	**35945.1**
for the following needs:					
Household	330.2	448.2	434.4	381.5	340.77
Industrial	362.5	324.6	1924	354.8	262.43
Irrigation, agricultural and other	27878.2	26664.0	28049.4	29095.2	35341.9
for irrigation (for available years)		155.642	226.047	4215.18	434.54
Wastewater discharge into surface water bodies, total	**27235.1**	**24144.0**	**30090.6**	**29202.4**	**34615.04**
of polluted water	475.3	438.2	477.7	93.4	158.5
Losses in water transportation	445.1	395.5	486.9	725.9	1058.64
Cycling and secondary water supply	224.0	309.0	316.0	226.8	190.3

Source: MEPA

Water abstraction is an unregulated in Georgia, subject only to provisions relating to the technical details of abstraction activities, set by the MEPA. There is no cadastre of water abstractors nor are details available regarding abstraction patterns. Consequently, it is hard to quantitatively demonstrate patterns of unsustainable abstraction in Georgia. However, several potential sources of future pressure on the water supply are clearly identifiable.

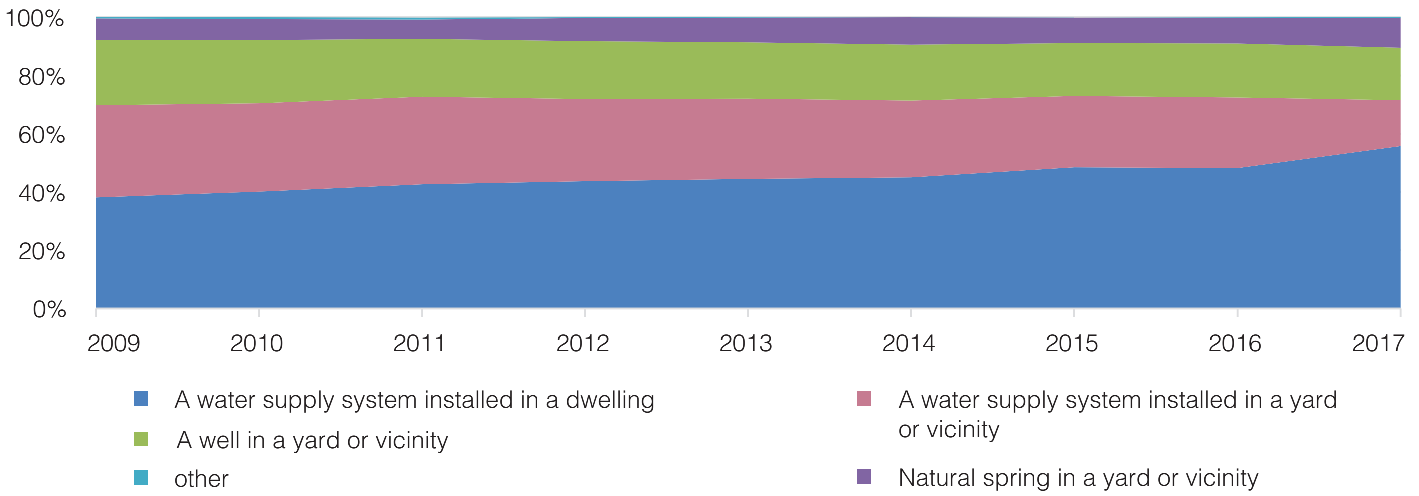
As previously noted, only a part of the Georgian population has uninterrupted access to drinking water. Furthermore, increasing levels of pollution of water resources, caused by untreated discharges of municipal and industrial wastewater, is also a highly problematic issue. To stimulate the country's agricultural development the government of Georgia is also planning the reconstruction and renovation of highly its deteriorated infrastructure, which will place additional pressure on bodies of water.

THE DRINKING WATER SUPPLY

The existing water infrastructure was mostly built in early 1950s and because of the low level of investment and poor maintenance it has been deteriorating over time. Moreover, increased transportation losses together with the higher demand for water are putting increasing pressure on the existing water resources.

According to the data, in 2017, from the Integrated Household Survey (IHS), only around 56% of households had a water supply system as the main source of sanitary-hygienic water installed in their dwelling (Figure 4). The percentage has been gradually increasing over the years (the same indicator in 2009 was only 38%), however it is still quite low. Significant differences exist between rural and urban households. For instance, 87% of urban households have a water supply system in their dwelling, unlike only 22% of rural households. In rural areas, the main sources of water for households are wells (30% in 2017) or water systems installed in their yards (27% in 2017).

Figure 4. Shares of Basic Supply Sources Giving Portable and Sanitary-hygienic Water (the whole country)



Source: IHS, Geostat

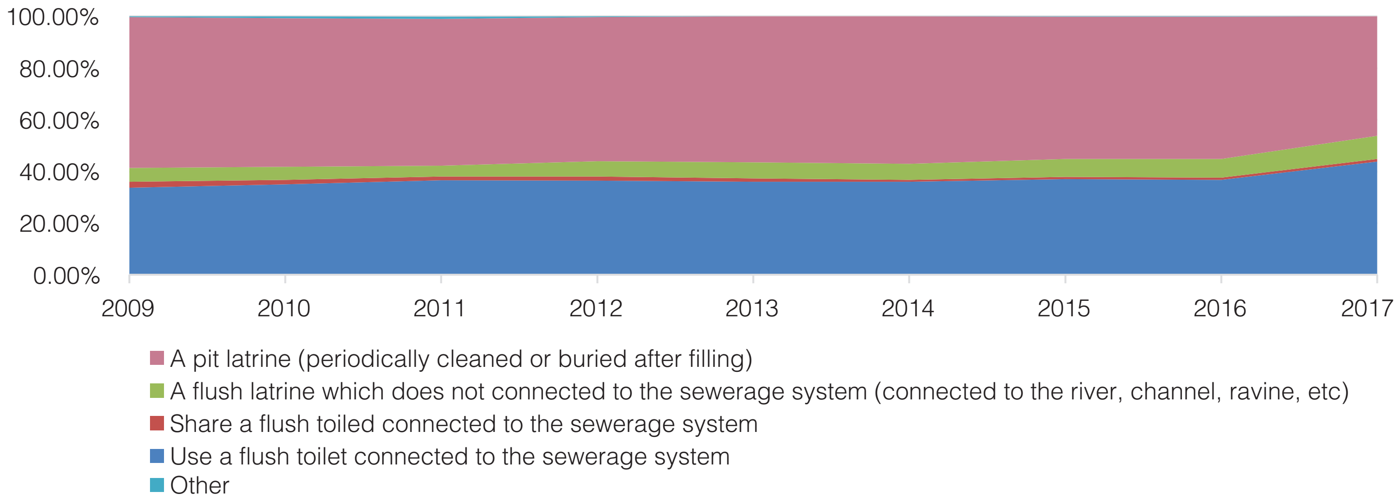
In Georgian households even a connection to the water supply system does not guarantee continued access to drinking water. According to United Water Supply Company of Georgia (UWSCG) (2017), several households connected to the water supply system do not yet have constantly available drinking water (with the exceptions of Tbilisi, and the Racha-Lechkhumi and Kvemo-Svaneti regions).

SANITATION

Even though the availability of water resources is not a major concern in Georgia, according to a report by the United Nations Economic Commission for Europe (UNECE, 2016), the water households receive is not always compliant with mandatory quality standards. According to the National Center for Disease Control and Public Health (NCDC), in 2017, 67% of the water supplied contained bacteria and, in some cases, also traces of pesticides.

Poor water quality in Georgia is widespread and the problem is only increasing. An important source of water pollution is the discharge of untreated sewage by water utilities companies. The impact of wastewater on the quality of bodies of water crucially depends on the way in which this water is discharged. According to the IHS data (2017), only 44% of the interviewed households across the country use toilets which are connected to the sewage system (Figure 5).The situation differs significantly between rural and urban households. In 2017, 78% of urban households had toilets connected to the sewage system, while in rural areas only 8% of households used the same system (showing very slow progress from 2009, when the share was 5.6%). In rural areas, most households (77% in 2017) use pit toilets which are periodically cleaned or buried after being filled.

Figure 5. Toilet Water Disposal (the whole country)



Source: IHS, Geostat

Despite the high percentage of urban households connected to the sewage system, only around 26% of wastewater is properly treated (UNECE 2016). Currently, sewage systems only exist in 41 towns and urban centres, although most of them are not functioning. The exceptions are Batumi biological wastewater treatment plants (WWTP) and Gardabani WWTP, which utilize mechanical pre-treatment.[53]

WATER SUPPLY AND SANITATION SERVICES

Water supply and sanitation services are provided by three local monopolies:

- **Georgian Water and Power (GWP)** – a private company, which operates in Tbilisi, Mtskheta and Rustavi
- **Batumi Water Company** – a state owned company, which operates in the Autonomous Republic of Adjara
- **United Water Company of Georgia** – a state owned company, which provides water supply and sanitation services to the rest of the country

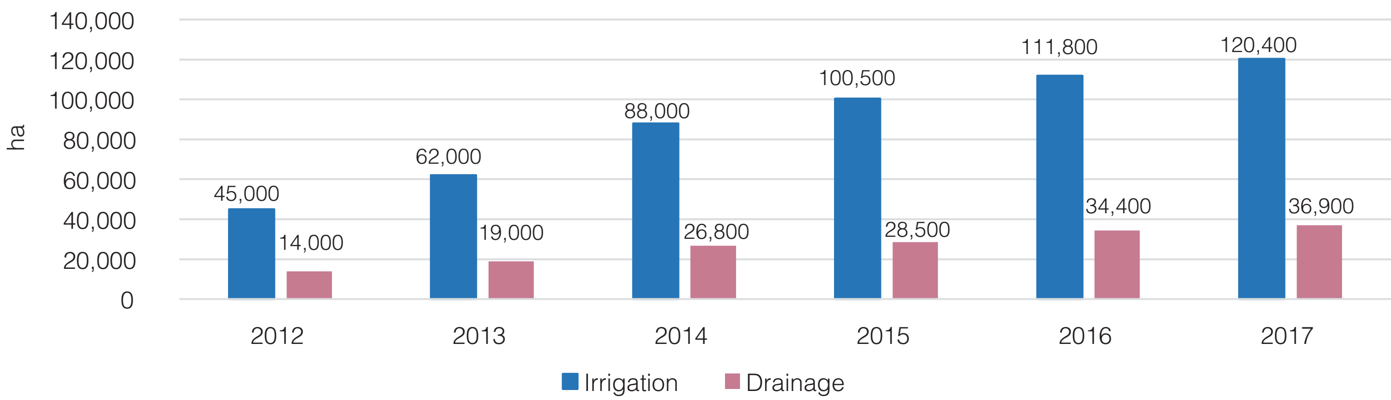
The Georgian National Energy and Water Supply Regulatory Commission (GNERC) has been regulating tariffs for these companies since 2007. The existing tariffs are different for commercial and non-commercial uses. Non-residential (industry, commerce and public institutions) consumers are obliged to have water meters and volumetric tariffs. Whilst, metered residential customers often pay significantly lower rates than commercial users (eight times lower for UWSCG consumers and sixteen times lower for GWP consumers). This reflects the significant cross-subsidization within the water supply sector. Currently, metering throughout the country is not overly developed and the percentage of households equipped with meters is still low, for instance, only 20% in Tbilisi and 50% for consumers of UWSCG. For those customers without water meters, a per person tariff applies.

