ALBANIAN
WASTEWATER TREATMENT REALITY

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C O N T E N T

1. General Information

Presently, practical experience in the wastewater sector in Albania is limited to the collection of wastewater and storm water in marginally adequate sewerage networks, and conveying this wastewater away from urban and peri-urban areas, as a raw discharge to a receiving stream. With the exception of one small secondary treatment plan, and some septic tanks, no proper wastewater treatment plant, exists anywhere in Albania at the municipal level. Although the connection between wastewater treatment and water loss management may not be apparent, it concerns the policy makers in Albania. Non-revenue water in Albania, on a national average basis is nearly 70%. If it can be assumed that some of this water is going to illegal or non-registered connections, it is still safe to estimate that 50% of the produced water is lost or wasted. However, this water is left unmanaged, will end up in the sewerage system and greatly impact the size of downstream facilities.

Furthermore, there are no reliable data, related to wastewater flow measurement and analysis, from which meaningful design criteria for the sizing of wastewater treatment facilities can be deduced. Nevertheless, in recent years, projects for a number of municipalities in Albania, financed by various international donors, have been launched. They are in various phases of feasibility study, design, tendering, or construction. The first waste treatment plant in Albania was operational in October of 2005. This pioneer was established with the support of the German Government via KfW to treat the water for 25,000 inhabitants. During the period from 2005 to 2009 the deepest reforms recognized in the water supply and sewage sector in Albania were undertaken, providing, inter alia, establishment of 14 urban wastewater treatment plants targeted to serve the most urbanized areas of the country (approximately 2.4 million inhabitants). Albania is stressing the need to make wastewater treatment a high priority, particularly along the more densely populated coastal areas of the country, which are a key economic driver of Albania's tourist industry.

However, Albania has also worked to emphasize the need to address wastewater treatment in less populated areas with populated communities of 500 to 4000 inhabitants, which have not been included in the mid-term national plan for the implementation of wastewater treatment for the principal reasons of: high investment cost for centralized systems, high operating costs, and low local capacities to operate and maintain the technologies. In light of these facts, Albania is advancing the knowledge and understanding of the use of more extensive wastewater treatment methodologies, commonly referred to as a "constructed wetlands", which use a combination of both vertical and horizontal flow through the treatment media. The application of this technology results in a treated water quality, before discharge to the receiving stream, which is in compliance with European wastewater treatment standards, while achieving a low, overall unit cost.

Establishment of wastewater treatment plants aims at ensuring environmental protection for the entire coastal area and protection of all the border waters to ensure a clean environmental and a safe and qualitative tourism. To this purpose, many agreements have been signed with donors so far, such as with the German Government through the KfW – the Financial Cooperation, the World Bank, the European Union, the Austrian Government through the ADA, the Swiss Government through SIDA, etc. with approximately 120 million Euro, where about 35% is the financial contribution of the Albanian government. There is no doubt that this intervention with projects and treatment of wastewater at a national level is considered as one of the most important challenges as it has a direct impact on the health of people, environment and tourism and shall guarantee a good neighborliness climate.

1.1 Wastewater treatment legal framework

The European Wastewater Directive (91/271/EEC), as amended by the Directive 98/15/EC and the Rules (EC) 1882/2003 is applied in Albania according to the Law no 9115, year 2003 "On the Environmental Treatment of Wastewater" and the Rules no 177, dated 31.03.2005 "on the allowed norms of liquid discharges and zone criteria for the receiving water environments".

The Albanian Law no 8934, dated 05.09.2002 "On the Environmental Protection" aims at regulating relations between the people and environment, protect the environmental components and processes and at ensuring material conditions for a sustainable development meeting the necessary framework for implementing the constitutional request for a clean ecological environment. It aims to:

- Ensure a rational environmental use and at reduction of the pollution discharges in it,
- Prevent its damage, ensuring the rehabilitation and revitalization of the damaged environment,
- Improve individuals' living quality and protection of their health,
- Protect and maintaining the natural water resources, be them renewable or not, and their rational and fruitful administration,
- Coordinating state activities to comply with the needs for protecting the environment,
- International coordination in the environmental field,
- Promote public participation in environmental protection-related activities,
- Coordinating the economic and social development of the country with the requirements for a sustainable development,
- Establish and strengthening of the institutional network of environmental protection in the central and local government level.

