Republika e Kosovës - Republika Kosova - Republic of Kosova

AUTORITETI RREGULLATOR PËR SHËRBIMET E UJIT
REGULATORNI AUTORITET ZA USLUGE VODE
WATER SERVICES REGULATORY AUTHORITY

ARRU

REPORT

ANALYSIS OF NON-REVENUE WATER SITUATION IN KOSOVO

January - 2020

CONTENTS

ABBREVIATIONS

CMA – Close Measuring Area

ILI – Infrastructure Leakage Index

IWA - International Water Association (IWA)

WLTF -Task Force for at Water Loss (IWA) NRW – Non-revenue Water

RWC – Regional Water Company

PI - Performance Indicator

WBM - Water Balance Model

NPM-NP- Policy and Monitoring Unit of Public Enterprises

BD - Board of Directors

IMWC – Inter-Ministerial Water Council

AMP – Annual Monitoring Plani

KPI – Key Performance Indicators

1. INTRODUCTION

One of the main challenges that service providers in Kosovo face is the high percentage of non-revenue water. So this is an amount of water that is produced and pumped into the distribution network but is not invoiced, and thus does not generate revenue for the interprise. In other words, non-revenue water is the difference between the water produced and the water invoiced. This water is lost as a concequence of leaks or bursting because of high pressure in network, outdated infrastructure network, illegal cnnection poor performance of water meters and their incorrect reading.etc. Despite the positive trends in some of the RWCs, without expection in all RWCs non-revenue water continues to have high levels. Moreover, the non-revenue water has always been an idenfying part of them and only now in recent years has received increased attention. Each year, the loss is of about 90 in mil.m^3, of the total treated water, conservatively estimated at 30 million euros; it is not something that the management of RWCs can ignore. Reducing these water losses is essential for efficient resource utilization, efficient service management, increased customer satisfaction, and the postponement of capital investments to increase production capacity. As stated in the scientific circles of the water industry, the cost of improvement for the provision of water supply service is much lower when they are undertaken through investments in reducing non-revenue water, than through investments in capital projects to increase supply capacities.
Water service providers are trying to provide their customers with a continues and quality supply and during this engagement, they have faced many challenges such as: dilapidated infrastructure with high leakage lack of maintenance of effective asset management systems, limited capacity in unmanaged water management, financial constraints including revenue collection, poor accountablity environment, lack of performance stimulation as well as poltical impacts, cultural and social. All these factors also affected the field of water loss management and water demand. However, NRW is one of the reasons why it continues to limit the necessary financial resources available to Service Providers to address all the challenges they are facing. Previously NRW management was based more on assumptions than on precise science, part of the problem was the lack of a standard approach to identifying NRW components. This has changed dramatically in many European countries and beyond, but also in recent years.

Given the institutional pressure on water companies in Kosovo to reduce NRW, and to address this situation, they developed individual Strategies for a five-year period (2018-2022). The Water Service Regulatory Authority, during 2018, also approved the standard structure and terminology according to methodology published by the International Water Association (IWA) and Water Balance Model, regarding the evaluation and reporting of NRW. This methodology not only helps service providers in identifying losses where they occur, but also expresses the volumetric amounts of water how much is lost associated with a correctional cost. The foundation of water loss control program is the compilation of water control with a basic routine as a standard business pracitce. So now water service providers have a rule for auditing water in a way similar to how an ccounting firm routinely examines a business's finance.

However, this report, drafted by WSRA officials, has come at time of increasing public and stakeholder pressure on RWCs to address the challenge of reducing NRW, the critical role of Non-Revenue Water management, constituent elements and accompanying measures for its addressing. This information should serve to Water Service Providers, Policymakers (Shareholders of Water Companies, Water Service Regulatory Authority), investors and all those who can hope to help change and drinking water management.

2. EXECUTIVE OVERVIEW

The main common denominator that water service providers in the country are facing is the high level of water losses in the distribution network, and this has made it difficult for customers to meet water needs. They have benn forced to increase the enormous amount of water production and this has not brought in revenue, on the countrary it has increased costs and made it more difficult to keep water tariffs at reasonable and affordable level. At the national level, the NRW rate is around 60% and without any significant improvement over the years. This has shown poor performance and poor management of public water supply companies.

While there are many explanations and justifications, many of failures are due to underestimation of the technical difficulties and complexity of NRW management. The executive management, during this time, was not sufficiently aware of the benefits and costs of NRW, along with the potential for improvement, and therefore were unable to convince the Boards o Directors (Shareholder) of the service to be engaged in securing funds for NRW[1] management acitvities and necessry investments in this regard. On the other hand, the lack of support from key executive officials for cmprehensive management has made it difficult to motivate staff directly involved in activities and provide support (funding, training and technology) to sucsessully and steadily reduce NRW .

About 60% of the water treated each year continues to be lost. On the other hand, in order to meet the growing demand, some of the RWCs (Prishtina, Gjakova and Mitrovica), have developed new resources. More water has been produced and distributed in the network without being able to increase sales and this cycle is still going on. However, there is no successful and comprehensive example at the national level from any service provider that reduce NRW, the best case is the situation at RWC 'Gjakova', where the level of water losses has marked a downward trend currently the rate is 44% and still far from an acceptable level of 25%.

For all RWCs, the reduction of NRW should have been the first option followed when it was aimed at expanding service coverage and increasing the demand for drinking water supply. The expansion of the water network, without addressing the water losses has led to a cycle of inefficiency. Also a high rate of NRW was closely related to high energy costs, as water transported in the grid was "charged" with energy through distribution and treatment processes, thus energy is lost with water. Therefore, in any of the variants, the high level of NRW has affected the overall efficiency, as it has not provided additional income and has increased the supply costs.

There have been and continue to be projects in support of the RWC to address the reduction of NRW, but it must be aknowledged that the reduction of NRW could not be solved through these projects. In this regard, the RWC has been asked to make the necessary restructuring in terms of organization and capacity building. Since addressing NRW and these changes also takes time. Reducing NRW will require further and ongoing efforts to maintain low levels once initial progress has been made.

[1] Kosovo Development Strategy

3. INVOICED WATER, NON-REVENUE WATER: DEFINITION, TERMINOLOGY

A prerequisite for calculating performance indicators for water losses and for them to be comparable both locally and internationally is the use of a standardized terminology. Based on this goal, the International Water Association (IWA) has developed and refined a comprehensive range of performance indicators for water supply services. As part of an initiative launched in the late 1990 and finalized with an International Water Balance. Kosovo has recently adopted this methodology and since 2018, has started to apply the calculation of NRW according to WBM with all the terminology and its defined definitions.

INVOICED WATER – AUTHORIZED CONSUMPION

It represents the volume of measured and / or non-measured water taken by registered customers, who are expressly or explicity authorised to do so by the drinking water serivce providers for household use purposes, businesses and institutions, this includes drinking water exported beyond the operational limits of the service provider. Authorised consumption, brought in income (also known as income water) might be: Metered invoiced consumption and unmetered invoiced consumpion.

NON - REVENUE – WATER LOSSES

It is the difference between the water entering the system and the authorised consumption.

Non – Revenue Water (NRW) consists of:

(i) Physical (real) losses

There are all the physical losses of water from the piping system under pressure and water desposits in the service area, up to the point of customer use. In metered system where the customer water meter is and in situations where water is used indiscriminately, this is the first point of use within the property. The annual volume lost in all types of leaks, breakdowns and overflows of deposite, depends on the frequencies, flow rates and average duration of leaks, breakdowns and individual overflows of deposits.

Commercial losses (visible)

Includes all types of inaccuracies related to: customer measurement, data handling errors (meter reading, lamp-sum billing estimates), unauthorised consumption (illegal use or theft).

(ii) Authorised Non-Revenue Consumption (free water)

Authorised Non-Revnue Consumption (free water), consists of authorised consumption which is legal but not billed and therefore does not generate revenue. It can be: metered non-revenue consumption and unmetered and non-revenue consumption. Authorised consumption includes water used for firefighting, washing of the sewerage network, expenses from hydrants, public hydrants, public springs and places of worship.

NRW components cover the entire water supply system from water treatement plant to the customer's water meter, which means that NRW management is the responsibility of the wate company. This method is based on the general

measurement of water entering the system and comparing it with the total consumption volumes by all customers, i.e., by domestic, commercial-industrial and institutional consumers.