53 In order to modernize, Gardabani WWTP- to make it compliant with provisions of EU WFD- was financed with 60 million GEL at the beginning of 2018.

IRRIGATION AND DRAINAGE

Development of agriculture is a key Georgian state priority. Both the irrigation and drainage infrastructure have deteriorated significantly since the 1990s. However, between 2012-2017 there was significant growth in both irrigated and drained areas, with an annual growth rate of 22% and 21% respectively (Figure 6). Further development of irrigation and drainage infrastructure is expected to create additional pressure on the country's bodies of both surface and underground water, although the renovation of the infrastructure and the application of new irrigation technologies are likely to lead to some gains in efficiency and have a positive effect on water abstraction.

Figure 6. Total Area Irrigated and Drained (per hectare)



Source: MEPA

The tariffs for irrigation are currently different in Eastern and in Western Georgia: In Eastern Georgia the irrigation tariff is 75 GEL per hectare per year, while in Western Georgia it is 45 GEL per hectare per year. The tariffs do not depend on the type of irrigated crop, on the number of times the land is irrigated during the year, or on the amount of water used. This creates incentives for using gravity irrigation, the least costly but also the most inefficient irrigation method. In addition, not all consumers pay for the irrigation services they receive, and enforcement is sometimes problematic.

Whereas, drainage costs 40 GEL per hectare per year and the tariff is the same throughout the country. Even though wastewater discharged from agriculture typically contains fertilizers and pesticides: according to the Ministry of Environment and Agriculture, agricultural wastewater does not require treatment, because the concentration of pollutant substances does not violate the standards of water quality. Discharges from the drainage systems into bodies of water are also not subject to any charge.

The revenues generated from irrigation tariffs are not enough for full cost recovery due to several factors: the low level of tariffs, the fact that tariffs are not based on true consumption, and the poor extent of tax collection. Therefore, it is necessary for the Georgian government to currently subsidize the sector, and the state finances both the capital, and the operation and maintenance costs of irrigation. Additionally, a large proportion of investment projects are implemented with the support of international organizations, such as the World Bank, the United States Agency for International Cooperation (USAID), the International Fund for Agricultural Development (IFAD), etc.

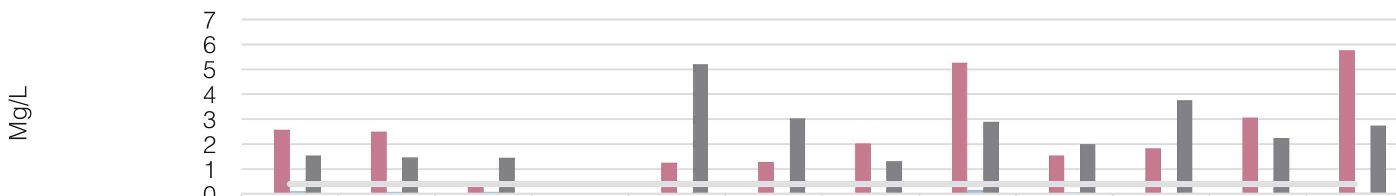
In the Irrigation Strategy for Georgia (2017-2025), developed by the MEPA and Georgian Amelioration (GA), notes that the current tariff structure is not efficient because: (i) it does not create incentives for farmers to use water more efficiently and (ii) Georgian Amelioration does not enforce farmers to pay their tax. In order to create a more efficient tariff system, the government of Georgia (GoG) is planning to change the structure of the irrigation tariffs. A new tariff requires two parts: fixed and variable. The fixed portion should be based on the area of agricultural land, within the local unit boundaries, while the variable portion of the tariff should depend on the volume of water delivered.

It is important to be careful when determining the weight of the fixed component of the tax. If the fixed part of the tax has a relatively high weight it would reduce incentives for the amelioration company to deliver a high quality service to the consumer, because a large part of their income will not depend on the efficiency of the water supply. On the other hand, a low weight fixed portion would reduce the guaranteed annual income for the company. While, the variable part of the tax would help stimulate farmers to cut their demand on water and to use water in the most efficient way. The tariffs are going to be set by the regulatory body considering their system's operating, maintenance and depreciation costs.

WATER POLLUTION

According to the UNECE (2016) report, the concentration of nitrogen compounds in Georgian rivers exceeds their acceptable normative values. As shown in Figures 7 and 8 below, the concentration of ammonium nitrogen and phosphates often exceed the Maximum Allowed Concentration (MAC) level in both the Caspian and Black Sea basins.

Figure 7. Concentration of Ammonium Nitrogen in the Black and Caspian Sea Basins: 2014-2016



	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4
Min in BSB	0	0.003	0.0001		0.001	0.001	0	0	0	0	0	0
Max in BSB	2.569	2.502	0.478		1.256	1.29	2.028	5.265	1.541	1.83	3.056	5.763
Min in CSB	0.109	0.086	0.078		0.031	0.025	0.047	0.156	0.062	0.016	0.039	0.054
Max in CSB	1.547	1.47	1.454		5.202	3.033	1.314	2.9	1.994	3.764	2.247	2.745
MAC	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39

Min in BSB   Max in BSB   Min in CSB   Max in CSB   MAC

Source: NEA monthly bulletin

Figure 8. Concentration of Phosphates in the Black and Caspian Sea Basins: 2014-2016

	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4
Min in BSB	0.02	0.033	0.019		0.006	0.001	0.009	0.001	0.006	0.003	0.003	0.003
Max in BSB	0.13	0.31	0.143		0.222	0.271	0.34	0.781	2.24	0.333	0.334	0.699
Min in CSB	0.001	0.001	0.001		0.001	0.001	0.001	0.001	0.001	0.001	0.021	0.015
Max in CSB	5.443	0.751	2.206		0.27	0.965	0.627	0.504	0.801	1.568	1.07	2.113
MAC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Min in BSB   Max in BSB   Min in CSB   Max in CSB   MAC

Source: NEA monthly bulletin

According to the MEPA, in 2016, wastewater discharges mostly came (excluding hydropower generation) from households (58%), followed by agriculture (33%), industries (6%) and fisheries (3%). Of the discharged water (excluding from Hydropower Plants (HPPs)), 36% did not require treatment- which implies this wastewater was not expected to violate water quality standards- a further 36% was already treated and 28% was untreated. From untreated wastewater, which negatively effects water quality, the highest portion came from households (97.8%), followed by industries (2.1%), fisheries (0.03%) and other sectors (0.04%).

THE LEGAL FRAMEWORK

Georgia adopted its Water Law in 1997. This law determines the main principles and objectives of the water policy and its main purpose is to ensure the protection and sustainable use of water resources. Aside from the Water Law, there are several other laws and regulations governing water resources in Georgia, including the Law on Subsoil, the Law on Fees for the Use of Natural Resources, the Law on Permits and Licensing, the Law on Mining, etc. After the Rose Revolution, Georgian environmental legislation went through major changes. For example, the Tax Code of 2004 abolished charges for environmental pollution, including on water pollution. While in 2015, several changes made to the Law on Permits and Licenses abolished the licensing system for water abstraction and wastewater discharges. Thus, economic instruments for water resource management are not currently enacted, with the exception of the commercial use of groundwater, and in other certain very specific situations.[54] Therefore, several gaps exist in the current legislation regulating water resource management. There is, for example, no coherent system for licensing, supervision or management of wastewater. The norms regulating water basins and water status are also decidedly lacking. The current legislation does not regulate how water quality should be improved nor how water resources should be allocated for more efficient uses.

A new draft Water Law has recently been devised, with the goal of closing the existing gaps, and to update the existing regulations in an appropriate way allowing for the current challenges to the water sector. According to the draft law, the water resources management system will include a wastewater management strategy, planning and control mechanisms for the protection of water resources, and their management at the national and river basin level. Management at the national level implies that the water resources will be organized and controlled under the national program of water use and protection, which has been developed by the state commission for water resources management, and has been approved by the Georgian government. The aim of managing resources at the river basin level is to ensure Georgian legislation in line with the EU water framework directive, according to which a river basin is the natural hydrological unit and requires a single system of water management. River basin plans indicates that the management and development of water resources occur within a given river basin. Thus, the use and allocation of water resources will be based on hydrological and meteorological data of the available water resources in a river basin, as well as on the characteristics and expected evolution of water demands. Plans for each river basin's management and development shall first be discussed by individual councils, to be created based on a territorial principle. Council members will be approved by the MEPA. The final plans for the development of river basins will also have to be approved by the Government of Georgia.

INSTITUTIONAL FRAMEWORK

Currently, the MEPA is the chief official body responsible for the management of water resources and for the development of a national strategy towards the sustainable management of water. It is also responsible for implementing policies and assuring compliance with existing environmental legislation. However, certain responsibilities are shared with other national and local authorities.

54 For example, a user charges for the water supply and sanitation in the form of water tariffs and irrigation water supply tariffs.