Albania's Law 9115 of 2003 "On the Environmental Treatment of Wastewater" is aimed at protecting the environment and the health of people from the negative impacts of wastewater, defining the rules for their environmental treatment and the obligations of wastewater dischargers. The objects of this Law are the urban and industrial wastewaters, according to the special branches of the industry, waters from the irrigation of the agricultural lands and the sewerage of any kind.

The Rules approved by the Decision of the Council of Ministers no. 177, dated 31.03.2005 "On the allowed norms of liquid discharges and the zone criteria for the receiving water environments' contains the approved standards for various industries and the quality of urban water following treatment, based on the respective instructions of the European Union. Setting of the sensitive zones and of the less sensitive zones is provided for in Article 14 of the Law no 9115 and of the Annex 5 of the above mentioned compliance within Decision of the Council of Ministers no 177. Further extension of this issue is subject of the Council of Ministers.

1.2 Water quality following treatment

The requirements related to the water quality following its treatment are fully complaint to the Rules approved by the Decision of the Council of Ministers no. 177, dated 31.03.2005 "On the allowed norms of liquid discharges and the zone criteria for the receiving water environments" and the European Union Directive 91/271/EEC as referred to the table 1.

Table 1 Effluence water parameters

Parameters	Concentration	Minimum % of reduction
Biochemical requirements for oxygen (BOD_5 for 20°C with no nitrification (nitrification – optional requirement)	25 mg/l O_2	70-90%
Chemical requirements for oxygen (COD)	125 mg/l O_2	75%
Suspended matter (MES)	35 mg/l O_2 35 mg/l for mountainous areas with more than 10,000 inhabitants, 60 mg/l for mountainous areas with a population of 2,000 – 10,000 inhabitants.	90% 90% for mountainous areas with a population of 10,000 inhabitants, 70% for mountainous areas with a population of 2,000 – 10,000 inhabitants.

Table 2 Urban wastewater quality after treatment in delicate environments which can in the future become subject of eutrophication

Parameters	Concentration	Minimal % of reduction
Total of phosphorus	2 mg/liter (10,000-100,000) inhabitants	80%
Total of nitrogen	15 mg/liter (10,000-100,000) inhabitants	70-80%

On top of meeting the national wastewater treatment standards, the treatment plant to be implemented in Shkoder, shall also reduce the content of N and P in the mid to long-term plan. As illustrated in Table 2, the need to remove N and P is identified for sensitive zones, according to the Law no. 9115. In any case, the removal of N and P shall be considered at the design stage, with the aim of allowing the establishment of special units realizing the treatment of wastewater in full compliance with the effluent quality standards for sensible areas.

Given that there are no official data on the quality and conditions of the lower part of the water flows in Shkoder, it is a bit difficult to foresee on whether the river basin shall be considered as a sensitive area or not. But, given that the River of Buna is part of the water-collection basin of the Adriatic, this fact shall be taken into consideration to treat the water discharged from the sensitive areas. Currently, Albania does not have any special law dealing with the issue of removal of sludge produced by the treatment plants or their re-use. Under these conditions, it is advisable to refer to the relevant Regulation of the European Union.

2. Wastewater treatment reality in Albania

The national experience regarding the urban and industrial wastewater treatment system is limited. Today, only 50% of the entire territory of the country is covered by urban wastewater systems, which means that there is a centralized collection and transport of the wastewaters, which are later discharged without any treatment in receiving water environments. Furthermore, the Albanian designers and constructors have a large experience in design and implementation of centralized urban engineering networks for sewerage construction and rain water, but they have less experience in industrial water network systems and treatment facilities.

The lack of basic knowledge regarding the water treatment in the central and local government level is with no doubt our greatest national challenge in the water field in order to be able to protect our health and environment. To face the requirements on the appropriate level of treatment and technologies required to be installed for this purpose, a great work is needed both in the theoretical and practical fields, emphasizing the indispensability of building such treatment units.

On the other hand, there is no official national data of the wastewater, treatment technologies, technical analysis and methods of treatment used so far, which shall for sure compose the basis for drafting the national design criteria depending on the plant dimension, the pollution level, concentration of the urban wastewater, indexes of the rain waters prior and after the treatment, etc. Consequently, the aim of this article is to elucidate the contribution of water treatment plants and to help the future designers decide on contemporary technologies that shall be used as the most suitable ones for the country, with the aim of ensuring high quality service for each citizen of Albania, and of protecting the environment.