4. NON-REVENUE WATER FOR KOSOVO

Companies, despite some personal commitments but also limited support from projects funded by international donors, were unable to resolve the alarming situation of water loss. On the contrary, NRW has remained at a high level and in some RWCs the situation has worsened as presented in the annual performance reports published by WSRA.

4.1 NON-REVENUE WATER AT THE SECTOR LEVEL

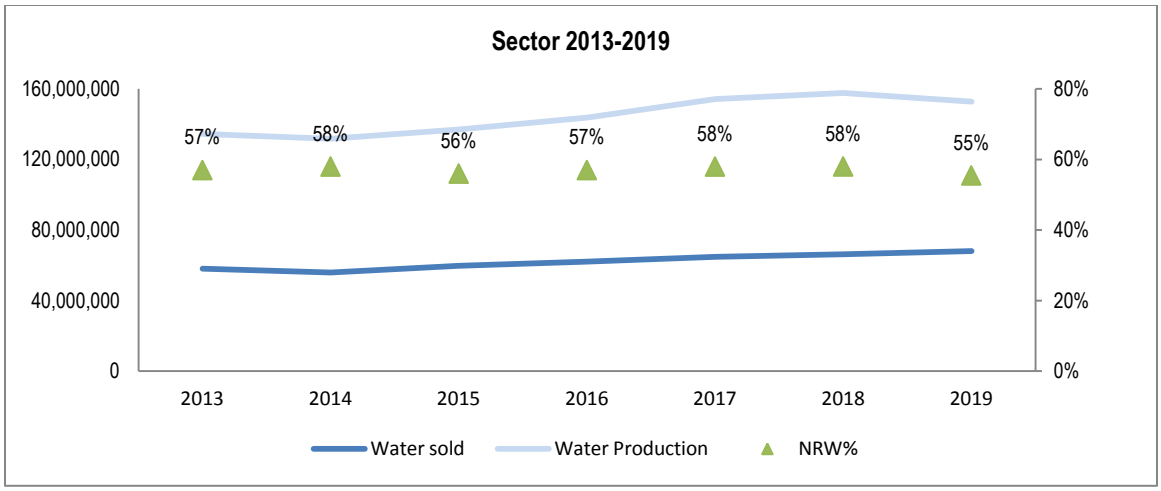
In 2019 NRW PF was at the level 55% of total water production and RWC failed to significantly reduce it for a long period of time.

Tab.1:Production, sales and NRW (2013-2018 and 2019[2])

Data	2013	2014	2015	2016	2017	2018	2019
Produced water m^3	134,459,244	131,828,167	137,044,281	143,736,575	154,220,031	157,761,608	152,877,087
Sold water m^3	58,081,289	55,850,398	59,743,615	62,073,994	64,794,837	66,235,347	68,063,974
NRW %	57%	58%	56%	57%	58%	58%	55%

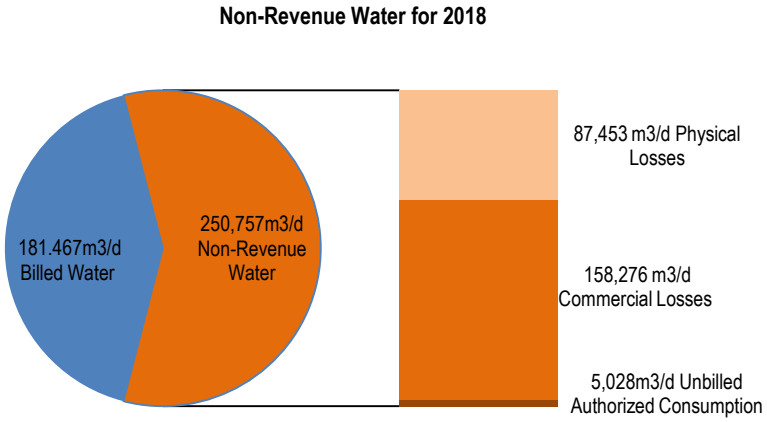
Tablel 1. and graph 1. present the statistics of production, sales and the rate of water losses over the last seven years. The growing trend of water production has not been followed by a trend necessary for increasing water sales. There has been a steady increase in water production, responding to the demands for sustainable supply of population. In 2019, out of 7 (seven) RWCs, a total of about 152.87 million m^3 of drinking water have been produced and distributed to their customers, which has decreased if compared to the previous year. The largest increase in water production in recent years has occured in RWC 'Mitrovica' and RWC 'Prishtina', given that there are two companies that have had greater reductions in water supply. With the increase in water production, the volume of Non-Revenue Water has also increased, and in 2019, this value is quite high, about 85 million m^3 is unrefined water which does not bring income to companies, morever it creates expenditures, as well as deficits in the regular supply of population, but if there is a value compared to the previous year 2018 we have a decrease of NRW around 6.7 mil.m3.

[2] The data for 2019 have been reported by the RWC, but have not yet been audited by the WSRA



Graph 1: NRW, at the sector level (2013 – 2019)

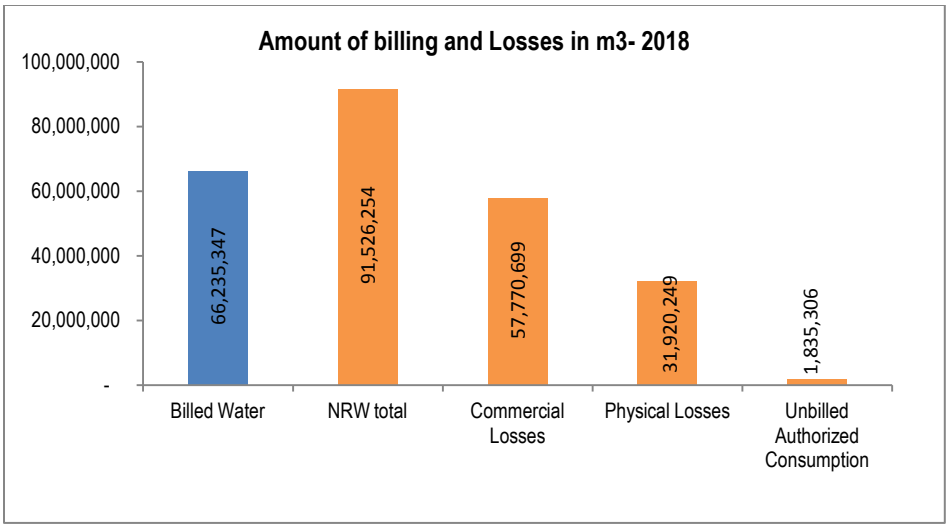
The NRW rate during this evaluation period is brought within a narrow interval from 55% to 58% ie by ±3%.



The trend of increased water production has not been folloed by the same trend of invoiced water (as a result the quantitative values of NRW have increased or decreased in its function).

Graph 2: Structure of NRW, m^3/day- 2018

Graph 2. shows the total of 250,000 m^3/day, 2/3 are commercial losses, 1/3 physical losses, and only about 5,028 m^3, or 2%, of the total NRW, is the amount of authorised Non-Revenu Water.



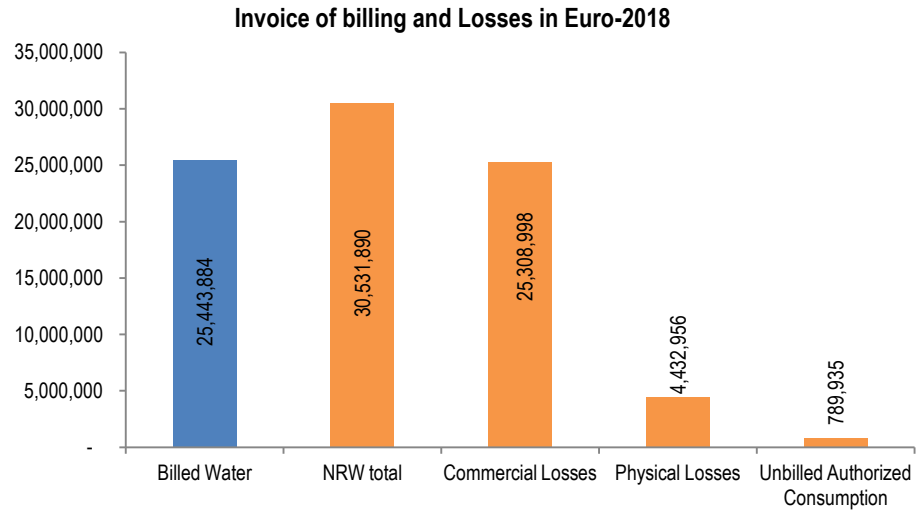
Graph.3: Quantitative values of billing and NRW in m^3, 2018

Of the total of 157,7 mil.m^3 of water produced and distributed to customers in 2018, only 66.2 mil.m^3, is the sale which could be realised. Of all the companies 91.5 mil.m^3 is NRW and of this about 57.7 mil.m^3 or 2/3 are. Commercial losses while 31.9 mil.m^3 or 1/3 are physial losses. Authorised Non-Revenue Water (fire extinguisher, cult facilities, hydrants, public fountains, etc.) is about 1.8 mil.m^3.