Table 6. Responsibilities of Subdivisions of Ministry of Environment and Agriculture and Other Authorities

Subdivision / Authority	Responsibility
The Water Resource Management Service	• Development of legislation • Organisation of river basin planning • Development of Policy • Implementation of EU-Georgia Association Agreement
The Department of Environmental Impact Permits	• Issuing permits for new development projects needing environmental ecological expertise • Ecological expertise for environmental permitting for surface water • Setting technical regulations and norms for surface water abstraction and wastewater discharges • The quality, quantity and destination of discharged wastewater
The Department of Environmental Supervision	• Monitoring of water pollution checking and compliance with the terms of environmental permits issued by the Ministry of Agriculture and Environment
The National Environmental Agency	• Monitoring surface and ground water quality and quantity.
The National and Technological Hazards Management Service	• Identifying the risks • Providing early warnings for extreme events
National Agency of Mines	• Regulation of groundwater use • Permits for groundwater use • Auctions for groundwater use
Other Institutions:	
The Ministry for Labor, Health and Social Affairs	• Establishment of national environmental quality standards (including for water)
National Food Agency	• Monitoring and state control of drinking water quality
The Ministry of Regional Development and Infrastructure	• Implementing policies, programs and regulations for the development of infrastructure of water supply, sanitation and flood protection
United Water Supply Company of Georgia (Throughout the country, excluding Tbilisi and the Autonomous Republic of Adjara)	• Management of water supply and wastewater drainage systems.
Georgian Water and Power (Tbilisi, Mtskheta, Rustavi)	
Batumi Water Utility (the Autonomous Republic of Adjara)	
The Georgian Amelioration	• Managing national irrigation and drainage infrastructure
The National Energy and Water Supply Regulation Company	• Regulates tariffs charged on drinking water supply, sanitation and irrigation

Source: OECD 2018, Author's review of institutional framework

As the table shows, responsibilities are spread across different agencies and departments, and there is no single authority fully responsible for sustainable water management. Water resources management in Georgia is recently highly centralized and local authorities have relatively limited responsibilities for the protection of local bodies of water. According to the Water Law, the main responsibilities of local authorities are to supervise the rational consumption of water, to ensure its protection within a local territory, and to fund the restoration works of local water sources if they have been damaged by natural disasters.

Even with the planned reform, some of the challenges associated with the implementation of economic instruments will remain. Specifically, the use of surface and underground water will still be regulated within the framework of two separate laws. The use of surface water will be managed in the framework of the draft Law on Water Resource Management and will remain under the responsibility of the MEPA, while groundwater use will be managed within the framework of the Law on Mining and under the responsibility of the National Agency of Mining (NAM), which in turn is under the Ministry of Economy and Sustainable Development (MoESD). This could pose a significant problem, as when defining and setting the economic instruments for water management close cooperation is vital for achieving proper sustainable water resource management. As discussed in the section on the theory of economic instruments for water management, it is important that prices for resource use are set correctly. This is true of both surface and underground water, as under or over-pricing of one "type" of water will lead to a distorted and sub-optimal use of all water resources and could potentially lead to unsustainable consumption patterns.

ECONOMIC INSTRUMENTS FOR WATER MANAGEMENT

As previously mentioned, other than the charges for abstraction and special use of water introduced in 1997 and eliminated in 2004, Georgia does not have any experience in using economic instruments for water resource management. All such charges were fixed rate based on water use and set in the law. However, their calculation did not follow any transparent methodology.

According to the new draft Water Law, water use will be divided into two categories: general water use and special water use. General water use implies consuming water for non-commercial needs, without special equipment, that can have significant negative impact on the quality of bodies of water. General water use is also free according to the Georgian legislation. In contrast, special water use is conducted with special equipment and can be expected to have a significant influence on a body of water. Special water use includes wastewater discharge and more than 20 m^3 extraction of water per day. Non-consumptive use of water (as with hydropower plants) require permit for water use, water extraction and for wastewater discharge. Special water use permits for surface water will be issued by the Ministry of Environment and Agriculture for a period of up to five years, apart from permits for special water use of centralized drinking water, which will be issued for up to 25 years. The holder of a special water use permit is obliged to use water only within the limits as specified in the permit.

There are already provisions relating to surface water abstraction charges in the Law on Fees for the Use of Natural Resources. However, these charges are not active due to a legal conflict within the legislation: according to the Law on Fees for the Use of Natural Resources there is a need to license water use, yet the Law on Licenses and Permits states there is no requirement for licenses to use bodies of surface water. The introduction of the permit system for surface water abstraction will remove the existing conflict and, therefore, surface water abstraction charges will be implemented again. Currently, surface abstraction charges are specified (with differing amounts) for two macro-basins i.e. the Caspian Sea Basin, and the Black Sea Basin and Black Sea water. In the future, they are likely to be defined at the level of the water basin.

Distinct from the surface water abstraction charges, groundwater abstraction charges have always been in effect in Georgia, as this activity requires licensing and thus no conflict arose within the legislation. Permits for groundwater abstraction can be issued for a maximum of 25 years. A license is only not required if the groundwater is located on private land and used only for household purposes. Charges for groundwater abstraction are set within the law. However, there is no transparent methodology from which the charges were calculated, and most of these fees are very low. Table 7 shows the charges tariffs for groundwater abstraction:

Table 7. Charge Rates for Water use

Bodies of Water and Their Use Categories	Fee rates (GEL / m^3)
Bodies of Surface Water	
The Caspian Sea Basin rivers, lakes and other reservoirs	0.01
The Black Sea Basin rivers, lakes and other reservoirs	0.005
Black Sea water	0.003
Use Categories	
Surface water abstraction for municipal and rural water supply	0.01
Water abstraction for thermal power production	1% of the base fee
Water abstraction for hydropower	0.01% of the base fee
Water abstraction for irrigation	1 % of the base fee
Bodies of Groundwater	
Freshwater for bottling	4
Freshwater for other commercial/industrial uses	0.005
Freshwater for municipal and rural drinking water supply	0.01
"Borjomi" Mineral Water Extraction	30
"Nabeglavi" Mineral Water Extraction	18
"Sairme" Mineral Water Extraction	6
"Utsera" Mineral Water for Bottling	4
"Utsera" Mineral Water for Spa use	0.04

Source: Law on Fees for Use of Natural Resources (2004)

INSTRUMENTS FOR WATER QUALITY MANAGEMENT

At present, Georgian legislation relies only on command and control policy tools- applied in a very limited manner due to the lack of resources for supervision and oversight- which do not contain any provisions about economic instruments for effluent discharge in bodies of water. Nevertheless, several fines are defined by the Administrative Offence Code of Georgia (Table 8) for effluent discharge in freshwater resources.

Table 8. Fines for the Pollution of Bodies of Water

Offence	Rate (GEL)
The dumping of waste into bodies of water	200 - 300
The discharge of industrial and household wastewater, also the discharge of drainage water, into a drinking water source or protection zone	400 - 600
The discharge of water pollutants in excess of the levels determined by the technical regulations	400 (For households) 1000 (For legal entities)
Freshwater pollution exceeding the levels determined by the technical regulations	500
Pollution of the Black Sea exceeding the levels determined by the technical regulations	1000

Source: The Administrative Offence Code of Georgia (1984)

Note: Fines for the pollution of the Black Sea can be higher in different cases. For example, a fine for pollution from ships can be as high as 65,000 GEL.

Furthermore, the legislation includes provisions on liability payments: companies are liable to pay for wastewater discharges if they constantly discharge wastewater with a higher than maximum concentration of pollutants. These payments are envisaged as a form of environmental compensation. The Department of Environmental Supervision at the MEPA is responsible to identify such polluters and requires them to pay compensation. The level of compensation depends on the damage caused by the wastewater discharge. The damage is calculated (ex-post) based on the following formula:

$$Y = K_s * K_a * P * A$$

where:

- **Y** damage expressed in GEL
- **K_s** coefficient showing how the pollutants entered the body of water. $K_s=1$ if the substance entered into water from the sewerage system owned by the polluting company and $K_s=0.5$ if the pollutant entered the body of water from the public sewerage system
- **K_a** coefficient showing the ecological condition of the body of water
- **P** amount of pollutants discharged (expressed in tonnes)
- **A** the normal rate of payment per tonne of pollutant substances (differs between pollutants)[55]

55 The charge is the lowest is for chlorides – 1 GEL per tonne, while the highest is for cyanide, phosphorus, copper, mercury, and phenol – 195,000 GEL per tonne.

Economic Instruments for Water Resource Management Among Trade Partners

Charging for water resources could have a substantial impact on Georgia's competitiveness. Therefore, understanding Georgia's trade partners pricing of water is vital to analyze the potential impact of imposing and/or increasing charges throughout the country, and for identifying the existing tradeoffs necessary to consider when designing optimal water management policies. Economic instruments, on the whole, should reflect the true value of water resources, so that their allocation over alternative uses maximizes the benefits for society. Thanks to the analysis of the impact of economic instruments for water management on the country's competitiveness, policy-makers can potentially devise and implement compensatory measures (for example, to reduce firms' costs by decreasing the burden from other taxes), which offsets, in part or in full, the negative effects of the economic instruments, thus restoring competitiveness.

Table 6 provides a summary of the costs of water resources for Georgia's major trading partners. Each country mentioned below was chosen for two main reasons: they are a major trade partner and are relatively similar in terms of economic development.[56] Geostat data reveals the significance of these countries:[57] during the first two quartiles of 2018, 56% of Georgia's total exports were directed to these six countries,[58] and 44% of the total imports were from these countries (with 15% of imports coming from Turkey and 10% from Russia).[59] However, not all these countries are similar to Georgia in terms of available water resources. According to the World Bank (2014),[60] among these countries the Russian Federation has the largest available renewable freshwater resource per capita, 29,982 cubic meters, while Georgia has 15,597 cubic meters. Whereas, the other listed trade partners report significantly lower values of the same indicator.[61]

Instruments used for water sector management differs among Georgia's main trade partners. For example, not all these countries charge for water abstraction or wastewater discharges. In most of these countries the consumers, abstractors and polluters are not charged with a unitary rate set across the whole country. Usually, the charge rates vary between regions and sectors. The lowest rate for surface water (as well as for groundwater) abstraction are in Bulgaria regions (0.001 GEL per cubic meter of abstracted water).[62] Drinking water supply tariffs are the lowest in the Russian federation (0.0007 - 0.002 GEL per m^3), and for residential customers the highest is found in Turkey (0.908 - 2.09 GEL per m^3);[63] as for non-residential consumers, the water supply tariff is the highest in Ukraine (1.07 - 4.53 GEL per m^3). Charges for wastewater discharge have been introduced only in Bulgaria, Azerbaijan and the Russian Federation. However, the tax base differs among these countries. For example, in Bulgaria the charge rate differs among pollutants (the more harmful the substance, the higher its rate), while in Azerbaijan the charge is volumetric (regionally varying between 0.15 - 1 AZN per m^3 of discharged wastewater).