2.1 Status of CENTRALIZED wastewater treatment plants

The national plan on urban wastewater plants in Albania, which have already been built or are under construction, is summarized in Table 3, afterwards the technical characteristics of the projects in these fields are summarized below.

Table 3-Implementation status of wastewater plants in Albania.

Nr.	AREA	DONORS	COST	INHABITANTS	STATUS
1.	Kavajë I	KfW (2005)	€ 5,00 M	25,000	Constructed
2.	Kavajë 2	KfW	€ 5,00 M	25,000	Design
3.	Durrës	BB/LUX/EIB (2008)	€ 8,50 M	250,000	Under construction
4.	Lezhë-Shëngjin	BB/LUX/EIB (2008)	€ 3,20 M	42,000	Under construction
5.	Sarandë	BB/LUX/EIB (2008)	€ 2,80 M	60,000	Under construction
6.	Vlorë	BE (2006)	€ 2,70 M	150,000	Constructed
7.	Pogradec	KfW (2006)	€ 5,00 M	54,997	Constructed
8.	Korçë	EIB/KfW (2009)	€ 6,70 M	86,000	Under construction
9.	Tiranë	JBIC (2009)	€ 67,0 M	1,000,000	Under construction
10.	Velipojë	IPA	N/I(*)	85,000	Design
11.	Orikum	The Islamic Bank	N/I(*)	8,000	Design
12.	Shirok Zogaj	KfW, SECO, ADA	€ 0,65 M	12,000	Design
13.	Ksamil	BE	N/I(*)	12,000	Design
14.	Shkodër	KfW, SECO	€ 9,50 M	100,000	Design
		Total of first phase:	**€ 120 M**	**2.4 million of inhabitants**	

Note: N/I (*) =has not been officially identified given that the project is at the designing phase.

Kavaje Wastewater Treatment Plant

By the end of 2035, the wastewater plant of Kavaja shall operate at full capacity to treat the urban wastewater for an equivalence of 125.000 PE. Building and extension of this facility is divided into three phases. While the first phase, scheduled to end by 2014, aims at treating the wastewater for 40% of the total population, the second phase, scheduled to end by 2025, aims to treat the wastewater for approximately 80% of the population.

The technology used for this plant is based on the biological treatment using the anaerobic ponds, followed by the leaking filter and the secondary clarifier. Pretreatment is realized through the installment of an automatic grit with a space of 10 mm settled in front of the anaerobic pond. The effluent does successfully meet the water-quality related obligations according to the national treatment standard and the European Directive 91/271/EEC, such as: BOD_5 25 mg/l and TSS 35 mg/l. The sludge produced in this treatment plant is partially used in agriculture and partially in sludge drying beds planted with vegetation. The effluent is discharged to the sea.

The particularity of this treatment plant (and the wastewater treatment plant of Pogradec), is that the wastewater produced by household in the same area but not connected to the centralized sewerage system, is treated inside the wastewater treatment plant compound on a separately dedicated pretreatment unit. The pretreatment unit collects the wastewater of the respective households and injects their pre-treated wastewater to the centralized treatment plant. This takes place especially when the treatment plant is working with low capacity. In this case, not only the manhole water is treated, part of which flows end up in the water receiving body, but moreover a certain stability and continuity of water flows is ensured in the plant.

Pogradec Wastewater Treatment Plant

The wastewater treatment of Pogradec, by the end of 2029 shall have full capacity to treat the wastewater for an equivalence of 75,000 inhabitants. Building and extension of this facility is divided in three subsequent phases. The first phase was successfully concluded at the beginning of 2009, treating the wastewater equivalent for 25.000 inhabitants. The wastewater technology in this treatment plant is similar to the one of Kavaja. The pre-treatment of Pogradec, different from the plant of Kavaja, is provided with an automatic grit with a space of 6 mm, where the secondary level of treatment is completed via the water treatment by 10 maturity ponds, which supply one-another consequently, up to the exit gate by gravity, different from the plant of Kavaja, where only one clarifier unit is installed after the trickling filtering.

