

Current and Economic Price of Water in Serbia [†]

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Abstract: In the context of this paper, the term “price of water” refers to the charges for drinking water supply and sewage services. The current price of water in Serbia is generally set at an affordable level and does not reflect the real costs. It varies from approximately 0.4 €/m³ in smaller settlements of less developed regions of the country, to approximately 1.0 €/m³ in some cities of more developed regions. Lower prices in some cases are the result of fact that these settlements do not provide sewage services (SS). The average price of water in the country is currently about 0.7 €/m³. This paper presents the current and economic price of water in Serbia, and its structure, from a sample of 34 public utility companies (PUC), which perform water supply (WSS) and sewerage services (SS).

Keywords: price of water; water supply systems; sewage systems; O&M costs; Serbia

1. Introduction

More intensive developments of water supply began in Serbia in the middle of the twentieth century. The number of users included in the public water supply system has increased over time, so that today it is around 85%. Total specific consumption also increased, from about 50–100 L per user per day in the 1950s to 3–4 times that value 50 years later, when it stabilized [1]. Today, the average total specific consumption is about 300 L per user per day, but there are significant differences from system to system, whereas just under 50% of the water produced relates to household consumption, the losses are about 40%, and the rest is used by public institutions and industries.

At the beginning of the 21st century, in Serbia, without Kosovo and Metohija (K and M), an average of about 23 m³/s of water (about 730 million m³/year) was abstracted annually for public water supply systems. This quantity has been gradually decreasing over the last 15 years, partly due to lower levels of economic activity, partially due to demographic decline, and today amounts to about 21 m³/s of water (about 660 million m³/year) [2]. This is illustrated by indicators for 2014, for which Table 1 shows the abstracted quantities of water and gives an approximate number of inhabitants and users of water supply and sewerage, as well as specific consumption. The results are divided into northern Serbia (Vojvodina region); population about 1.9 mil., Belgrade; about 1.6 mil. and central Serbia; about 3.6 mil. inhabitants. The reason for the division into these three sections is that Belgrade’s water supply and sewerage system is by far the largest in the country, and Vojvodina is a lowland area with lower losses and a slightly lower average specific consumption than the rest of the country. Sewerage infrastructure in this region is least developed.

Table 1. Number of inhabitants, % and number of users of water supply (WSS) and sewerage services (SS), produced water and specific drinking water consumption in 2014 in Serbia by regions.

Region	Number of Inhabitants, % and Number of Users of					Produced in 2014		Specific Total Drinking Water Consumption
	WSS and SS							
	Inhab.	WSS	SS					
	10 ⁶	%	10 ⁶	%	10 ⁶	m ³ /s	10 ⁶ m ³ /Year	L/WSS User/Day
Vojvodina	1.9	93	1.8	34	0.6	5.3	166	257
Belgrade	1.6	96	1.5	90	1.4	5.7	180	321
Central Serbia	3.6	75	2.7	50	1.8	9.9	312	317
Whole Serbia without K and M	7.1	85	6.0	55	3.9	20.9	658	300

As the topic of this paper is the price of drinking water in Serbia, Table 1 gives only basic indicators of utility systems operations, while other aspects of water supply will not be mentioned (types of sources, water quality, types of treatment, characteristics of distribution systems, etc.).

Water services systems, particularly drinking water supply, were in a good condition in the beginning of 1990s due to quite high investments in water sector at that time. Today, average price of drinking water in Serbia is about 0.7 €/m³, and barely covers operational and to some extent maintenance (O and M) costs of public utility companies (PUC). In the last 30 years only high priority investments have occurred. water supply (WSS) and sewerage services (SS) degradation that occurred mainly due to the lack of funding. Such a situation makes the sustainability of these systems impossible. Therefore, there is a need for the alignment of price of water with real costs.

It was estimated in some studies, papers and adopted documents [3–5] that the economic price of water should be set at a level of about 1.5 €/m³. In addition to the current price of drinking water, this paper presents the applied methodology and the results (just) of these studies.