Tab.2: Statistical data norm and value (Euro) of NRW, from Water Balance Model for RWC-2018

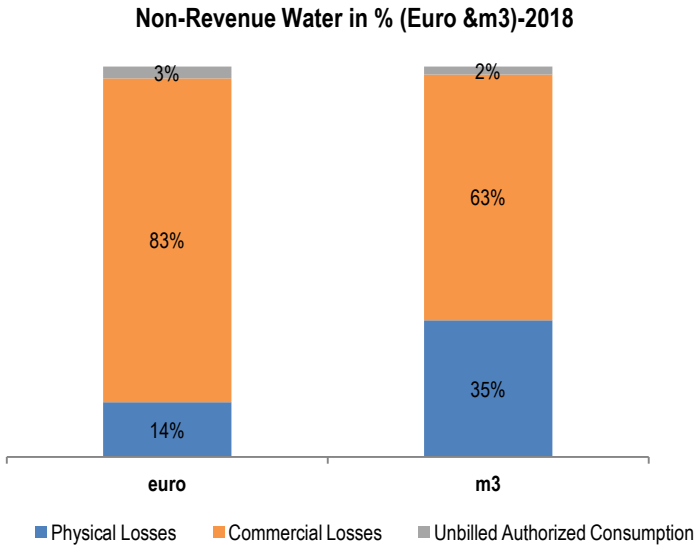
WBM 2018	PR	PZ	PE	MIT	GJA	GJI	FE	Sector
Production m3	54,569,918	17,038,292	25,366,310	28,347,492	14,992,458	8,464,519	8,982,619	**157,761,608**
Billed water m3	21,841,205	7,347,813	9,662,715	11,553,469	8,467,412	4,012,702	3,350,038	**66,235,354**
Non-Revenue Water m3	32,728,713	9,690,479	15,703,595	16,794,023	6,525,046	4,451,817	5,632,581	**91,526,254**
Commercial losses m3	17,643,671	6,351,509	11,844,213	10,085,840	4,668,005	2,930,869	4,246,591	**57,770,699**
Physical losses m3	14,688,240	3,140,374	3,416,646	6,545,933	1,311,369	1,506,343	1,311,345	**31,920,249**
Authorised Non-Revenue Water m3	396,802	198,596	442,736	162,250	545,671	14,606	74,645	**1,835,306**
Commercial losses (%)	54%	66%	75%	60%	72%	66%	75%	**63%**
Physical losses (%)	45%	32%	22%	39%	20%	34%	23%	**35%**
Authorised Non-Revenue Water (%)	1%	2%	3%	1%	8%	0%	2%	**2%**

NRW %	60%	57%	62%	59%	44%	53%	63%	58%
Annual value (E) of NRW in relation to average tariffs (€)	11,416,670	3,591,783	4,607,930	5,340,277	2,373,018	1,299,369	1,902,841	**30,531,890**



Graph. 4: Invoice Value and NRW in Euro, 2018

About 25.5 mil euros is the value of billed water, while 30.5 mil euro are financial losses, most o them are from commercial losses 25.3 mil.euro, while 4.4 mil.euro is the value of physical losses and only 789 thousand euros are from athorised Non-Revenue Water.



Graph. 5: NRW proportion in Euro and m³ epressed in (%) - 2018

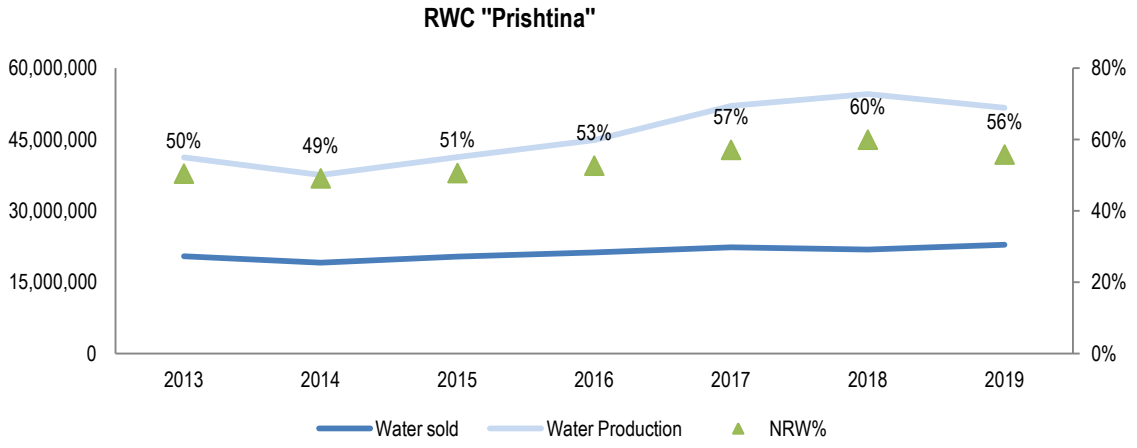
The graph above shows the value and impact of NRW components, in financial terms at the sector level. In this case, commercial losses account for about 63% o the volume of NRW, while they account for 83% of the total monetary value of NRW, while physical losses account 35% of the total volume of NRW and accunt for only 14% of the value. This clearly shows hy water balance calculation is a very important instrument for strategic information and decission-making regarding NRW. Therefore, any service provider should be prepared for a brief cost estimate and benefit from NRW strategy implementation activities, based on a reliable water model.

Reducing commercial losses is almost always cost effective and offers quickly and offers quick returns and activities are technically easy to accomplish. On the other hand, reducing physical losses through flow control can be costly, requires important technical knowledge, and must be carried out extensively to bring results. It is clear that investing funds and resources in reducing commercial losses will show a greater improvement in the company's financial balance than trying to reduce physical losses. However, water companies need to strive to achieve an economic balance between flow control costs and the benefits of reducing water losses (economic level of losses).

4.2 Non-Revenue Water for RWC

RWC - Prishtina

A very high level of NRW is constantly following RWC 'Prishtina', it is worrying that the trend is increasing. From 2013 to 2018, the percentage of NRW has increased by 10% while in 2019, as can be seen from the chart below; we have a positive donward trend at the level of 56%. By 2017, the company had applied tough water supply reductions. In 2017, the production capacity of this company increased by 700l/s, thus improving the regular supply, but the value of water losses has increased, while sales have remained constant with a slight upring during 2019. Out of 54.6 mil. m3, water produced and distributed, 32.7mil.m3 is water lost in 2018, most about 54% are commercial losses and 45% are physical losses.

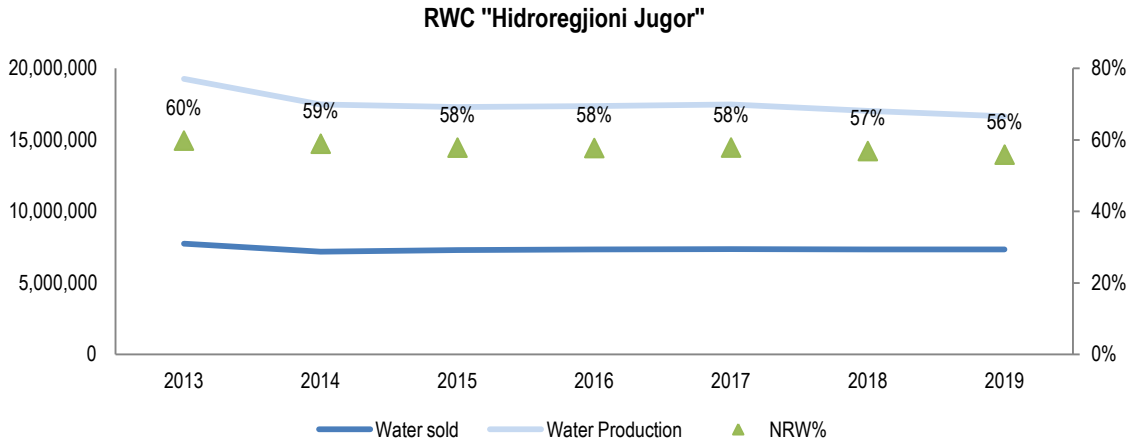


Graph 6: NRW 2013-2019 RWC "Prishtina"

RWC 'Prishtina', should proactively address the large water losses (32.7 mil.m^3), engaging in parallel in both components of losses. To establish and verify / calibrate water pruduction meters and customers water meters, data accurary must be improved (improving the reporting and retention system, eliminating production and consumption estimates). Continue monitoring and managing the network system by expanding closed metering areas. Continue monitoring and managing the network system by expanding closed metering areas (CMA) as well as established and pipelines in particular.