The effluent meets the obligations according to the treated water indexes, compliant to the national standard and the European Directive 91/271/EEC. In 2019, a unit for reducing the percentage of phosphorus in the treatment plant by using chemicals will be installed. The nitrification process shall be realized by a trickling filter, whereas the denitrification process shall be realized through anaerobic ponds by re-circulation of the sludge generated from the secondary decanter or the maturity pond. Indexes of feeders by 2029 are envisaged to be as follows: 2 mg/l total phosphorus (TP) and 15 mg/l of total nitrogen (TN). The sludge produced by the anaerobic ponds is mechanically distributed in the sludge treatment unit, which is planted with local vegetation (lake seeds). The maturity funds and the sludge beds are built utilizing the former fishing basins in Pogradec.

Durrës Wastewater Treatment Plant

At the raining period, the treatment capacity for the Durres area is 60.000 m^3/d and at an non-rainy period it‘s about 30.000 m^3/d. The treatment plant is of a conventional type, and is based on biological processes. Treatment shall be made according to the activated sludge technology, with air injected at the end part of the aerating basin, followed by the secondary decanter. The secondary level effluent shall keep being treated together with the rain water and in the tertiary treatment level using beds with vegetation filters.

The sludge produced at the primary and secondary level shall be stabilized at the anaerobic digesters. The sludge shall be used as a raw material to put in motion the plant generate and to produce electricity for the electric needs of the plant. To ensure sludge of less humidity, the sludge treatment line shall continue treatment in the beds of vegetation.
The effluent quality has even more advanced parameters than the national standards and the European Directive 91/271/EEC. Whereas the P and N values shall be achieved according to the standard, they would not meet the criteria defined by the European Directive for the sensible areas.

Durres wastewater treatment plant will provide treated water in the industrial zone in its vicinity. With regards to the feasibility study made for the industrial zone, the need for approximately 500l/sec water supply is projected, which means that double of the current amount supplying Durres today is required. This approach of re-use treated water for other purpose makes this plant known not only for being a highly efficient treatment plant, but also as a contemporary one, at a time when the world insistently asks for the re-use and not discharging the treated water to the water body. This treatment plant shall realize even another element, electricity production from by-products such as sludge and gas. Therefore, this realization gives us another argument to install contemporary technologies in the country, despite the fact of disruptions in the continuity of the electricity supply.

Lezha and Shëngjin Wastewater Treatment Plant

The wastewater plant of Lezha and Shëngjin has been designed and will start in operation at the same time as the plant of Durrësi and Saranda. Its treatment capacity until 2022 shall be 12.240 m³/d. The technology of this plant is of a biological nature with component participles with surface aerations airing and anoxic zone, followed with beds of vegetation. Building of this plant shall be interrupted at this level, as the ground it is being built into is a swamp area and requires a complex engineering approach and a high cost. The sludge treatment line is envisaged to be of drying bed with vegetation. The level of effluent quality will meet the national standards and those of the European Directive 91/271/EEC.

Saranda Wastewater Treatment Plant

The plant of Saranda started to be built at the same time as the plant of Durrës. It has a treatment capacity of up to 14.400 m³/d. The scheme is similar to that of the plant of Lezha and Shëngjin. The technology envisaged for this plant is through building of the superficial aerated basin supplied with an anoxic zone, followed by secondary level at the vegetation beds. The treated water shall be disinfected by hypochlorite. The sludge treatment line is foreseen to be with beds and vegetation. The post-treatment water quality parameters meet the national standards and those of the European Directive 91/271/EEC.

Tirana Wastewater Treatment Plant

The plan for constructing the wastewater treatment plant of Tirana is divided in two phases. The first phase has just started in Kashar of Tirana, and shall end by 2013. Its aim is to treat the wastewater for 350,000 inhabitants. In this phase, about 4.4 km of pipe of a diameter of 900-1,500mm are planned to be implemented. The second phase ends by 2022. Continuation of the second phase it is envisaged in parallel to this stage, ensuring treatment of water for 850,000 inhabitants, where 10.4 km of pipes with a dimension of 450-1,650 mm are foreseen as well as the construction of the treatment plant in Bërxull, ensuring treated water for 170,000 inhabitants, and where about 6 km of pipes with dimension of 450-1,350 mm shall be implemented.