2. Current Price of Water in Serbia

Generally, three types of consumers connected to water supply systems (WSS) are recognized: households, public institutions (schools, hospitals, culture centres, etc.), and industrial consumers. In the majority of cases, the prices of water for household and public institutions are the same, while price for industry is significantly higher. On average, 80% of water is delivered to households and public institutions, while about 20% of water is delivered to industrial consumers. So, overall price has been calculated as a sum of the price for households (WSS + SS) multiplied by 0.8 and the price for industry (WSS + SS) multiplied by 0.2. The current rate is 117.5 dinars for 1 euro.

Table 2 presents the current prices in 34 Public utility companies (PUC), split across Belgrade (1), Vojvodina (12) and central Serbia (21 PUCs). The prices are from 2018, but in the of majority cases, current prices are the same.

Table 2. Current prices in the sample of 34 Public utility companies (PUC) in Serbia.

Name of the PUC		WSS Price (din/m ³)		SS Price (din/m ³)		Overall Price (din/m ³)	Overall Price (€/m ³)
		House.	Ind.	House.	Ind.		
1	Belgrade (BVK)	51.48	85.19	20.81	45.84	84.0	0.72
NORTH SERBIA (Region Vojvodina)							
1	Zrenjanin	29.36	65.77	30.03	62.34	73.1	0.62
2	Sombor	58.87	92.46	62.55	87.59	133.1	1.13
3	Vrbas	54.76	81.80	30.30	40.90	92.6	0.79
4	Plandište	30.61	30.61	15.31	15.31	45.9	0.39
5	Srem. Mitrovica	49.70	71.30	24.80	37.00	81.3	0.69
6	Bačka Topola	46.63	144.11	23.32	70.31	98.8	0.84
7	Subotica	47.00	47.00	30.00	30.00	77.0	0.66
8	Kikinda	47.12	110.00	41.62	107.00	114.4	0.97
9	Bela Crkva	37.70	114.21	18.87	58.72	79.8	0.68
10	Odžaci	54.89	125.54	27.45	62.76	103.5	0.88

11	Bečej	44.00	83.00	17.00	30.00	71.4	0.61
12	Indija	48.00	88.00	18.00	30.00	76.4	0.65
Vojvodina averages		45.72	87.82	28.27	52.66	87.28	0.74
CENTRAL SERBIA							
1	Bor	52.82	144.72	52.92	31.72	119.9	1.02
2	Požega	57.15	98.94	14.28	25.54	82.0	0.70
3	Knjaževac	59.40	75.00	17.60	25.90	81.8	0.70
4	Despotovac	45.56	91.12	11.37	30.36	69.8	0.59
5	Koceljeva	42.10	86.32	9.38	12.49	60.9	0.52
6	Arandelovac	56.85	115.07	12.22	32.26	84.7	0.72
7	Obrenovac	69.81	187.41	19.70	65.12	122.1	1.04
8	Mladenovac	53.00	105.19	12.17	39.98	81.2	0.69
9	Ljig	50.75	93.69	9.00	38.73	74.3	0.63
10	Knić	40.67	82.98	5.57	18.54	57.3	0.49
11	Svilajnac	53.22	105.50	25.99	51.60	94.8	0.81
12	Zaječar	60.00	105.00	23.00	31.50	93.7	0.80
13	Užice	50.33	100.66	12.58	25.16	75.5	0.64
14	Čajetina	42.50	77.40	12.50	20.40	63.6	0.54
15	Ražanj	50.00	100.00	10.00	30.00	74.0	0.63
16	Svrljig	24.61	64.88	9.61	20.69	44.5	0.38
17	Bela Palanka	44.00	108.00	12.00	36.00	73.6	0.63
18	Dimitrovgrad	30.00	30.00	8.64	8.64	38.6	0.33
19	Pirot	48.48	24.24	12.05	6.03	54.5	0.46
20	Bosilegrad	36.36	123.60	14.54	36.00	72.6	0.62
21	Vladičin Han	42.60	101.20	12.60	23.00	69.0	0.59
Central Serbia averages		48.11	96.23	15.13	30.05	75.6	0.64

As can be seen from Table 2, current prices are low, and they cannot cover all the needs of one PUC (WSS + SS).