RWC – 'Hidroregjioni Jugor'

In RWC 'Hidroregjioni Jugor', as the graph no 7 shows, NRW marked a very decreasing trend during this evaluation period (2013-2019) and this is mainly due to the reduction of production over the years and almost the same state of water sales. During 2018, out of total of 57% of NWR, 66% are commercial losses, 32% physical losses and only 2%, the authorised Non-Revenue Water.

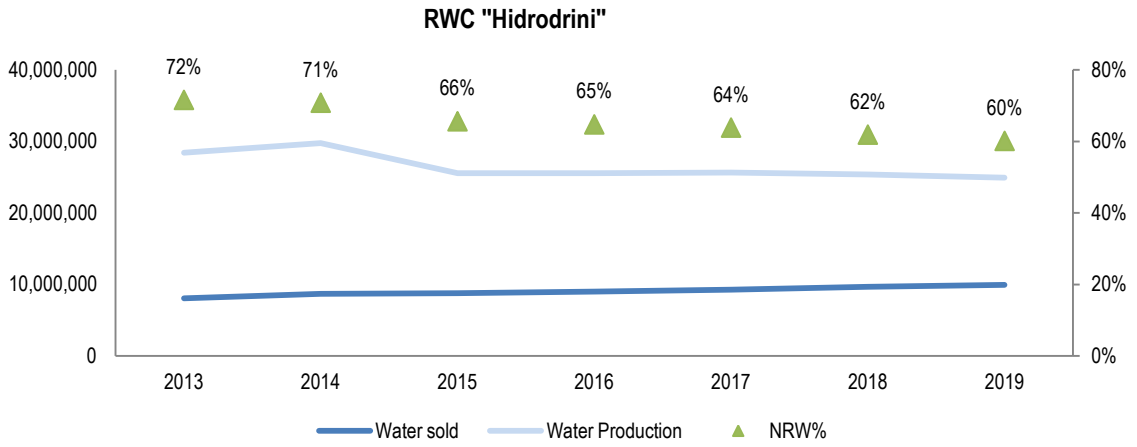


Graph 7: NRW 2013-2019, RWC 'Hidroregjioni Jugor''

RWC "Hidroregjioni Jugor", should first focus on taking faster meae commercial losses, such as: setting water meters for all customers and billing them through functional water meters and verified in terms of accuracy, to ensure cmplete and accurate measuresment of water production to make systematic control in order to identify and eliminate illegal connections, misuse of drinking water. Also it needs to undertake activities in tems of reducing physical losses such as identiying and repairing leaks in time as soon as possible and developing water loss management programs according to good practices and through CMA.

RWC – "Hidrodrini"

There is a significant decrease of NRW in the RWC "Hidrodrini", currently the level of 60% during 2019 is still very high. This is mainly due to the reductin of production by about 3.5 mil.m^3 in 2019 compared to 2013, also a positive ha been recorded in water sales, although they are gradual. During 2018, out of a total of 62% of the NRW rate, ¼ of that are physical losses, and also ¾ of that are commercial losses and a rate of 3% is considered to be authorised Non-Revenue Water.

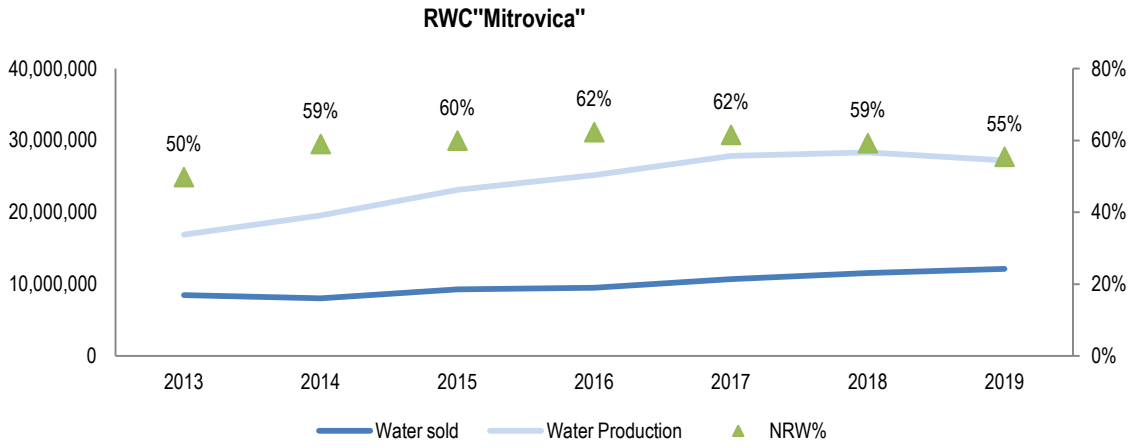


Graph 8: NRW 2013-2019 RWC 'Hidrodrini'

The prioritety of the measures to be taken by this company should be more oriented towards the identification and reduction of commercial losses, in this regard there is no doubt that improving the accuracy of water production and water consumption data will be important, in this regard, RWC "Hidrodrini", should ensure the accuracy of water meters through verification and calibration of their order, identify illegal connections. The company must also deploy and develop the NRW management system through CMA and the asset management program with priority distribution network.

RWC – "Mitrovica"

RWC "Mitrovica", is facing more important challenges, including a high rate of NRW. Water losses in this company have continuously increased until 2017; while in 2018 and 2019 have begun to mark one declinig trend. In the last few years, the water roduction capacities of this company have significantly increased, the supply has improved, but this has not been followed by the same sales rate. According to data from the Water Balanace Model, Commercial losses are almost double that of physical losses. In addition to other costs, the loss revenue from NRW has continuously affected the financial stability of this company. Undoubtedly, this high level of losses is also affected by the fact that about 30%of customers of this company do not have water meters and their billing is done in an assessed manner.

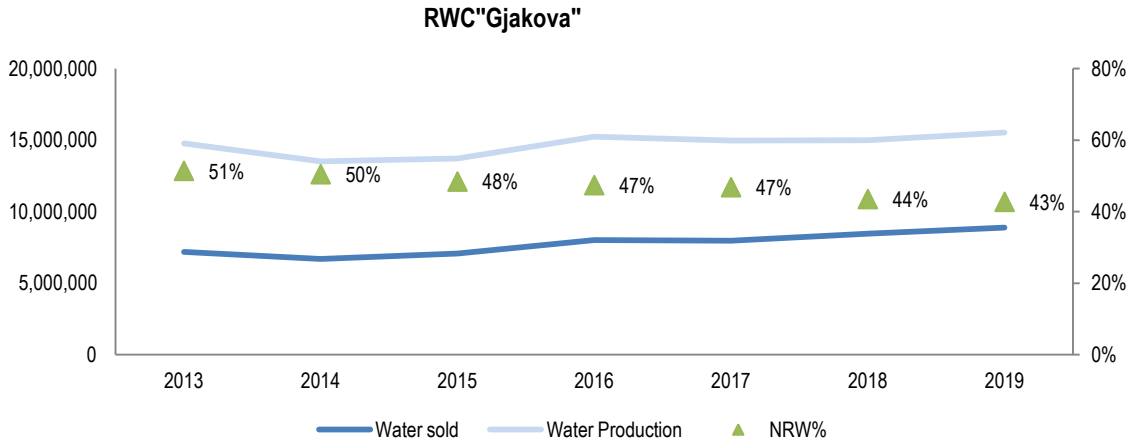


Graph 9: NRW 2013-2019 RWC 'Mitrovica'

Since a significant number of customers are billed according to estametes (lump sum), the equipment and program of measuring water consumption, should be a priority for RWR "Mitrovica". The control team for illegal connections needs to be strengthened and illegal connections addressed. Establishing a verification and calibration program, in addition to effective meter reading, will bring immediate results in reducing NRW. The company must also approve and implement the GIS application, establish CMA, a hydraulic pressure management model in the distribution network.