In the Russian Federation, water pollution charges are imposed for 197 different pollutants. Their environmental authorities define enterprise-specific emission limit values (ELVs) for all applicable regulated pollutants. The ELVs are determined, using computerised dispersion models, on the basis of so called Maximum Allowable Concentrations (MACs). The MACs are set at levels that supposedly should cause neither immediate harm nor long-term negative effects on human health. The charge differs depending on how harmful the pollutant substance is, for example, for discharging BOD into a body of water the rate is 81 RUB per tonne, while phosphates are set at 1554 RUB per tonne.

56 According to the World Bank classification (2017) all trade partners (expect Ukraine – lower-middle) are in the upper-middle income country group.
57 http://geostat.ge/index.php?action=page&p_id=134&lang=eng
58 Armenia – 7.7%; Azerbaijan – 12.8%; Bulgaria – 8%; the Russian Federation – 13%; Turkey – 9.8%; Ukraine – 4.9%.
59 Armenia – 3.8%; Azerbaijan – 6.8%; Bulgaria – 2%; the Russian Federation – 10%; Turkey – 16%; Ukraine – 5.4%.
60 https://data.worldbank.org/indicator
61 Armenia – 2.360 m^3, Azerbaijan – 851 m^3, Bulgaria – 2,907 m^3, Turkey – 2,947 m^3 and Ukraine 1,217 m^3.
62 Though the rate varies across regions and sectors.
63 This tariff is for water supply and sanitation.

Table 8. Summary of Cost of Water in Main Trading Partners of Georgia[64]

Country	Economic Instrument	Tax Base	Unit	Charge Rate (native currency)	Charge Rate (in GEL)
Turkey	Water supply and sanitation tariffs	Amount of water used	M^3	1.32 - 3.04 TRY	0.908 - 2.09
Armenia	Drinking water tariff	Amount of water used	M^3	11.4 AMD	0.59
	Irrigation water tariff	Amount of water used	M^3	1.9 - 3.86 AMD	0.09 - 0.2
	Surface water abstraction fee	Amount of water abstracted	M^3	0.025 - 1.5 AMD	0.001 - 0.08
	Groundwater abstraction fees	Amount of water abstracted	M^3	0.005 - 1 AMD	0.0003 - 0.05
Azerbaijan	Drinking water tariff	Amount of water used	M^3	0.15 - 1 AZN	0.22 - 1.46
	Wastewater discharge fee	Amount of water discharged	M^3	0.15 - 1 AZN	0.22 - 1.46
The Russian Federation	Surface water abstraction charge	The amount of water abstracted from a body of water over a tax period (differs between rivers and lakes)	M^3	246 - 576 RUB	0.01 - 0.02
	Use of surface area of bodies of water	Surface area of provided water space	Km^2	28.20 - 34.44 RUB	0.012 - 0.015
	Use of bodies of water for hydropower purposes	Amount of electricity generated over the tax period	Kw/ Electric energy	4.80 - 13.70 RUB	0.0002 - 0.0006
	Use of bodies of water for the purposes of timber floating	Product of the amount of product of timber floated	M^3	1,454.4 - 1,705.2 RUB	0.06 - 0.07
	Groundwater Extraction Tax	Annual average capacity of extracting entity	M^3	300 - 678 RUB	0.013 - 0.3
	Water Pollution Charge	Standard charges are set for each component of the waste/pollutant, taking into account the level of their threat to the ambient environment and human health.			
	Water supply tariffs	Amount of water used	M^3	17.14 - 38.06 RUB	0.0007 - 0.002
Bulgaria	Groundwater abstraction charge	Purpose of water use	M^3	0.001 - 0.065 BGN	0.001 - 0.09
	Surface water abstraction charges	Purpose of water use	M^3	0.0008 - 0.75 BGN	0.001 - 1.09
	Wastewater discharge fee	Dependent on the pollutant	M^3	0.001 - 1 BGN	0.001 - 1.45
	Irrigation water tariff	Amount of water used	M^3	0.001 BGN	0.001
	Drinking water supply tariff	Amount of water used	M^3	0.02 BGN	0.03
Ukraine	Water supply tariffs (residential)	Amount of water used	M^3	0.17 - 0.6UAH	0.16 - 0.57
	Water supply tariffs (non-residential)	Amount of water used	M^3	1.14 - 4.81 UAH	1.07 - 4.53

Sources: The Ministry of Forestry and Water Affairs of Turkey; the Ministry of Nature Protection of the Republic of Armenia; the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan; the Tariff Council of the Republic of Azerbaijan; the Tax Code of the Russian Federation; the Bulgarian Ministry of Environment and Water;
the Tariffs for Water Abstraction, Water Use, and Wastewater Discharges in Bulgaria; the Tariff Reform in the Municipal Water Supply, Ukraine (2002).

64 Exchange rates are gives as the average exchange from 2017.

THE FEASIBILITY OF ECONOMIC INSTRUMENTS

There are a wide range of factors that can influence the feasibility of a given instrument within a specific context. Factors such as technical challenges, data availability, institutional capacity, enforcement capabilities, the number of water users, political acceptability, vulnerable groups of society, are each key. Alongside economic rationale, these factors can influence the choice of the instrument(s) necessary to implement. In this section, we will first examine the institutional arrangements that could be used to introduce and implement economic instruments in Georgia. Thereafter, we will individually discuss the feasibility of each economic instrument.

INSTITUTIONAL SET-UP

As noted in the chapter on the current situation in Georgia, surface and underground water use are regulated separately. Surface water use is managed by the MEPA. Whereas groundwater use is under the responsibility of the NAM, under the MoESD. The draft law on water resource management, in compliance with the EU WFD and expected to be legislated by the end of 2018, does not change this institutional set-up. Although the MEPA will be responsible for the ecological conditions of both surface and underground bodies of water, while the concession of the right to use groundwater resources will remain among the competences of the NAM.

The draft law introduces three new institutional bodies involved in water resources management: (i) Basin Organizations, (ii) Basin Consultation and Coordination Councils, (iii) and the State Commission on Water Resource Protection and Use. Basin organizations will be created, under the MEPA, in six Georgian river basins.[65] The responsibility of these basin organizations is to: (i) define the borders of the bodies of water within a basin, (ii) participate in the development of basin management plans, (iii) ensure the societal participation in the development of basin management plans, (iv) issue permits for surface water use, (v) creating registries of water users, and (vi) to monitor the implementation of basin management plans. Basin consultation and Coordination councils will be consultative bodies, created by the Ministry to ensure stakeholder participation in the development of basin management plans. Finally, the State Commission on Water Resource Protection and Use will be created under the government to develop a national strategy for water resource protection and use.

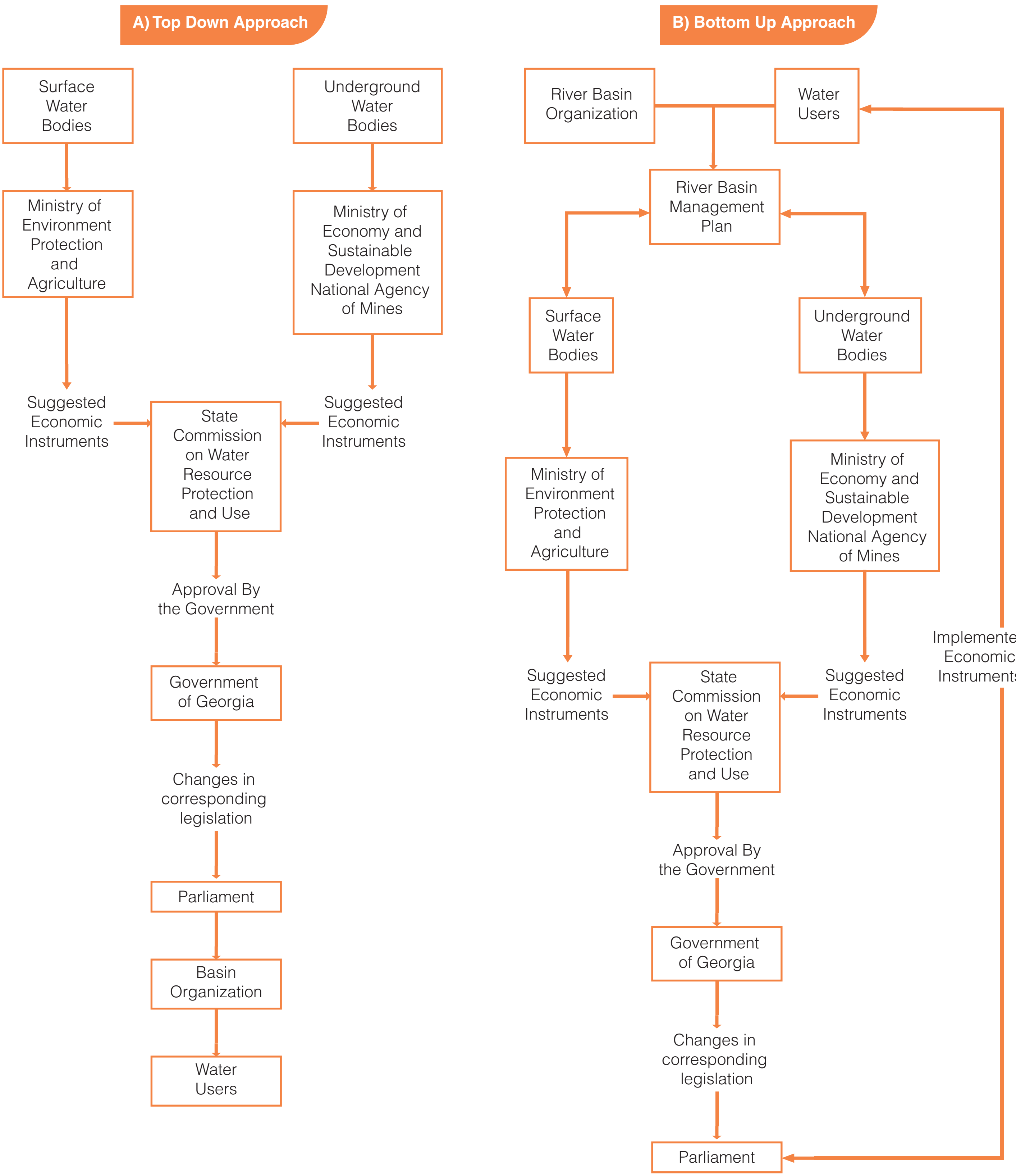
Considering the new institutional arrangement, economic instruments can be introduced with either (A) a top-down approach led by the central government, or with (B) a bottom-up approach led by basin organizations. In the top-down approach the central government will identify the economic instruments required either on a national, basin, or another territorial basis. In this case, economic instruments for the management of surface bodies of water will be suggested by the MEPA, while those for underground bodies of water will be recommended by the NAM. Proposed economic instruments could then be approved in the framework of the state commission on water resource protection and use. Thereafter, the approved economic instruments could be sent to parliament to implement the required changes in the relevant legislation (part A of Figure 9).[66]

A bottom-up process would be similar, although here economic instruments would be suggested within the economic analysis chapter of the 6-year basin management plan. Economic instruments in this instance could be implemented at the basin or water body level (within the same basin). Therefore, a bottom-up approach would not work for the introduction of common economic instruments at a national or a regional level. Nevertheless, a relative merit to a bottom-up approach is in the fact that economic instruments will be defined and implemented at the basin level, thus giving the opportunity to better consider local characteristics. Furthermore, as the basin management plan establishes a comprehensive review, data analysis and study of specific basins, it ensures that the economic section of the plan will have enough data to suggest the most efficient economic instrument. After suggesting an economic instrument and providing the corresponding support studies, the MEPA and the NAM could subsequently propose these economic instruments to the state commission for the government's approval and to parliament for legislative changes (part B of Figure 9).