3. Economic Price of Water in Serbia—Methodology

In the context of a municipal water system, the concept of the economic price (EP) of water covers all necessary costs of the WSS and SS operation and maintenance, all depreciation and planned WSS development expenses, all depreciation and planned SS development expenses, as well as expenses related to state fees for the development of the facilities of significant public importance. The economic price also includes **non-realization of profits** made from the sale of services provided by the PUCs. In order to respond to the task, it has been necessary to process adequate sample data, comprised of enough public utility systems from all parts of Serbia.

The economic price of water can be divided into 6 parts:

- A. Operational expenses,
 - B. Waterworks depreciation expenses,
 - C. Sewerage depreciation expenses,
 - D. Water supply system development expenses,
 - E. Sewerage system development expenses,
 - F. Fees payable to the state for the development of facilities of public significance.
- A. Operational expenses comprise:
- Employees' wages,
 - Costs payable to third parties unrelated to the water supply or sewerage systems themselves (fuel, electricity, telephone, representation, external assistance in solving some problems, etc.),

- Renovation and re-organization of the fixed assets owned by the PUC,
 - Modernization of the mechanization owned by the PUC.
- B. Waterworks depreciation expenses comprise (annual depreciation shown on Table 3):
- Depreciation of water source facilities,
 - Depreciation of water treatment plants (WTPs),
 - Depreciation of pump stations,
 - Depreciation of reservoirs,
 - Depreciation of pipelines,
 - Depreciation of other water supply system facilities.
- C. Sewerage depreciation expenses comprise (annual depreciation shown on Table 3):
- Depreciation of wastewater treatment plants (WWTPs),
 - Depreciation of pump stations,
 - Depreciation of main sewers,
 - Depreciation of other sewerage facilities.

Table 3. Presents adopted annual depreciation rates for water supply (WS) and sewerage systems (SS).

Part of PUC	Annual Depreciation (%)
Fixed Assets	1.8
Mechanization and miscellaneous equipment (cars, trucks and other vehicles, as well as other property of the PUC which is not included in fixed assets and does not comprise a part of the WS or SS)	12.0
<i>Water Supply and Sewerage Systems</i>	
Water Source	3.0
WTP & WWTP	3.5
Pump Stations (all)	4.0
Pipelines & Main Sewers	2.0
Reservoirs	2.0
Other Parts of Water Supply and Sewerage Systems	3.0

D. Water supply system development expenses are the costs of adding new elements to the water supply system over the course of the next 15 years. The following are principles for determining the development level have been determined:

- Investment in the treatment plant development at the municipal level equals the WTP's investment value of the municipality's central water supply system. Central municipal WSS which need a water treatment device yet do not have one, will have one built over the stated time period. Other, smaller local municipal systems will, if needed, have one built later. Those central municipal water supply systems already equipped with WTPs for drinking water, will start the development process,
- Investment in the development of water sources and of distribution systems at the municipal level are based on the current WSS value, as well as on the percentage of the population that is connected to the system, proportionally up to a connectivity of 95%,
- Total development of WSS at the municipal level is equal to the sum of investments planned for the WTP, the water source and the distribution network. The distribution of investments within the municipality by built-up areas is proportional to each area's population,
- The investments are to be repaid through the price of water over a time period of 15 years.

E. Sewerage system development expenses are the costs of SS adding new elements to the SS over the course of the next 15 years. The following principles for determining the development level have been determined:

- Investment in SS development is based on the same principles applied to WSS, with the difference being that the central municipal SS already equipped with WWTPs are to begin developing WWTPs in smaller scale built-up areas, equal to the half of the value of the given central municipal system's WWTP. Another difference is that the sewerage connectivity agreed upon for the near future, amounts to up to 90% (as opposed to 95% in the case of the WSS).

F. All above parts of economic price of water (A - E) are related and covered on the municipality level. But, the need for fees payable to the state for the development of the facilities of a regional or public significance also exist. There is a prescribed percentage (nowadays, 50% in most cases) subsidized by the state, when it comes to constructing water source facilities, plants and main supply pipes. The state also funds the construction of common use facilities, such as regional WSS and SS, and the development of important studies and designs pertinent to the subject area. The Study has defined that these fees should be the same for all the systems in Serbia (approx. between 0.15 and 0.20 €/m³).