RWC – "Gjakova"

RWC "Gjakova", has marked a slight positive trend in the reduction of Non-Revenue Water during this period (2013-2019), the improvement is by 8%, this is followed by a sight increase in the value of billing, and more management good amount of wate produced. The NRW rate of 44% in 2018, according to the data extracted from the water balance, NRW reaches the value of 44% where most of the losses or 72% are commercial. Regarding authorised Non-Revenue Water, a high percentage of losses in this category of 8% has been reported by this company.

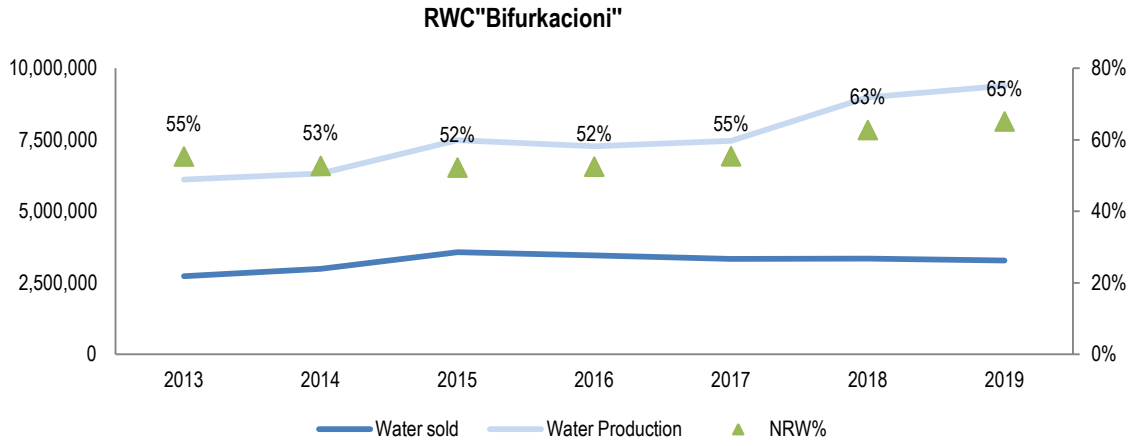


Graph. 10: NRW 2013-2019 RWC 'Gjakova'

In RWC “Gjakova”, most of customers (98%), are with measured consumption, also the production water meters are installed in all sources. The priority should be the development of the program for maintenance and verification of customer water meters, considering that this compaby is now licensed for the laboratory for verification-calibration of water meters. An advantage that should also be considered by the company necessary for the effective addressing of controlling and reducing physical and commercial losses is the creation CMA, in addition to an effective campaign to identify illegal water users. Also installed are water meters of production at all sources.

RWC – “Bifurkacioni”

RWC “Bifurkacioni”, initially had an improvement in the NRW reduction in 2014, when water sales aslo showed a positive trend, then they came to increase to reach the level of 65% for 2019. Since this company has not installed water meters in all sources, this increase of NRW may be due to movements in the assessment of water production. Even in this company, the data extracted from the water balance model show that commercial losses are significantly higher in relation to physical losses, or ¾ are commercial losses in relation to ¼ physical losses and 2% authorised Non-Revenue Water. Also, the pysical losses are high and mainly dictated by the poor performance of water supply network, although there has been a positive trend (reduction of the number of defects) since last year.

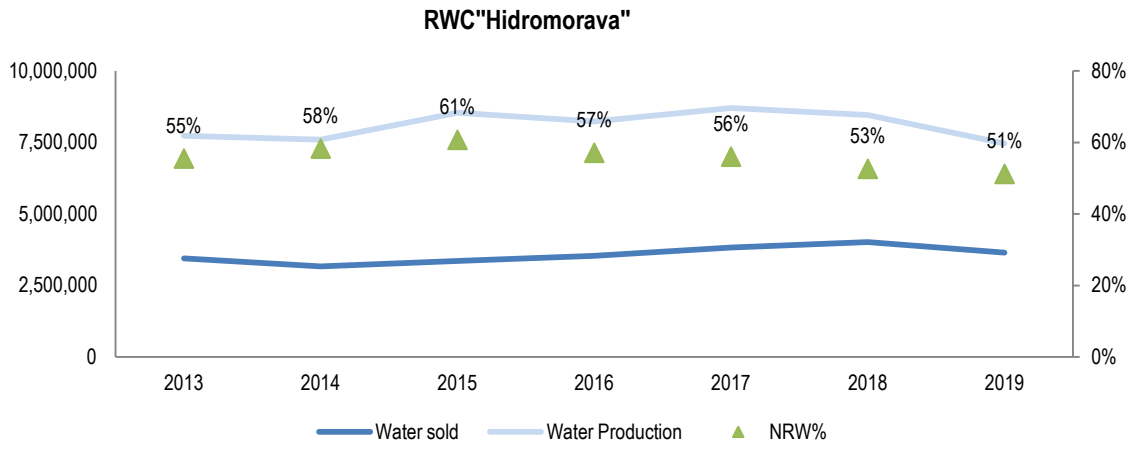


Graph. 11, NRW 2013-2019 RWC ‘Bifurkacioni’

Although in RWC “Bifurkacioni”, 96% of customers have water meters installed, the company must continue to provide all customers with water meters. According to water meters, the billing is essential, as woould the installation of accurate water meters at all points of water production and treatement. In order to manage and reduce water losses, it would be essential in this regard that consumption meters but also water production be maintained and replaced according to an implementing program, in which case all water meters will be subject to verificaation and calibration to ensure measurement accuracy. The company needs to establish and implement water loss monitoring and management practice effectively through CMAs.

RWC – "Hidromorava"

Non-revenue water in RWC "Hidromorava", has had oscillations year after year, mainly affected by the amuont of water produced and less by the impact of sales which have marked as slight increase in recent years. In 2019, the NRW rate was 51%. While in terms of data calculated from the water balance model for 2018, commercial losses are twice as much as physical losses. Without excluding the possibility of illegal consumption in commercial losses, the fact that about 8% of customers are still billed is also influential. Even the network managed by RWC "Hidromorava", has shown poor performance, although there is a trend of improvement.



Graph 12, NRW 2013-2019 RWC 'Hidromorava'

Starting from 2018 and continuously throughout 2019, the company is facing a lack of water resources due to drought, customers have undergone waater supply reductions. Therefore, water losses in this company have a very negative effect, not only on operational sustainability but also on other aspects of customer service. Prioritety and focus should be on addressing commercial losses such as calibration of consumption water meters but also water meters of water production resources. Teams should be strengthened and supported to identify illegal links and all illegal users should be addressed in the jusice system. Physical losses should also be addressed, implementing and ensuring the proper functioning of CMAs, with all functional aspects (pressure management, etc.), as well as the creation of team to detect and repair leaks. The company must eventually design and implement and effective asset management program with specifics in the water supply network.

4.3 DEVELOPMENT STRATEGY OF NRW

All companies have drafted strategic plans to reduce NRW for a five-year period (2018-2022), in addition to the implementation of water balance modules. These are essential issues: how much water is being lost, where it is being lost and why it is being lost, and an action plan has been drawn up to achieve sustainable performance in reducing NRW. The strategy themselves contain the annual objectives of reducing NRW, they are challenging but at the same time, real to achieve. In principle, the adoption of the reduction of water losses with a rate of 2%, has been taken as an attitude, on an annual basis starting from the current level of each, to achieve an improvement of 10%, with the completion of strategies. But, according to priorities in undertaking actions there is a need for increased commitment of management, staff involved in activities, and financial support. Monitoring the implementation of strategies as well as evaluatiing progress is becoming a regular quarterly basis within the inter-institutional group and

RWC. To make progress, companies must have a systematic and simultaneous approach to addressing all components of water loss.

It is essential that the control of physial losses is done according to the main element-priorities:

Activ flow control, by monitoring the pipe network system on a regular basis to identify the occurrence of new leaks earlier so that they are detected and repaired as soon as possible.