65 These six river basins are: Alazani-Iori, Mtkvari, Khrami-Debeda, Enguri-Rioni, Chorokhi-Adjaristskali, Bzipi-Kodori.

66 Unless an economic instrument can be directly implemented with the government decree, in which case there is no need for parliament's involvement in the process.

Figure 9. The Institutional Framework for the Initiation of Economic Instruments for Water Resource Management



WATER ABSTRACTION CHARGES

It should be noted that after introduction of the new law on water resource management, surface water use will become a licensed activity, and the old charges (summarized in Table 4)[67] will again be applicable. Consequently, there will be a de facto operational economic instrument applied to surface water abstraction. As previously discussed, at this stage there is no clear methodology defining how these abstraction charges were calculated. Thus, it is unclear whether the amounts specified in the Law on Charges for Natural Resources Use are even appropriate. Consequently, it is advisable that the charges are re-assessed and, if necessary, adjusted. Attention should also be payed to the differences between abstraction charges for surface and underground water bodies, to ensure the sustainable use of the resource in each case. The current structure of charges, summarized in Table 4, seem to incentivize the use of underground water (once extraction facilities are in place).[68] For example, in the Caspian Sea Basin charges are the same for surface and underground water abstraction. While the difference in quality in most cases is large, water users have significantly smaller costs for the water treatment of underground water abstraction. Consequently, having equal charges creates incentive only for greater usage of underground bodies of water compared to surface water.

During the reassessment and redefinition of water abstraction charges, several of the following issues should be considered:

1. The main aim of the water abstraction charges – to create incentives for sustainable water resource use or recover the costs of water management
2. The geographical level at which water abstraction charges are going to be set – national, regional, sea basin, river basin or water body
3. The basis for water charges – with volumes stated in permits or using a metering system
4. The industries for which different charges might be applied – the drinking water supply, agriculture, industry, hydropower generation, and thermal power generation

Creating incentives for sustainable water use and recovering the costs for the management of water resources can also be the combined aim for water abstraction charges. From a feasibility perspective, using a pure cost-recovery principle as a basis for calculating water abstraction charges is simpler and, thus, more practicable. In this case, policy makers need to quantify the costs of water management and create rules for distributing these costs amongst various types of water users. In contrast, focusing on the environmental criterion will require the valuation of the opportunity cost for water resources use, which includes the cost of water management and other complicated quantifiable elements (such as negative externalities imposed on members of society). This is a significantly more data intensive process and requires more extensive expertise. The main difference, in this respect, between the two criteria, lies in the assessment of the true opportunity cost of water, beyond the pure management costs of the system. Setting abstraction charges that create incentives for sustainable water use also includes safeguarding the recovery of water management costs, while the charges levied according to the "cost-recovery approach" may be seen as a lower bound to "sustainability charges".[69]

Setting the new water abstraction charges entails reviewing the rates currently available in the legislation and deciding the appropriate values to be charged across the country. While this might appear the simplest approach for the government, as it seems to minimize the cost of coordinating with other stakeholders, yet one can anticipate that considering the various local characteristics of individual river basins and subsequently incentivizing sustainable water use, it will constitute a challenging task. It may be argued that, if the purpose is to create abstraction charges following an approach aimed at full sustainability, the process would benefit, in terms of feasibility, from a bottom-up institutional set-up such as the one discussed above. Such an approach would facilitate the collection of information and the incorporation of local stakeholders' knowledge in the process, allowing for better tailored and more efficient charges. Charges could be thus be calculated for river basins separately, within the framework of the basin management plan, and set in the 6-year period.[70]

67 Based on the Law on Charges For Natural Resource Use

68 Several stakeholders identified this as a potential challenge during a stakeholder consultation process. Furthermore, as both GNERC and the NAM mentioned during these stakeholder consulta tions, large commercial customers prefer to abstract water from underground sources, rather than to purchase it from water utilities providers due to high water tariffs.

69 The two types of charges coincide when there are no issues with scarcity.

70 With this approach charges can be calculated separately for different bodies of water, however this will be more data intensive and, relatively, less feasible.

The simplest way to implement water abstraction charges is seemingly to set the maximum volume that can be abstracted within a permit and set volumetric charge based on that amount. However, the apparent simplicity of the system hides a challenge. The public administration, in order to avoid over abstraction, would still need to put in place a monitoring and enforcement system, which might prove complex and costly (especially in the long-run) in the absence of metering. Alternatively, water users should have an obligation to install water meters and pay volumetrically based on the actual amount abstracted. Financially, using a metering system is costlier in the short-run. However, as mentioned, it might lead to savings in the long-run. Furthermore, water metering creates better incentives to save water, as users will not be paying for the water they did not abstract a situation that cannot be avoided when the charge is set based on a maximum amount to be abstracted.

Industry characteristics should also be fully considered, as previously discussed, when setting abstraction charges. Water users should be classified based on their industrial characteristics and regulatory framework. Specifically, abstraction charges could be separately calculated for:

1. Drinking water and the sanitation sector
2. Agriculture
3. Hydropower
4. Thermal power
5. Other industries

Drinking water and sanitation are subject to tariff regulation from the Georgian National Energy and Water Supply Regulatory Commission (GNERC). The current tariff methodology[71] in this sector allows the regulator to include the cost of water (i.e. abstraction charge) as a cost for the water abstractor. This enables utilities providers to transfer the expenses to their end customers.

Agriculture is more problematic, comparatively, in terms of applying abstraction charges. At present, a state monopoly, Georgian Amelioration (GA), is the largest agricultural water user in the country. GA tariffs are regulated by GNERC's decree and subject to fixed tariffs for Western and Eastern Georgia, without the option to transfer water abstraction charges onto consumers. Therefore, the implementation of water abstraction charges can be expected to create additional liabilities for GA and weaken its financial condition. In recent years, stakeholders have been discussing the design and implementation of a new regulatory framework for the irrigation sector, with GNERC retaining its regulatory functions, and the introduction of a new tariff methodology. According to the new methodology, water abstraction charges would be included among the appropriate costs for the company and the increased costs could, therefore, be transferred from GA onto its consumers. Therefore, the application of water abstraction charges to the agricultural sector may become feasible after the introduction of the new tariff methodology.

The upcoming regulatory framework also allows the possibility to include abstraction charges in tariffs for regulated hydropower and thermal power plants, although, theoretically, hydropower could be exempt from abstraction charges as they do not have a consumptive use of water. However, the fact that HPPs can alter river flows offers the rationale for subjecting them to the abstraction charge regime (under different rates). If abstraction charges will be set following a bottom-up approach, HPP charges for water abstraction may be decided at the basin level, considering local development priorities.

In general, implementing abstraction charges will have to be done with caution, balancing the need to incentivize sustainable water use and the concerns about the competitiveness of specific industries.

WATER MARKETS

To assess the feasibility of implementing water markets in Georgia we will refer to the water market's readiness framework developed by Wheeler et al. (2017).

The first step is understanding the contextual situation, the active legislative framework currently has several gaps in specifying property rights (ISET Policy Institute / G4G, 2017). The new draft law for water resource management specifies the responsibilities of different institutions for defining property rights within the different levels of each watershed's area. These are primarily rules for conducting commercial activities or land use within a watershed area, while the government remains the owner of water resources throughout the country. These responsibilities lie within

71 Decree #18 on the approval of tariff methodology for the water supply sector of 29 August, 2008, of the Georgian National Energy and Water Regulatory Commission.

the jurisdiction of basin organizations. However, dealing with this obligation might be challenging for basin organizations due to the issues with Georgia land registration.[72] Furthermore, there is no cadaster for water users, thus at this stage it is hard to identify the possible scale and potential gains from a market arrangement. Considering these challenges, it will be impossible to clearly define the property rights on water, unless cadaster for water users is established, which specifies detailed information on property rights for land and water consumption patterns (abstraction volume, type of industry, etc.).

The second step for the necessary framework concerns assessing market development and implementation. As there is no cadaster for water users, it is currently impossible to assess whether there is a large enough number of water users to merit a functioning water market. Thus, it is unclear whether gains from trade of a water markets could cover the cost of its implementation.

Ultimately, arranging water markets can be decided in the framework of basin management plans and after consultations with the water users. International experience identifies that functioning water markets around the world are the product of cooperation among various stakeholders within a basin. Consequently, arranging water markets ought to be decided at the basin level, and only after enough information has been collected.

WATER POLLUTION CHARGES

As with water abstraction, pollution charges can be implemented following either a top-down or a bottom-up approach. In terms of feasibility, analogous challenges can be also expected. These are: the availability of data regarding water polluters (a cadaster for water polluters), the type of effluents, and other discharge characteristics. Much like water abstraction charges, the government has to decide whether the main aim of charges is to generate revenue for the budget, or to create incentives for decreasing pollution. When setting water pollution charges, the impact on the competitiveness of different industries equally has to be considered.