Other notes and defined principles necessary for understanding the Study:

- As a means of loss reduction, a realistic limit has been set for the reduction of the unbilled portion at 25% of the total water production. Hence, the amount of water which determines its economic price, is 75% of the total water production in the given WSS.
- Investments are determined by considering standard principles and specific prices applied in Serbia for these purposes [3].

4. Economic Price of Water in Serbia—Results

Table 4 presents EP for the same 34 PUCs as in Section 2, split across Belgrade (1), Vojvodina (12) and central Serbia (21). Prices are without Value Added Tax (VAT). The displayed calculations for each PUC should be accepted with an accuracy of $\pm 10\%$, as they have been performed for the purpose of the global Study. The estimated mean economic price of drinking water by categories in Belgrade, North Serbia and Central Serbia (€/m³) are shown in Figure 1.

Table 4. Estimated economic price of drinking water in 34 PUCs all over Serbia.

Name of the PUC		Operatio nal Costs	Water Supply System		Sewage System		State Fees	Overall Economic Price
			Depreci ation	Develo pment	Depreci ation	Develop ment		
(€/m³)	(€/m³)	(€/m³)	(€/m³)	(€/m³)	(€/m³)	(7) = ∑(1÷6)		
(1)	(2)	(4)	(3)	(5)	(6)			
1	Belgrade (BVK)	0.37	0.25	0.13	0.17	0.36	0.15	1.44
NORTH SERBIA (Region Vojvodina)								
1	Zrenjanin	0.41	0.10	0.27	0.10	0.34	0.15	1.37
2	Sombor	0.34	0.15	0.09	0.26	0.41	0.15	1.39
3	Vrbas	0.28	0.16	0.08	0.15	0.34	0.15	1.16
4	Plandiste	0.58	0.09	0.06	0.01	0.19	0.15	1.08
5	Sr. Mitrovica	0.19	0.06	0.09	0.06	0.51	0.15	1.06
6	Backa Topola	0.47	0.08	0.18	0.06	0.48	0.15	1.41
7	Subotica	0.45	0.16	0.18	0.29	0.40	0.15	1.64
8	Kikinda	0.34	0.12	0.31	0.20	0.59	0.15	1.71
9	Bela Crkva	0.42	0.24	0.23	0.06	0.20	0.15	1.29
10	Odzaci	0.48	0.13	0.25	0.06	0.23	0.15	1.30
11	Becej	0.41	0.19	0.15	0.23	0.56	0.15	1.69
12	Indijia	0.68	0.12	0.25	0.01	0.37	0.15	1.59

Vojvodina averages		0.42	0.14	0.18	0.12	0.38	0.15	1.39
CENTRAL SERBIA								
1	Bor	0.47	0.28	0.12	0.03	0.13	0.15	1.19
2	Požega	0.31	0.16	0.22	0.10	0.18	0.15	1.12
3	Knjaževac	0.37	0.31	0.28	0.08	0.60	0.15	1.79
4	Despotovac	0.49	0.15	0.04	0.17	0.24	0.15	1.25
5	Koceljeva	0.29	0.17	0.19	0.10	0.32	0.15	1.22
6	Arandelovac	0.42	0.92	0.48	0.10	0.57	0.15	2.65
7	Obrenovac	0.47	0.33	0.19	0.09	0.33	0.15	1.56
8	Mladenovac	0.89	0.21	0.27	0.05	0.25	0.15	1.81
9	Ljig	0.46	0.18	0.05	0.10	0.23	0.15	1.17
10	Knić	0.41	0.12	0.09	0.04	0.48	0.15	1.29
11	Svilajnac	0.37	0.15	0.23	0.35	0.43	0.15	1.69
12	Zaječar	0.59	0.50	0.41	0.05	0.24	0.15	1.93
13	Užice	0.29	0.75	0.05	0.12	0.12	0.15	1.47
14	Čajetina	0.45	0.41	0.06	0.05	0.12	0.15	1.25
15	Ražanj	0.89	0.31	0.09	0.07	0.34	0.15	1.85
16	Svrljig	0.50	0.08	0.07	0.17	0.15	0.15	1.13
17	Bela Palanka	0.42	0.16	0.06	0.24	0.12	0.15	1.15
18	Dimitrovgrad	0.26	0.05	0.08	0.32	0.41	0.15	1.27
19	Pirot	0.45	0.20	0.06	0.41	0.12	0.15	1.40
20	Bosilegrad	0.48	0.12	0.05	0.16	0.16	0.15	1.12
21	Vladičin Han	0.38	0.16	0.14	0.07	0.32	0.15	1.22
Central Serbia averages		0.46	0.27	0.15	0.14	0.28	0.15	1.45