Pipe and asset management, managing and rehabilitating the network ecnomically to reduce the need for corrective.

Speed and quality of repairs, timely and efficient leak repair, incuding work organization and maintenance of repair materials stocks.

Management pressure, regulation of network pressure thorugh reasonable pressure use – valve reduction (often an understimated opportunity to reduce leaks).

Actions to reduce commercial losses do not depend much on local circumstnces, mainly generalized to all RWVs, including:

Improving the accuracy of the customer water meter, ensuring that customer water meters are in good working order.

Improving water meter and reading billing, eliminating errors in the reading and billing chain due to poor technology, or manual readings, errors in office data handling, but also eliminating any possible fraudulent practices by service staff.

Detection of illegal connections and misuse of water, by researching and indentifying illegal connections, espacially in rural areas where there is a possibility i misuse of water for irrigation of lands-gardens, or even control in areas where are expressions of construction and large business, etc.

An important point to mention and a prerequisite for service providers to improve their performance is a.\lso to provide incentives or management and water supply staff to achieve and maintain the reduction of NRW. This should be proportional to the benefits from increasing efficiency in reducing NRW.

4.4 WATER BALANCE MODEL, IMPORTANCE AND IMPLEMENTATION

The International Water Association (ANU-IWA) has developed a method for calculating water balance, as one of the best methods with a wide international use in the water industry which is the first step in the practical treatment of water loss. Tab.3, below illustrates how different forms of water loss can be categorised. Furthermore, the method is also used to determine where efforts should be made to achieve the greatest impact. So the logic is that dividing the amount of water lost (NRW), into smaller parts, gives the opportunity to work in a more structured and effective way to reduce it.

Tab. 3: – ANU Water Balance

<table>
<tr><td rowspan="8">The volume of water entering the system</td><td rowspan="3"></td><td rowspan="2">Invoiced Authorised Consumption</td><td>Metered Invoiced Consumption (including water exports)</td><td rowspan="2">Invoiced water</td></tr>
<tr><td>Unmetered invoiced consumption</td></tr>
<tr><td rowspan="2">Authorised non-revenue water consumption (free water)</td><td>Metered Invoiced Consumption</td><td rowspan="6">Non-revenue water (NRW)</td></tr>
<tr><td>Unmetered non-revenue water consumption</td></tr>
<tr><td rowspan="5">Water losses</td><td rowspan="2">Commercial losses</td><td>Unauthorised consumption</td></tr>
<tr><td>Measurement inaccuracies</td></tr>
<tr><td rowspan="3">Physical losses</td><td>Leaks in main transmission and distribution pipes</td></tr>
<tr><td>Leaks and spills in the reservoirs of water supply system</td></tr>
<tr><td>Leaks and service connections to the customer’s installed water meter</td></tr>
</table>

The year 2018, has been the first year that the RWC, according to the requirement of the WSRA they have implemented and reported NRW based on the Balanc methodology. WSRA has helped all RWCs to update with Balance Sheet data, (in doing this analysis) we have also served with WBM which RWC have forwarded in the finale version. It should be emphasized that water balance components should be measured, evaluated or calculated using a number of techniques. Ideally all of these important ingredients should be measured. In terms of data on water production and billing, the figures have a certain degree of accuracy as a significant portion in the absence of water meters is estimated. Approximate estimates should have been made regarding data on unathourised consumption (illegal connections, connections outside bypass water meters, etc.) and errors in reading water meters, etc.

Therefore taking into account that the main data, such as 'system input volume', is not, entirely accurate, so determining water balances in the case, from the outset, has degree of inaccuracy. However, we have estimated that it is worth trying to implement a water balance, although some of its key elements are based on estimates. Hopefully, that once the RWCs take concrete action they will come to improve accuracy. In the concrete case WBM in 2018, using estimates and other measured data, the software has calculated the volume of NRW and its various components, along with the margin of error. The margin of error in the NRW assessment through the water balance module for 2018, on avarage, is the highest (±30%) in RWC "Bifurkacion', RCW Hidrodrini (±16.2%), RCW 'Hidroregjioni Jugor', (±13.5%), RWC Prishtina' ±5.5% to the smallest margin of error in RW (Gjakova, Mitrovica dhe Hidromorava) with (±0.0%).

For this model to be as valid as possible, the data to be systemized must be as classified or verified as possible in terms of their reliability over time.

4.5 PERFORMANCE INDICATORS FOR NRW

At present, performance indicators applicable to water supply services in Kosovo include the following service infrastructure indicatores:

i. Non-Revenue Water (absolute and relative),
ii. Bursting (frequency, absolute and relative).

Table 4: Performance indicators in Kosovo for non-revenuw water assessed by WSRA

WSRA Reference	Performance Indicators	Units	Description
W.1.B.01	Non-revenue water (total)	m³ per day	Average volume NRW (differencies between produced and sold water) per day during the reporting period
W.1.B.02	Non-revenue water (based on connection)	Liter for daily consumption	Average NRW volume divided by the total number o connection in the service area
W.1.B.03	Non-revenue water (based on connection) – modified	Liter for daily consumption	Average volume of NRW divided by the total number of connections in the service area adapted for limited supply
W.1.B.04	Non-revenue water (related to production)	Percentage of production	Average volume of NRW divided by the volume production
W.1.B.05	Frequency of pipe network burst	Burst by month	Average number of pipe burst per month
W.1.B.06	Pipe network burst per 100 km tof pipes	No. / 100 km	Total number of pipe burst per year per 100 km of pipe (excluding service connections)

There where no relaible and standardised methods for caclulating water losses, until the early 1990. As a part of initiatie launched in the late 1990, ANU set up a Water Loss Task Force (WLTF) to examine international best practices and develop performance indicators related to water loss. As a result, ANU developed the most advanced water loss management concepts, tools, and strategies, and made available to the water service sector the "Internationa Water Balnce Modeli", with clear definitions and a standardized terminology.

Perheps most importantly, ANU has developed and refined a comprehensive range of performance indicators for water supply services. NRW now has a precise and simple definition, so it represents the difference between the volume of water placed in a water distribution system and the volume charged to customers. NRW includes the three main ingridients as follows:

Commercial losses (visible), contain all types of inaccuracies related to: customer measurement, data handling errors (meter reading, lump sum billing estimates), and unauthorised consumption (illegal use or theft).

Physical (or real) losses contain leaks from all parts of the system (pipes) and urther fillings in the company's reservoirs.

Unauthorised Non-Revenue Water consists of authorised consumption which is legal but not invoiced, may be: metered non-revenue consumption and unmetered non-revenue consumption. Authorised consumption includes water used fo firefighiting, rinsing of the sewerage network, expenses from hydrants, public springs and cult facilities.

Infrastructure Leak Index (ILI): This is an internationally accepted indicator of physical losses developed by ANU, which takes into account the way the network is management is the ratio of the current annual volume of physical losses to the minimum achievable annual physical losses. ILI is calculated through water balance analysis and can be used as a targeted KPI for NRW management.

4.6 NRW – RWC KEY PERFORMANCE INDICATOR

High level o water losses is one of the main challenges facing water services in Kosovo. WSRA has developed the Annual Monitoring Plan, defined the methodology, criteria and developed as scheme of Key Performance Indicators.NRW is a key indicator of operational and financial performance for RWCs where their evaluation and ranking is based on the results shown in meeting reference objectives.

Tab.5 Current performance measurement structure (KPI and their weight)

Group	Performance Measure Unit	Sub-group coefficient		Group coefficient	
Water	Quality of drinking water	25%	100%	45%	100%
	Pressure	5%			
	Availabillity	20%			
	Service coverage	20%			
	Cost efficiency	10%			
	Non-Revenue Water	**20%**			
Wastewater	Quality of discharges	20%	100%	35%	
	Reliability	20%			

	Service coverage	50%			
	Cost efficiency	10%			
	Points (reliability) determined by the Audit	5%			
	Profitability	5%			
	Commercial efficiency	10%			

A long-term objective in AMP is that NRW ≤ 25% and in the framework of restructuring the KPI scheme it is proposed to increase the weight o NRW from 20% to 25% within the overall assessment.