However, there are also new challenges. Unlike in the case of abstraction charges, there are no legal provisions that will be activated with the introduction of discharge permits. Consequently, effluent charges will have to be introduced for the first time. Furthermore, there are substantial differences among the river basins in terms of their respective polluters[73]. Therefore, it is advisable to use a bottom-up approach to study the specific polluters by basin; to estimate the specific cost of pollution and the maximum tolerable level of pollution (in compliance with centrally defined guidelines); and to introduce the corresponding charges. Alternatively, charges could be introduced adopting a top-down approach at the national or a territorial level. Nevertheless, until a comprehensive study of effluent discharges around the country is performed (allowing the introduction of alternative charges, based on the effective amount of discharge), the main function of such an economic instrument can only be cost recovery for pollution monitoring and compensation for damage, for cases where a violation of the admissible discharge limits is verified.

Based on international experiences, the most feasible way to implement water pollution charges is to base payments on the maximum amount of discharge of specific effluent, as stated in a permit. However, this approach will not incentivize a decrease in pollution, nor the adoption of cleaner technologies, unless the maximum amount of acceptable discharges is set at levels below the current level of emissions. For this purpose, other economic instruments, such as subsidies for environmentally friendly technologies can be used alongside effluent charges. The most feasible way to further maximize this incentive over time, is to ensure a comprehensive review of total admissible pollution charges, and for each pollutant, in the planning period for every basin. Such charges can increase for effluents which threaten the improvement of the water status of a basin.

Water pollution charges can be separately introduced for different industries. Considering the current situation, in which urban wastewater treatment is developed for very few Georgian settlements, it is vital to disaggregate the charges based on industries. The following types of industries have to be discussed separately:

1. Urban wastewater treatment
2. Agriculture
3. Other sectors

For urban wastewater treatment, the introduction of pollution charges could be offered after the expiration of the transitory period, during which water suppliers are required to set up WWTPs.[74]

72 Presently, Georgia still has problems with land registration, as, in the past, much private land, with poorly defined borders, was not registered in the cadaster, which creates property rights disputes between landowners and the government.

73 For example, in Khrami-Debeda the basin is substantially polluted from the nearby gold mines, while in the Enguri-Rioni Basin, one of the large polluters is the manganese mines.

74 A version of the draft law, available to the research team, states that urban water suppliers are obliged to have WWTPs after 2021.

For agriculture, introducing charges for water pollution at the level of the polluter is impossible, as agricultural activities are characterized, mostly, by non-point discharges. To control agricultural pollution policy-makers could introduce different mechanisms for fertilizer and pesticide control. This could include economic instruments such as: charges on pesticide use or subsidies for environmentally friendly practices.

Lastly, water pollution charges should apply to the remaining sectors, based on the type of effluent discharged.

Introducing water pollution charges will require a significant initial investment in order to identify major polluters and to understand their impact on the quality of water. This will require investment in current monitoring technologies and the training of human resources involved in the sector.This will allow the computation and introduction of pollution charges by type of industry and by effluent. In the second stage, it will be vital to improve the capacity of the department of environmental supervision to ensure the effective detection (and hopefully the prevention) of excessive water pollution. Together with the continuous updating of water pollution charges this will reflect the evolution of pollution patterns and of environmental goals. For pollution charges to function efficiently it will also be vital to keep administrative costs associated with this economic instrument at the lowest level possible.

TRADABLE POLLUTION PERMITS

The introduction and implementation of a tradable pollution permit system would require significant data gathering and analysis. The current pollution patterns in basins have to be studied for this economic instrument to function well. Furthermore, it is important to understand their sources and to design markets for pollution permits. In Georgia this could be done at the river basin level, through agreement with stakeholders during the basin planning phase.

A general overview of the current situation in the country shows that, at this stage, this economic instrument might not be yet feasible. A major current polluter of water is urban wastewater discharge (UNECE, 2016). Thus, as all Georgian water utilities providers are regional monopolies, the benefits associated with the trading of pollution permits is not likely to emerge for, most, discharged wastewater. For industrial discharges, it is important to produce a cadaster for water users, in order to have a clear understanding of the possible scale of the market and of its feasibility. Crucially, the possible gains from such a market arrangement should overweight its administrative costs. If the number of potential water polluters is too limited, the market arrangement may not create sufficient gains to justify its introduction. Equally, having variability in the size of firms is problematic, where the biggest players will have the opportunity to gain market power at the expense of the smaller ones. For instance, such problems could appear in the Georgian mining industry.

SUBSIDIES AND OTHER PAYMENTS

From a feasibility standpoint, the implementation of subsidies or (government funded) payments for environmental services is subject to state budget constraints. In Georgia, the government is limited by a law[75] which maintains public expenditure to a GDP ratio below 30%. As the effective ratio is normally very close to this limit, introducing new subsidy schemes is always problematic. In addition, over the past several years, water management has not been a priority for the government. Thus, the launch of subsidy schemes is unlikely. Though, as previously suggested, revenues from abstraction and pollution charges could be used to subsidize positive externalities in water management, if these resources were earmarked specifically for this purpose. However, at this stage all state revenues are accumulated in the central budget, and only afterwards distributed among specific expenditures.

However, before introducing new subsidy schemes, an important first step to improve the efficiency of the water management system would be to reconsider the existing subsidization and cross-subsidization schemes. The current regulatory framework in the water supply sector allows the regulator to use cross-subsidization between commercial water consumers and households (where commercial water consumers cross-subsidizes households water supply tariffs). This policy clearly supports households' overconsumption and inefficient water wastage. Resultingly, there has also been increased pressure on bodies of groundwater, as many large industrial water users switched from centralized water utilities to individual abstraction. Furthermore, the Georgian agricultural sector has many different subsidy schemes which support the increase in production and the development of the sector.

75 The Law on Economic Freedom.

Additionally, water management considerations will have to be considered for all these programs; to ensure that they do not support over abstraction; the inefficient use of water resources; or the use of those chemicals (pesticides, fertilizers, etc.), which can significantly and negatively influence the quality of water in Georgian water basins.

Overall, introducing Payments for Ecosystem Services appears the most feasible and promising option, especially within each basin. At the basin level, stakeholders could reach mutually beneficial agreements leading to improvements in water quality, which are not funded by the central budget. This could be facilitated by the adoption of a more decentralized (bottom-up) approach in water management, as well as with a support framework, encouraging private or private-public basin-level agreements, via fiscal benefits, distribution of information concerning water quality and pollution patterns and so forth. With access to detailed information and low transaction costs, private agents would be optimally placed to implement mutually beneficial programs, potentially leading to both improved environmental quality and improved well-being in the basin.

RECOMMENDATIONS

This policy paper discussed all the major economic instruments used to incentivize the sustainable use of water resources. After reviewing the feasibility of each economic instrument, conclusions can be drawn on the recommended policy options at each stage of Georgia's developing water resource management. This section summarizes our major conclusions and recommendations for the implementation of economic instruments for water resource management in Georgia.

These general recommendations focus on:

1 Institutional structure

2 Data collection, monitoring and supervision

3 Implementation of economic instruments

4 Regulation of surface and underground water bodies

5 The evolutionary stage of the water management system

To incentivize sustainable use of water at a basin level, it is generally advisable to adopt a **bottom-up institutional structure** (Figure 9, part B). The initiation of the process for the definition of economic instruments at a basin level is essential to ensure all relevant information regarding basin characteristics and local challenges is fully considered. However, introducing this institutional structure will require:

- Well-organized and structured involvement of the different water users in the basin planning process
- Gathering of large amounts of data at a basin level
- A comprehensive study of environmental and socio-economic conditions within a basin

Producing a high-quality basin management plan requires a substantial amount of data gathering and collection. This creates the need for additional governmental investments to improve, and increase, data collection and monitoring in basins. Furthermore, for basin management planning it is vital to create a cadaster for water users, including information about their major characteristics, such as: the type of industry, firm size, abstraction/discharge volumes, etc. Without a sufficiently informative cadaster for water users and adequate data, it will be impossible to effectively introduce economic instruments which aim to incentivize the sustainable use of water. However, before the introduction of economic instruments, it will be important to evaluate their possible impact on water users and on the rest of society. The availability of reliable data is thus vital to perform this exercise. Moreover, to ensure the proper implementation of economic instruments, it will be vital to invest in the department of environmental supervision. These investments will be essential to minimize the risk of violations or the avoidance of economic instruments.

Given the current legal framework and the feasibility of various economic instruments, after the introduction of the new law, it will be crucial to review abstraction charges for surface and underground water bodies. At this stage, water abstraction and pollution charges appear to be the most feasible economic instruments. However, their review and the creation of a system, which regularly updates, will be essential to ensure incentives for sustainable water use are created. Furthermore, it is advisable that a transparent methodology for the valuation of water and the calculation of water abstraction charges is introduced. This will ensure a consistent approach among the river basins and ensure that the charges effectively incentivize sustainable water use. The definition of a clear methodology and approach towards calculating abstraction charges will also facilitate more constructive discussions among the stakeholders within a basin.

The introduction of water pollution charges will be more challenging, as there is no legal framework nor any past experience administering such charges. However, the introduction of these type of instruments- vital in the "polluter pays principle", which ensure the efficient management of water quality- is perfectly feasible, as shown by various international cases. The adoption of a transparent methodology and the collection of a significant amount of detailed data on effluents and polluting industries will be significant in the successful implementation of this instrument.

There are two important aspects to be considered for the implementation of both abstraction and pollution charges: (i) substantial initial investments will be important to introduce these economic instruments; (ii) thereafter, the administrative costs of implementing these instruments must be kept at the lowest possible level.

Finally, cooperation is essential between the agencies regulating surface and underground water use. Specifically, the NAM and the MEPA will have to cooperate within a basin's existing management planning framework, in order to introduce economic instruments that do not incentivize imbalances that place pressure on either of the two types of water source. To facilitate this, the current legal framework itself will have to be reviewed, as it presently motivates the exploitation of bodies of groundwater.

As time passes and experience, data, and resources increase, the assessment of the feasibility and relative desirability of each instrument should be updated. The table below provides a schematic assessment of the feasibility of economic instruments, considering three different time-horizons: short, medium and long-term. For instance, market based solutions (trading and private payments for environmental services) can be expected to become potentially feasible in the medium-term, while the feasibility of subsidies and publicly funded PES might remain impractical, due largely to financial constraints, even in the long-term.