By the end of 2022, the plant shall operate at a full capacity by treating the water for nearly 1 million inhabitants of Greater Tirana area. The wastewater treatment technology applied is the same as in the Kavaja and Pogradec treatment plant. The treatment units are automatic grits, sand collectors, fat collectors, the primary decanter, followed by the leaking filters and the second decanter. Afterwards, the treated water shall be disinfected before it is discharged in the water receiving body.

The sludge shall be stabilized in sludge anaerobic diluents and shall afterwards be dried in drying beds with filter and vegetation. Part of this project is also intended to generate electricity by the use of the plant by-products, such as sludge and gas. The effluent quality meets the obligations related to the water indexes after treatment, and is in full compliance to the national standard and the European Directive 91/271/EEC.

Shkodra Wastewater Treatment Plant

The wastewater treatment plant of Shkodra is envisaged to be of an active sludge technology. The effluent quality at the exit shall meet treatment standards of BOD_5 = 20 mg/l and TSS = 20 mg/l.

2.2 Comparative approach of treatment levels

The technologies and techniques on wastewater treatment in Albania show clearly that considerable efforts are done to built small and medium-sized treatment plants, which have efficient technology installed, such as anaerobic ponds and trickling filters, combined with low cost generation of electric energy.

Classical treatment plants of a high capacity where the treatment technology shall be with an active sludge, digesting sludge, bio-gas products, etc. are proposed only for Durrës and Tirana as the low-cost technologies for these areas would require a huge construction field. The water quality, after treatment, does adequately meet the obligations compliant to the national standard and the European Directive 91/271/EEC, such as: BOD_5 25 mg/l and TSS 35 mg/l. Removal of feeders is envisaged for the plant of Pogradec and Shkodra and later in Durrës, to avoid the discharges in the lake or at sea. So far there is no plant that foresees achievement of treatment standards compliant to the, so called, sensitive areas.

The sludge stabilization in the small and medium-sized enterprises is realized by beds with vegetation, whereas in the plants of a high capacity, treatment is aimed at producing bio-gas to generate electricity for the needs of the plant itself. Drying of the sludge in most of the cases is intended to be realized in drying beds or in beds with filters planted with vegetation.

2.3 Status of DECENTRALIZED Wastewater Plants in Albania

The issue of filter beds with vegetation to treat the urban wastewater is well-spread in the world today. In particular this tendency is remarked in individual households that are away from the inhabited areas and live in small communities. About 50,000 similar plants are identified all over the world, from which 1,640 such treatment systems are found in the United States of America, 21% of them are thought of being installed in individual households away from the urban developed areas and 89% for small inhabiting communities with less than 5,000 inhabitants. Their performance and monitoring depends on the geographical location, type of land and weather conditions. The world today does still not have an exclusive center for receiving information on the best practices and the problems of such treatment practices.

The examples have shown that in the overwhelming part of the cases, their design is based on subjective engineering and professional judgments collected in years. From one decentralized plant in 2006, Albania shall have two additional wastewater treatment plants for small inhabitant communities (see Table 4). The history of building such techniques dates back to the year 2004 when an Albanian company focused on metallic nets of gabions got located in vicinity of the "Mother Teresa" airport. After building the facility, the company faced the question of where to discharge sewage and wastewater to be generated in its territory.

Therefore, it contacted a German company, which designed a treatment plant with a filter bed with a horizontal feeding for 60 workers. After the design period, an Albanian utility realized the project successfully. Given that the activity of this investor was not successful, the plant built for the purpose of wastewater treatment was never put to operation; therefore, its success was not tested. This example shows that the need to treat the water, apart from the theoretical and the technical reasons, is also dictated from geographical circumstances.

Table 4 Status of the decentralized wastewater treatment plant in Albania.

Nr.	Area	DONORS	COST	INHABITANTS	STATUS
1.	9 year elementary school of Narte, Vlore	UNDP	40,000€	200 pupils	Constructed
2.	SOS Child Village, Tirana	GTZ, SOS, and the Government of Albania	70,000€	450 inhabitants	Constructed
3.	Village of Prespë	Commune	N/I(*)	1,000 inhabitants	Designed
		Total :	**110 000 €**	**1,650 inhabitants**	

Note: N/I (*) = is not officially identified given that it is in the final designing phase.