5. THE IMPACT OF WATER LOSSES ON THE EFFICIENCY OF SERVICE PROVIDERS AND CUSTOMERS

It is logical that no business can survive for a long time if it loses a significant part of its production. But this is exactly what is happening to the country's water service providers. But this is exactly what is happening to the country's water service providers. High levels of NRW have led to low levels of efficiency. With the loss if treated water, the costs of water collection, treatment and distribution have been lost, revenues from water sales have been reduced, and significant capital expenditure programs have been implemented to meet the ever-increasing demand for water. Consequently, a high level of NRW has a serious impact on financial sustainability as it loses significant profits and generates higher operating costs for the company, such as energy used to treat and pump water, chemicals and other costs for its production and distribution. Furthermore, leaks have required costly infrastructure repairs as well as a need to expand production capacity.

Our estimates are that water service providers in the country lose about 90 mil m^3 or about 60%, of their total production each year. It is unrealistic to except water servic providers to eliminate all comercial and physical losses. but their goal in the short term should be to halve high levels. And if only half of it is reduced, a sufficient amount of 45 mil.m^3 will be provided to clean water to an additional population of 400,000 people, who need it. Reducing NRW would have not only a significant positive impact on the performance of service providers, but also on increasing the quality of services provided and increasing the coverage of the drinking water suppy system.

The main goal of water service providers is to meet customer demand. A high level of NRW has a direct impact on thier ability to meet this objective and therefore has a negative impact on customers causing a lack of service standards. High physical losses for a long time have affected the regular water supply, as a result customers have been subjected to water supply reductions. This has happened in almost all service areas of the RWCs. The intermittent supply has also caused a decrese in water quality, as contaminated groundwater, or even sewage, has enetered the pipes durig supply interruptions and during periods of low flow pressures. Water losses have also increased flow rates in the pipeline network, which caused the necessry pressure losses that have affected customers and has often led to supply disruptions during peak hours of demand. All these have left customers dissatisfied with the service provided with consequnces even though some customers expressed willingness to pay their bills. One aspect of the impact of NRW on customers was that of tariff charges. High levels of NRW have led to unnecessary high tariffs, so in fact, they had to reflect a mutual subsidy with the billed wate, otherwise the service provide would have remained financially unstable and not being able to provide the right service to their customers.

6. GENERAL CONCLUSIONS AND RECOMMENDATIONS

During monitorng, analysis of situationn, causes and trends of water loss management by the RWC, we can conclude that:

- Water losses are at a high level of 55%, without any substantial improvement during this period. Movemement in NRW rates, with a narrow interval of ± 3%, in this estimation period are more likely to be due to movements in water production than to effective reductions in NRW. Currently this one of the biggest challenges affecting the operational- finacial effeciency as well as the level of services provided by RWC. While the country is going through the crises of water resources for the cause.
- Reducing NRW is currently the highest priority for the water sector in Kosovo. Companies have developed a strategic approach to NRW management, they (7- KRU), have developed strategic plans to reduce NRW over a five–year period (2018-2022) and the objective of reducing NRW has in principle been taken as a position to be a rate of 2% on an annual basis, starting grom the current state level of wach to achieve a 10%, improvement, with the completion of strategies. Kosovo Development Strategy (2016-2021), has defined it as a strategic priority, while the WSRA has determined a level of NWR below 25%, as acceptable.
- Data on water produced in most RWCs is not accurate and reliable, as these companies still estimate a significant amount of water in the absence of water meters or even non-functional water meters (innacuracies in measurement). Not all customers are measurd and when their bills are not based on measurement and as such they have no incentive to save water. Lump sum charge bills usually represent an equivalent lower volume than ahas actually been used. Therefore, accurate measurement of water production and consumption is essential to enable WSRA to effectively regulate RWC in order for the latter to manage NRW to achieve the set objectives.
- Companies have started to report NRW according to WBM and WSRA, which in fact has standardized the evaluation methodology, NRW components and terminology according to the best international practices WBM– according to ANU. The water balance modules for 2018, and 2019H1 (first si months - 2019), have been updated by the essentil step towards the evaluation and identification of NRW, although their accuracy and reliability leave much to be desired.

Based on the analysis of the Water Balance Models and NRW trends, over the year aim of managing and reducing NRW, we suggest that the RWC, WSRA, and the Government of Kosovo take the following steps:

- Company managers need to be activated with the highest intensity and make available all the company's resources such as loss control team, operational and managerial staff, readers and support administration in order to reduce NRW.
- Implement and implement strategies and actions to reduce wate losses and control NRW according to WBMand to assess step-by step progress and measurable indicators.
- In all treatement systems to install water meters to measure the treated water, to ensure that all customers are billed according to water meters they need to be maintained – verified, replaced according to an implemenetation program by the RWC.

- Water service providers will also need to practice an appropriate system layout modeling (in existing parts and new parts of the network to establish a water management system according to CMAs) and use works, materials and higher quality equipment.
- WSRA and policy makers should ask water companies to conduct annual water inspections and regularly publish detailed NRW data, which can then be audited independently by WSRA, based on criteria and categorizations detailed reflecting high accurcy and relaibility.
- Provide incentives for water management and staff to achieve and maintain NRW reduction. This should be proportional to the benefits from increasing efficiency in reducing NR.
- In accoradance with the recommendations of the Government of Kosovo (IMWC) to apply performance contracts between NJPM-NP and BD for RWC, based on performance indicators and business plans approved by the Water Authority Regulatory Authority.
- Also the Boards of Directors to be obliged and committed to the reduction of non-invoiced water and other indicators by implementing permanent contracts based on the performance of the management of the RWC.

Note: The data used in the analysis for the needs of this Report are taken from:

- ✓ Annual Performance Reports for Kosovo Water Service Providers (2013-2018)
- ✓ Water Balance Module from RWC - 2018, Reported by RWC – final versions sent to WSRA as well as
- ✓ Data reported by RWC - 2019, which are still not audited (verified) by WSRA

APPENDIX: Water balance for RWCs for the period 2018

Figure 1 – Water balance for RWC "Prishtina" 2018

<table>
<tr><td rowspan="5">System Input Volume
54,569,918 m3/year
Error Margin [+/-]:
3.4%</td><td rowspan="3">Authorised Consumption
22,238,007 m3/year
Error Margin [+/-]:
0.1%</td><td rowspan="2">Billed Authorised Consumption
21,841,205 m3/year</td><td>Billed Metered Consumption
21,131,711 m3/year</td><td rowspan="2">Revenue Water
21,841,205 m3/year</td></tr>
<tr><td>Billed Unmetered Consumption
709,494 m3/year</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption
396,802 m3/year
Error Margin [+/-]:
3.3%</td><td>Unbilled Metered Consumption
108,570 m3/year</td><td rowspan="4">Non-Revenue Water
32,728,713 m3/year
Error Margin [+/-]:
5.7%</td></tr>
<tr><td>Unbilled Unmetered Consumption
288,232 m3/year
Error Margin [+/-]: 4.5%</td></tr>
<tr><td rowspan="3">Water Losses
32,331,911 m3/year
Error Margin [+/-]:
5.8%</td><td rowspan="2">Apparent Losses
17,643,671 m3/year
Error Margin [+/-]:
4.7%</td><td>Unauthorised Consumption
11,658,100 m3/year
Error Margin [+/-]: 7.1%</td></tr>
<tr><td>Customer Meter Inaccuracies and Data Handling Errors
5,985,571 m3/year
Error Margin [+/-]: 1.8%</td></tr>
<tr><td colspan="2">Real Losses
14,688,240 m3/year
Error Margin [+/-]: 13.9%</td></tr>
</table>

Figure 3 – Water balance for RWC "Hidroregjioni Jugor" 2018

<table>
<tr><td rowspan="5">System Input Volume
17,038,292 m3/year
Error Margin [+/-]:
7.7%</td><td rowspan="3">Authorised Consumption
7,546,409 m3/year
Error Margin [+/-]:
0.1%</td><td rowspan="2">Billed Authorised Consumption
7,347,813 m3/year</td><td>Billed Metered Consumption
6,750,790 m3/year</td><td rowspan="2">Revenue Water
7,347,813 m3/year</td></tr>
<tr><td>Billed Unmetered Consumption
597,023 m3/year</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption
198,596 m3/year
Error Margin [+/-]:
3.8%</td><td>Unbilled Metered Consumption
35,596 m3/year</td><td rowspan="4">Non-Revenue Water
9,690,479 m3/year
Error Margin [+/-]:
13.5%</td></tr>
<tr><td>Unbilled Unmetered Consumption
163,000 m3/year
Error Margin [+/-]: 4.6%</td></tr>
<tr><td rowspan="3">Water Losses
9.491.883 m3/year
Error Margin [+/-]:
13.8%</td><td rowspan="2">Apparent Losses
6,351,509 m3/year
Error Margin [+/-]:
2.8%</td><td>Unauthorised Consumption
5,049,045 m3/year
Error Margin [+/-]: 3.5%</td></tr>
<tr><td>Customer Meter Inaccuracies and Data Handling Errors
1,302,464 m3/year
Error Margin [+/-]: 2.0%</td></tr>
<tr><td colspan="2">Real Losses
3,140,374 m3/year
Error Margin [+/-]: 42.0%</td></tr>
</table>