Table 10: Feasibility of Different Economic Instruments

Instrument	The Assessment of Feasibility
Short-Term (1st Planning Period – 6 years)	
Water Abstraction Charges	• **Legal Framework** – a review of the old provision in the law on charges for natural resources is needed. New methodology for calculating abstraction charges will be required • **Data Availability** – there is no data on the supply and demand characteristics within basins, nor data on water management costs within basins • **Administrative Burden** – will require coordination among different actors within basins and the central government. From an institutional perspective allocating charges will be needed. An increase in capacity of the monitoring (NEA) and supervision agencies (DES) to ensure proper implementation of charges • **Human Capital for Implementation** – hiring experts for water valuation will be needed. Additional training for staff of basin organizations necessary to facilitate the coordination process within basins. Hiring additional staff for monitoring and supervision might be required • **Public Finance** – the costs for hiring new staff for the monitoring and supervision of charges. Hiring consultants will increase costs. However, donor funding can be retrieved for technical assistance in the development of a methodology for charges and performing work in calculating abstraction charges. The instrument will increase government revenue, as charges will be reintroduced • **Overall Assessment of the Instrument** – the most feasible instrument in the short-term is to address the "beneficiary pays principle", as earlier provisions are already given, and it is relatively simple to implement
Water Pollution Charges	• **Legal Framework** – will have to be developed to enable the use of economic instruments for water pollution. A methodology for setting water pollution charges will have to be developed • **Data Availability** – there is no data on the types and characteristics of water pollution. Nor any data / cadastre for water polluters • **Administrative Burden** – will require coordination among different actors within basin and the central government, while developing a framework for water pollution charges. Coordination will also be important while implementing pollution charges • **Human Capital for Implementation** – experts will have to be hired for developing the methodology for water pollution charges and performing necessary calculations. Require the hiring and training of the staff for improving the monitoring (NEA) and supervision (DES) of water pollution charges

	● **Public Finance** – the costs for hiring new staff for the monitoring and supervision of charges. Hiring consultants will increase costs. However, donor funding can be retrieved for technical assistance in the development of a methodology for charges and performing work on pollution charges. The instrument will increase government revenue as new charges will be introduced ● **Overall Assessment of the Instrument** – the most feasible instrument in the short-term to address the "polluter pays principle"
Medium-Term (2nd Planning Period – 6 - 12 years)	
Water Abstraction Charges	● **Legal Framework** – assuming no changes in the current framework of charging the use of natural resources, the methodology for calculating abstraction charges might be reviewed to implement more advanced practices ● **Data Availability** – consistent data gathering after the 1st planning period will significantly improve data availability ● **Administrative Burden** – can decreased due to greater prior experience implementing and administering abstraction charges. Coordination among the main actors will become easier ● **Human Capital for Implementation** – increased capacity among the main actors implementing the instruments can potentially improve the charging system ● **Public Finance** – the increased human capital might decrease the need for external expertise and technical assistance. Increased efficiency in implementing the instrument might decrease the overall administrative cost of the charging system. The government revenue will potentially increase ● **Overall Assessment of the Instrument** – the most feasible in the medium-term, as past experiences will have accumulated in the sector
Water Markets	● **Legal Framework** – after the implementation of abstraction charges, available data on water users can enable the creation of a workable legal framework for the creation of water markets. However, the law on charges for natural resource use should exempt market participants from water abstraction charges ● **Data Availability** – in the medium-term, a significant amount of data can be gathered about water users to identify possible gains from trade on water markets ● **Administrative Burden** – water markets will require the creation of different institutions that will enable coordination and trading among water users. Thus, the administrative burden will increase ● **Human Capital for Implementation** – implementation will require capacity building for water users, public servants and staff administering water markets ● **Public Finance** – the impact of water markets is uncertain and will depend on the property rights arrangement of water resources. In case the government remains the owner of water resources, the public budget might receive royalties, otherwise the budget revenue will decrease due to a decrease in abstraction charges ● **Overall Assessment of the Instrument** – a water market can be introduced in the medium-term, within different bodies of water, conditional on the extent of potential gains from trade
Water Pollution Charges	● **Legal Framework** – considering experience from implementing water pollution charges in the 1st planning period, the calculation methodology might require review and renewal ● **Data Availability** – data should be available on water pollution characteristics, the types of pollution and the polluting industries ● **Administrative Burden** – the administrative burden might decrease due to increased experience in the implementation of water pollution charges. Coordination among different institutions and water users involved in the sector can improve

	• **Human Capital for Implementation** – increased capacity among the main actors implementing the instruments can potentially improve the charging system • **Public Finance** – the impact on the government revenues from water pollution charges is uncertain. However, the costs of administering water pollution charges will decrease • **Overall Assessment of the Instrument** – the most feasible in the medium-term to incentivize a decrease in water pollution, also experience will have accumulated since the 1st planning period
Tradable Pollution Permits	• **Legal Framework** – after the implementation of water pollution charges, available data on water users can enable the creation of a workable legal framework for the creation of a tradable pollution permit system. However, the legal framework on pollution charges should allow exemptions for water users involved in the tradable pollution permit scheme • **Data Availability** – the data gathered for development and implementation of water pollution charges can be used for assessing the potential for a tradable pollution permit system. However, data on water discharge characteristics must be detailed • **Administrative Burden** – the implementation of the instrument will require setting up infrastructure to operate the market, such as institutions enabling coordination and trading among water users • **Human Capital for Implementation** – operating a market for tradable pollution permits will require capacity building for water users, public employees and staff involved in market operations • **Public Finance** – the exemption of water user involved in a tradable pollution permit scheme will decrease government revenues. However, revenues might also increase through the introduction of fees / royalties on the market. Setting market infrastructure will require investment from the state budget • **Overall Assessment of the Instrument** – tradable pollution permits can be introduced in the medium-term within different bodies of water conditional on the potential gains from trade
Payments for Environmental Services	• **Legal Framework** – significant legislative amendments have to be made throughout a wide range of laws to enable the transfer of payments from water polluters to water users. Legislation has to be in place to create water resource funds and other institutions are needed for a functioning system of payments for environmental services • **Data Availability** – much data will be required to identify the generators of environmental services and to identify the valuation of the positive externalities they generate • **Administrative Burden** – very high capacity and technical assistance to the public sector will be required to create a functioning PES system. Furthermore, administration of this system might create significant costs • **Human Capital for Implementation** – the implementation of a PES schemes will require significant capacity building both among public employees and water users • **Public Finance** – depending on the payment scheme, whether it will be (i) private, (ii) public, or (iii) public-private, there will be an impact on the state budget. The introduction of a public, or public-private payment scheme might require significant public expenditure • **Overall Assessment of the Instrument** – introducing the instrument might be feasible in the medium-term, depending on the existence of a legislative framework enabling private actors to implement PES schemes. The feasibility of a "government-initiated" PES is unlikely, because of its data and funding requirements

Long-Term (3rd Planning Period – 12+ years)

Water Abstraction Charges	• **Legal Framework** – for water abstraction charges, including methodologies for calculating abstraction charges, can be improved throughout every planning period • **Data Availability** – the extent and quality will improve over time • **Administrative Burden** – it is vital to keep the administrative burden of abstraction charges as low as possible to ensure efficiency of the instrument • **Human Capital for Implementation** – in the long-term the capacity of public employees at a basin level will improve to ensure efficient implementation of abstraction charges • **Public Finance** – with clearer rules and an increase of water users, state revenues from abstraction charges might increase • **Overall Assessment of the Instrument** – to ensure proper operation the instrument it has to be refined periodically
Water Markets	• **Legal Framework** – in case water markets are implemented in the medium-term in several bodies of water, the legal framework, in the long-term, can be renewed to consider past experiences • **Data Availability** – data gathering and its availability will be vital to identify new bodies of water where water markets can be introduced • **Administrative Burden** – the administrative burden should decrease to ensure efficiency and to increase the gains from trade • **Human Capital for Implementation** – over the long-term, experience will have accumulated for those bodies of water where market will have been functioning since the 2nd planning period • **Public Finance** – conditional on the government retaining ownership of water resources, it is unclear what the impact will be on the state budget from an increase of water bodies where markets are implemented. This will depend on the extent of royalties from water resources to be received by the state • **Overall Assessment of the Instrument** – the feasibility of water markets increases in the longer-term, as more detailed data and more experience is accumulated in water resource management
Water Pollution Charges	• **Legal Framework** – for water pollution charges, including methodologies for calculating abstraction charges can be improved throughout each planning period • **Data Availability** – the extent and quality will improve over time. It might enable the charging of different effluents which have impacted on water quality • **Administrative Burden** – implementing water pollution charges will become easier in the long-term as experience on its operations will have accumulated • **Human Capital for Implementation** – in the long-term the capacity of public employees responsible for monitoring and supervision of the instrument will increase • **Public Finance** – the impact of water pollution charges on the state budget is unclear in the long-term. Increases in the number of effluents to be charged will have a positive impact on the revenue. However, decreasing pollution patterns (the main aim of the instrument) will have a negative impact on the revenues compared to first years of its implementation • **Overall Assessment of the Instrument** – in the long-term there is an opportunity to improve administrative and management practices of the instrument, thus its performance in decreasing water pollution