2.4 Overview on planning for building decentralized plants in Albania

Designing of such treatment plants allows one to judge that designing of a treatment plant for a small community needs analysis of similar stages as in the plants for the urban considerable zones, such as the choice of technology, location of the plant, technical specifications, cost assessment, etc. The wastewater treatment plant in the village of Narte serving 200 pupils and that of SOS village, serving 500 inhabitants, shows that these plants:

- Work under such conditions enabling production of treated water with constant flows in the exit, despite continuity of the amount of the water that enters the plant for treatment,
- Appeal for the use of water after treatment, for various purposes, such as for instance, irrigation of green spaces of the villages or use of treated water for the school toilets,
- Function under such conditions that require the use of a pump for the entire plant,
- Function under such conditions that require the presence of only one operator,
- Can be built with all the materials and pieces of equipment that shall be found in the country.

In Albania, the application of such a plant using cheap and safe treatment techniques takes a special importance, as it shall serve as the first scientific and demonstrative laboratory in the country, which can be used for the under-grad students, for the MSC students or students at more advanced levels, so that they can one day draft national design, implementation and maintenance standards.

These techniques are easily installed for similar conditions as the village of SOS or the school of Narta, in particular in the areas that are considered as of touristic interest. Furthermore, these treatment techniques can be installed even in those parts of the country that have a more difficult winter. Lastly, these techniques are valid even for all the countries of the Western Balkans, given that the weather and land conditions have similarities between our countries, rendering this expertise go beyond the boundaries of Albania.

3. Main issues to be resolved in Albania

Today, it is right time to deal with the issues of multi-plan policies related to the wastewater treatment in Albania and in particular it is time to determine objectives regarding the treatment level, investment cost, reference standard, suitable technology, etc. The main issues requiring solution are the followings:

- Determining of the wastewater standard, compliant to the receiving water body,
- Treatment standards of a reasonable cost,
- Treatment standards that ensure sustainability, including the operational and the maintenance cost.

The wastewater treatment standard, compliant to the receiving Riviera quality:

Is it currently possible to use a part of the River of Vjosa, Shkumbini and Drini for self-cleaning of the wastewater as a first treatment level? If so, why is it that we should think of a secondary treatment level today? Is it the right time to think of it? Where should this treatment take place?

Treatment standards for reasonable costs:

By this day, it has not been calculated what the capital investment cost shall be for treating the wastewater in Albania in a secondary or further level. It is the right time to make such a calculation, considering the impact on the management of current assets for this service.

Sustainable treatment standards including the operational and the maintenance costs.

It is only now that we are asking: are we capable of ensuring the maintenance of plants we are building in Albania for the first time? Do we have a business plan, including a work calendar, maintenance and operation, regarding the treatment plants in utilities? Do we have a sufficiently informed local government or customers on the cost of the service per each household?

4. Literature

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Summary Background on Dr. Eng. Enkelejda Gjinali, PhD

Dr. Eng. Enkelejda Gjinali received her Bachelor of Science Degree in 1992 from the Hydro-Technical and Hydraulic Engineering Department, Faculty of Civil Engineering, University of Tirana, and in the same year she started career teaching in this Department. She later received her Master of Science Degree in Environmental Engineering from Ecole Supérieur d'Ingénier de Poitiers, France, and completed her research, at that time, at the one of the largest water treatment utilities in the world, Laiyonnaise des Aux, Bordeaux, France. Since then, she has continued to teach in the Department of Environmental Engineering, Faculty of Civil Engineering, University of Tirana.

Dr. Gjinali defended her PhD thesis on the subject, "Low Cost Wastewater Treatment Plants for Small Communities Applicable in the Albanian Context". This is considered to be the first PhD awarded in Albania, in the field of wastewater treatment plant design and construction, based on research and the demonstrations of wastewater treatment systems in Albania using constructed wetland and wastewater reuse technologies.

Since 2000, she has been a key volunteer supporting the formation and development of the Water Supply and Sewerage Association of Albania, which is now a full member of the European Water Association. Since 2002, Ms. Gjinali has led the water program of the German Government supporting the Republic of Albania through the GTZ- Technical Cooperation on behalf of the German Federal Ministry for Economic Cooperation. Since, early in 2007, Dr. Gjinali has served as the Water Sector Advisor to the Prime Minister of Albania on water policy, water sector reform matters, and related issues, both in Albania and in its neighboring countries.