Figure 4 – Water balance for RWC "Hidrodrini" 2018

<table>
<tr><td rowspan="4">System Input Volume
25,366,310 m3/year
Error Margin [+/-]:
10.0%</td><td rowspan="2">Authorised Consumption
10,105,451 m3/year
Error Margin [+/-]:
0.0%</td><td>Billed Authorised Consumption
9,662,715 m3/year</td><td>Billed Metered Consumption
8,844,709 m3/year</td><td rowspan="2">Revenue Water
9,662,715 m3/year</td></tr>
<tr><td></td><td>Billed Unmetered Consumption
818,006 m3/year</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption
442,736 m3/year
Error Margin [+/-]:
0.2%</td><td>Unbilled Metered Consumption
422,736 m3/year</td><td rowspan="3">Non-Revenue Water
15,703,595 m3/year
Error Margin [+/-]:
16.2%</td></tr>
<tr><td>Unbilled Unmetered Consumption
20,000 m3/year
Error Margin [+/-]: 4.0%</td></tr>
<tr><td>Water Losses
15.260.859 m3/year
Error Margin [+/-]:
16.6%</td><td rowspan="2">Apparent Losses
11,844,213 m3/year
Error Margin [+/-]:
3.9%</td><td>Unauthorised Consumption
9,619,575 m3/year
Error Margin [+/-]: 4.8%</td></tr>
<tr><td>Customer Meter Inaccuracies and Data Handling Errors
2,224,638 m3/year
Error Margin [+/-]: 2.0%</td></tr>
<tr><td colspan="3">Real Losses
3,416,646 m3/year
Error Margin [+/-]: 75.5%</td></tr>
</table>

Figure 5 – Water balance for RWC "Mitrovica" 2018

<table>
<tr><td rowspan="4">System Input Volume
28,347,492 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Authorised Consumption
11,715,719 m3/year
Error Margin [+/-]:
0.1%</td><td>Billed Authorised Consumption
11,553,469 m3/year</td><td>Billed Metered Consumption
9,458,171 m3/year</td><td rowspan="2">Revenue Water
11,553,469 m3/year</td></tr>
<tr><td></td><td>Billed Unmetered Consumption
2,095,298 m3/year</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption
162,250 m3/year
Error Margin [+/-]:
3.7%</td><td>Unbilled Metered Consumption
102,250 m3/year</td><td rowspan="3">Non-Revenue Water
16,794,023 m3/year
Error Margin [+/-]:
0.0%</td></tr>
<tr><td>Unbilled Unmetered Consumption
60,000 m3/year
Error Margin [+/-]: 10.0%</td></tr>
<tr><td>Water Losses
16.631.773 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Apparent Losses
10,085,840 m3/year
Error Margin [+/-]:
2.9%</td><td>Unauthorised Consumption
7,789,100 m3/year
Error Margin [+/-]: 3.7%</td></tr>
<tr><td>Customer Meter Inaccuracies and Data Handling Errors
2,296,740 m3/year
Error Margin [+/-]: 0.9%</td></tr>
<tr><td colspan="3">Real Losses
6,545,933 m3/year
Error Margin [+/-]: 4.5%</td></tr>
</table>

Figure 6 – Water balance for RWC "Gjakova" 2018

<table>
<tr><td rowspan="4">System Input Volume
14,992,458 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Authorised Consumption
9,013,084 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Billed Authorised Consumption
8,467,413 m3/year</td><td>Billed Metered Consumption
8,112,059 m3/year</td><td rowspan="2">Revenue Water
8,467,413 m3/year</td></tr>
<tr><td>Billed Unmetered Consumption
355,354 m3/year</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption
545,671 m3/year
Error Margin [+/-]:
0.0%</td><td>Unbilled Metered Consumption
545,671 m3/year</td><td rowspan="3">Non-Revenue Water
6,525,045 m3/year
Error Margin [+/-]:
0.0%</td></tr>
<tr><td>Unbilled Unmetered Consumption
0 m3/year
Error Margin [+/-]: 0.0%</td></tr>
<tr><td>Water Losses
5.979.374 m3/year
Error Margin [+/-]:
0.0%</td><td>Apparent Losses
4,668,005 m3/year
Error Margin [+/-]:
2.5%</td><td>Unauthorised Consumption
3,139,000 m3/year
Error Margin [+/-]: 3.6%

Customer Meter Inaccuracies and Data Handling Errors
1,529,005 m3/year
Error Margin [+/-]: 1.9%</td></tr>
<tr><td colspan="3">Real Losses
1,311,369 m3/year
Error Margin [+/-]: 8.9%</td></tr>
</table>

Figure 7 – Water balance for RWC "Bifurkacioni" 2018

<table>
<tr><td rowspan="4">System Input Volume
8,982,619 m3/year
Error Margin [+/-]:
18.8%</td><td rowspan="2">Authorised Consumption
3,424,683 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Billed Authorised Consumption
3,350,038 m3/year</td><td>Billed Metered Consumption
3,208,173 m3/year</td><td rowspan="2">Revenue Water
3,350,038 m3/year</td></tr>
<tr><td>Billed Unmetered Consumption
141,865 m3/year</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption
74,645 m3/year
Error Margin [+/-]:
0.4%</td><td>Unbilled Metered Consumption
2,450 m3/year</td><td rowspan="3">Non-Revenue Water
5,632,582 m3/year
Error Margin [+/-]:
30.0%</td></tr>
<tr><td>Unbilled Unmetered Consumption
72,195 m3/year
Error Margin [+/-]: 0.4%</td></tr>
<tr><td>Water Losses
5,557,937 m3/year
Error Margin [+/-]:
30.4%</td><td>Apparent Losses
4,246,591 m3/year
Error Margin [+/-]:
2.7%</td><td>Unauthorised Consumption
3,163,546 m3/year
Error Margin [+/-]: 3.5%

Customer Meter Inaccuracies and Data Handling Errors
1,083,045 m3/year
Error Margin [+/-]: 2.0%</td></tr>
<tr><td colspan="3">Real Losses
1,311,345 m3/year
Error Margin [+/-]: 129.1%</td></tr>
</table>

Figure 8 – Water balance for RWC "Hidromorava" 2018

<table>
<tr><td rowspan="5">System Input Volume
8,464,519 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Authorised Consumption
4,027,308 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Billed Authorised Consumption
4,012,702 m3/year</td><td>Billed Metered Consumption
3,525,645 m3/year</td><td rowspan="2">Revenue Water
4,012,702 m3/year</td></tr>
<tr><td>Billed Unmetered Consumption
487,057 m3/year</td></tr>
<tr><td rowspan="3">Unbilled Authorised Consumption
14,606 m3/year
Error Margin [+/-]:
0.2%</td><td>Unbilled Metered Consumption
13,356 m3/year</td><td rowspan="4">Non-Revenue Water
4,451,817 m3/year
Error Margin [+/-]:
0.0%</td></tr>
<tr><td>Unbilled Unmetered Consumption
1,250 m3/year
Error Margin [+/-]: 2.0%</td></tr>
<tr><td rowspan="3">Water Losses
4.437.211 m3/year
Error Margin [+/-]:
0.0%</td><td rowspan="2">Apparent Losses
2,930,869 m3/year
Error Margin [+/-]:
2.5%</td><td>Unauthorised Consumption
2,045,168 m3/year
Error Margin [+/-]: 3.5%</td></tr>
<tr><td>Customer Meter Inaccuracies and Data Handling Errors
885,701 m3/year
Error Margin [+/-]: 2.0%</td></tr>
<tr><td colspan="2">Real Losses
1,506,343 m3/year
Error Margin [+/-]: 4.8%</td></tr>
</table>