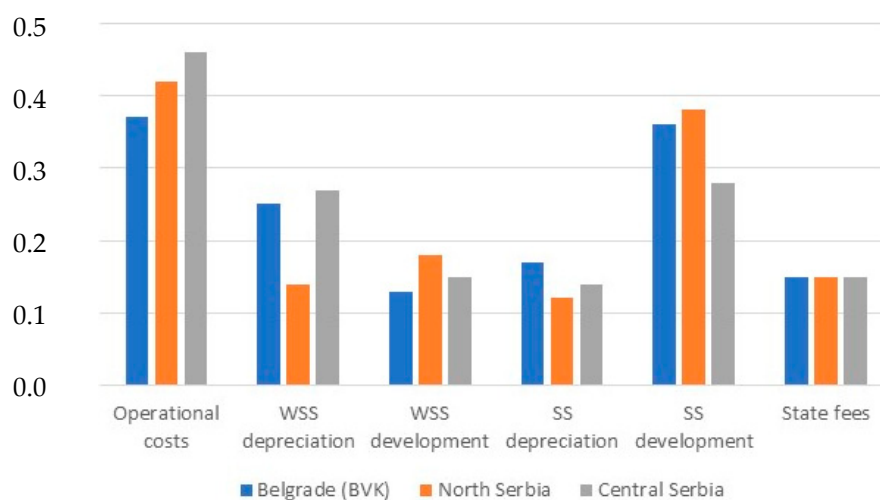


Figure 1. Estimated mean economic price of drinking water by categories in three main parts of Serbia (€/m³).

5. Discussion and Conclusions

It could be seen that current overall prices vary from 0.39 €/m³ in Plandište to 1.13 €/m³ in Sombor, with a country average of about 0.7 €/m³. The average current price in central Serbia (0.64 €/m³) is slightly lower than in the rest of the country, probably due to the slightly lower standard.

The EP for operational costs is, in the majority of PUCs, between 0.3 €/m³ and 0.5 €/m³.

The average EP for WSS for the depreciation part (approx. 0.2 €/m³) is slightly higher than the development part of EP (approx. 0.15 €/m³), while for the SS it is quite the opposite (approx. 0.15 €/m³ for the depreciation part and approx. 0.35 €/m³ for the development part). It is logical and also a consequence of the percentage makeup of these systems—Table 1 (WSS 85%, SS 55%) and especially due to the low number of built wastewater treatment plants. It should be said that the WSS depreciation is higher in central Serbia primarily due to the existence of dams in some WSS (Arandelovac, Zaječar, Užice and Čajetina from the list).

The average EP in Vojvodina (1.39 €/m³) is slightly lower than in the rest of the country (PUC Belgrade 1.45 €/m³ and PUCs in central Serbia 1.44 €/m³). One of the main reasons is the terrain configuration in the north of the country (plain). The difference would be greater if the coverage with SS in this part of the country was higher (just 34% now).

State fees, which should cover national important regional studies, designs and jobs (such as regional water supply systems) should be the same for all PUCs and has been defined at a level between 0.15 and 0.20 €/m³.

Generally, the economic price for drinking water for the great majority of PUCs (22 of 34) is more than double that of the current price. The question is, which is the optimal way and how can it be achieved? Experiences of other countries will likely help to find the best answers [6–8].

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