Tradable Pollution Permits	• **Legal Framework** – in case tradable pollution permits are implemented in the medium-term in several bodies of water, the legal framework can be renewed in the long-term to consider past experiences • **Data Availability** - data gathering and availability will be vital to identify new bodies of water where tradable pollution permits can be introduced • **Administrative Burden** – the administrative burden for implementing a tradable pollution permit system will decrease, this can increase gains from trade from water markets • **Human Capital for Implementation** – over time the capacity of employees involved in institutions forming pollution market will increase, assuming their implementation in the medium-term • **Public Finance** – the impact on the state budget is uncertain and depends on possible royalties/-fees applicable to the market • **Overall Assessment of the Instrument** – tradable pollution markets are more implementable in the longer term, with increased data gathering, monitoring and supervision systems in the water sector
Payments for Environmental Services	• **Legal Framework** – significant legislative amendments have to be made throughout a wide range of laws to enable the transfer of payments from water polluters to water users. Legislation has to be in place to create water resource funds and other institutions are needed for a functioning system of payments for environmental services • **Data Availability** – significant data will be required to identify the generators of environmental services and to identify the valuation of the positive externalities they generate • **Administrative Burden** – a very high capacity and technical assistance to the public sector will also be required to create a functioning PES system. Furthermore, such administration might create significant costs • **Human Capital for Implementation** – implementation of PES schemes will require significant capacity building both among public employees and water users • **Public Finance** – depending on the payment scheme, whether it will be (i) private, (ii) public, or (iii) public-private, there will be an impact on the state budget. The introduction of a public, or public-private payment scheme might require significant public expenditure • **Overall Assessment of the Instrument** – introducing the instrument is likely to be feasible in the long-term, depending on the existence of legislative framework enabling private actors to implement PES schemes. The feasibility of a "government-initiated" PES is more challenging, as it requires the availability of additional data and funds needed to effectively implement the scheme
Subsidies	• **Legal Framework** – legislative amendments might be needed to ensure that sustainable use of water is considered as a criterion, while giving state subsidies to different industries • **Data Availability** – detailed data on water abstraction/discharge patterns is required to effectively implement subsidy schemes • **Administrative Burden** – additional administrative resources will be needed if subsidy schemes are introduced, to specifically address water abstraction/discharges. However, if characteristics of water use are considered as a criterion for eligibility for other subsidies, savings can be ensured in administrative costs • **Human Capital for Implementation** – public employees will require capacity building to take into account water use as a criterion for eligibility in a subsidy scheme. Also, if subsidies are introduced for the water sector separately

Subsidies

- **Public Finance** – implementing subsidy schemes specifically for the water sector will require additional resources from the state budget. However, considering water use patterns as a criterion for eligibility for subsidies can improve the overall efficiency both in the water management sector and for the state subsidies of different industries

- **Overall Assessment of the Instrument** – Giving subsidies for sustainable water use on a large scale might not be feasible, as potential gains from other instruments such as water abstraction charges and water pollution charges might not be sufficient to cover the costs. It is also unlikely that subsidies are efficient enough to be desirable, when revenues from charges are insufficient to cover the costs. However, if coupled with other instruments, which provide additional incentives to adopt better water use practices, their use might become feasible and advisable

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APPENDIX

Table A1. Types of Goals, Objectives and Actions Taken by the Government of Georgia to Implement the EU Water Framework Directive, 2018-2030.

Action	Compliance with EU-Georgia AA	UN SDGs[76]	Stakeholders	Implementation period	Indicator
Strategic Goal 1. Ensure the adoption of key legislation in the environmental and natural resources field, including the obligations defined by the EU-Georgia Association Agreement, UN SDGs and other international requirements, through effective and close collaboration with relevant state agencies, other parliamentary committees and civil society.					
Objective 1.1. Initiate and support the implementation of sectoral reforms and stemming out from the strategic directions of the environmental field.					
Implementation of legislative and institutional reform in the water sector	Directive 2000/60/EC establishing a framework for community	SDG 15[77] SDG 16[78]: Target 16.6	Ministry of Environmental Protection and Agriculture	No later than the year 2022	Relevant reform is implemented
Objective 1.3. Assure the harmonization of new legislation in the area of environmental protection and natural resources with the obligations under the EU-Georgia Association Agreement.					
Adopt the Law on Water[79]	Directive 2000/60/EC establishing a framework for community		Ministry of Environmental Protection and Agriculture	December	The draft law is prepared and adopted
Strategic Goal 2. Increase the effectiveness of the committee's oversight activities in order to improve both the enforcement of laws and the performance of relevant state institutions in the environmental field.					
Objective 2.3. Oversight over the fulfilment of obligations defined by the EU-Georgia Association Agreement.					
Finalise a guidance document containing guidelines for the development of the River Basin Management Plan (RBMP)[80]	Directive 2000/60/EC establishing a framework for community: Article 13-14	SDG 6[81]	Ministry of Environmental Protection and Agriculture	December	Guidance document is prepared and adopted

Source: Committee on Environmental Protection and Natural Resources of the Parliament of Georgia. Committee Strategy 2018-2030 and Action Plan 2018-2020. Published 2018.

76 The UN Sustainable Development Goals – https://www.un.org/sustainabledevelopment/.
77 Covers Life on Land: Sustainability manging forests, combating desertification, halting and reversing land degradation, and halting biodiversity loss.
78 Covers Peace, Justice and Strong Institutions: Promoting just, peaceful and inclusive societies. Target 16.6 is about developing effective, accountable and transparent institutions at all levels.
79 Additional information on the Action Plan: The adoption of Law of Water includes the integration of water pollution aspects from the sources of agriculture (nitrates) in national legislation. It also includes flood risk management.
80 The guidance document needs to be approved in advance of the RBMP. The deadline according to the Association Agreement is 2024.
81 Covers Clean Water and Sanitation: Ensure access to water and sanitation for everybody.

Table A2: Summary of the Positions of Government Entities, NGOs and Private Sector Stakeholders as Expressed During the Consultation Process.

STAKEHOLDER GROUP	SUMMARY OF RESPONSES
Government Entities Ministry of Environment and Agriculture Georgian National Energy and Water Supply Regulatory Commission (GNERC) National Agency of Mines	During the interviews with the stakeholders, issues regarding to the surface and ground water abstraction, wastewater discharges and river basin organizations were discussed. According to the interviewed stakeholders: » **Water abstraction charges** should be **different across the sectors** (sectoral analysis is needed to define proper charge rates for each industry) » The government should define its priorities clearly. For example, if the best priority is drinking water supply, **charge rate for water abstraction for the water supply purposes should be low** » Tariffs should be different based on the availability of water resources into the river. However, **tariff for drinking water supply** should be **similar** across all regions » Potentially three different tariff structure can exist: • **Unitary** tariff across the whole country (but this approach will not be efficient) • Two different tariffs for **Black Sea Basin and Caspian Sea Basin** (as it already exists) • Different across the river basins (tariffs should be defined in the process of development action plans for these river basins) » Ground and surface water abstraction **are not under the supervision of one institution**. Surface water abstraction is under the control of MEPA, while the MOE manages ground water abstraction. It would be more efficient if the use of all kinds of natural resources will be **regulated by one regulatory body**, rather than divided among different authorities. » Charges for **groundwater abstraction** are extremely **low** and they should be revised in cooperation with the Ministry of Economy » Tariff **for surface water abstraction should be lower than for ground water abstraction**. Surface water abstraction is associated with higher treatment costs than groundwater. If we add higher charges for surface water abstraction, it will be a big financial debt for the businesses » Charge rate should be defined based on the following criteria: **existing volume of water into the water body and quality of water**. If the resources are identical, charge rates for them should be similar as well. Methodology of defining rate should be common for every source of water » In the regions, where the central Distribution Company operates, businesses should not be allowed to get **licenses** and abstract water on their own. Because **less consumers** for the distribution company (associated with lower revenue) **will cause increase of tariffs for water supply**. In addition, from the **ecological** point of view, it is more sustainable if one big water supply company develops the centralized system and provides water to all users, rather than all companies dig their own bore-holes

Government Entities

Ministry of Environment and Agriculture

Georgian National Energy and Water Supply Regulatory Commission (GNERC)

National Agency of Mines

- **Water pollution charges** should be set according to the **pollutants**. Initially, charges should be defined for those pollutants, which have such **strong negative impact** that even treatment facilities cannot neutralize their adverse effects
- As for the **wastewater discharges**, discharge rate should be **high enough** to create incentives for the companies to establish **treatment facilities**. In the areas where centralized systems exist, it can be more efficient, if one big treatment facility exist and companies pay for the service
- **River basin organizations** should have a crucial role in the **adoption of methodology** to define tariff for abstraction charges. Also, they should decide how the water resources will be **allocated** among the users (based on the water use purposes)
- **River basin organizations** will be **financed** from the **central budget**
- In order **municipalities** to be involved in the process of the river basin management, they should get certain benefits from this involvement. **Revenue** generated from the charges should directed to the budget of **local municipalities**. This will strengthen them and in the long run it will be possible to delegate responsibilities from central to local authorities
- **Revenue** generated form the abstraction charges should be used for **environmental purposes**
- According to the law, revenue generated from the **pollution permit fees** will be directed to the central budget. There is an **option**, that revenue goes to the National Agency of Environment and direct these funds to improve water monitoring process

NGO's

Green Movement of Georgia

Kura II: Advancing IWRM across the Kura River Basin

- Water Abstraction Charges **should be differentiated** according to the sectors. Whereas, wastewater discharge charges should be defined based on the pollutant substances
- Government could set the **minimal tariff level** across the country. However, in specific river basis this **tariff can be higher** considering its special characteristics
- Tariff should be set either by the **government** or by the **ministry of finance**, since there might exist conflict of interest between the other ministries (such as MEPA and MOE). In addition, responsible government entity should refer **GNERC** for recommendations
- **Theoretically it is a good idea to set different charges across the different river basins**, however, it is questionable whether currently such approach is affordable for Georgia or not. At least, during the first few years the central government should determine charges, because local authorities do not have enough capacity
- Water abstraction charge should be sufficiently high in order to **prevent inefficient use of water resources**
- Charges **should be fixed, rather than progressive**
- Surface and groundwater abstraction should be supervised under one regulatory body

Private Sector

Rich Metals Group

United Water Supply Company of Georgia (UWSCG)

- It will be fairer if prices are **different based on different river basins**. However, **fixed tariff** across the whole country will be **easier** to manage
- The issue about river basin organizations is that it is not clear how the **responsibilities of different stakeholders** will be allocated (river basin organizations, municipalities, USWCG…)
- On the positive side, introduction of river basin organizations will make **system more transparent** (including availability of information about the quality of water into the water bodies, seasonal flows of water, points where water abstraction and wastewater discharge occurs etc.)
- Unlike to the government representatives, some stakeholders from private sector claim that for them abstraction of groundwater is associated with higher **expenditures** than abstraction of surface water, because it requires big bore-holes, infrastructure, drainage systems, proposal for the project, license fee and etc. **For this reason, groundwater abstraction charge should be lower than surface water abstraction charge**
- Charge for wastewater discharges should be based on the **amount of water discharged** rather than pollutant substance. Big polluter companies (such as Georgian Manganez, Chiatura Mine etc.) are obliged to clean their wasted water before they discharge water into the UWSCG facilities
- **Monitoring** for wastewater discharges should **be improved**. Proper staff and laboratory equipment is needed

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ISET Policy Institute

www.iset-pi.ge iset-pi@iset.ge 995 322 507 177