

MUNICIPAL INFRASTRUCTURE AT THE LEVEL OF PROTECTED NATURAL AREAS ROSCI0045 JIU CORRIDOR, BISTREȚ ROSPA0010 AND NATURAL RESERVES DRĂNC FOSSIL PLACE-2391 AND ZAVAL FOREST - IV.33 + A6

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ABSTRACT

The paper aims to highlight the aspects related to the urban infrastructure for the protected areas ROSCI0045 Jiu Corridor, Bistreț ROSPA0010 and the Drănic Fossil Place-2391 and Zaval Forest Nature Reserves – IV.33+A6, given that they group a significant number of species of plant and animal origin. These protected areas play an essential role in biodiversity conservation at the level of the 56 ATUs (37 in Dolj County, 17 in Gorj County, one in Mehedinți County, one in Olt County), on whose territory they are located. The paper refers to the drinking water distribution network, the sewerage network and the natural gas distribution network (including adjacent aspects related to them).

The area has 740 km of city streets, of which 578 km modernized, 1971.2 km drinking water network, 936.0 km sewerage network, produces about 342 thousand cubic meters of water per day, achieving a daily consumption of 19,956 cubic meters. Within the area, there are 940.2 km of pipelines for natural gas distribution (two thirds located in the urban area), which facilitated a consumption of 133,040 thousand cubic meters of gas annually. The urban infrastructure improved during 2017-2021, but certain aspects related to it need to be properly analyzed in order not to have a high negative impact on the state of the environment.

Key words: drinking water, natural gas, modernization, sewerage network, street

INTRODUCTION

The protected areas ROSCI0045 Jiu Corridor, Bistreț ROSPA0010 and the Drănic Fossil Place-2391 and Zaval Forest Nature Reserves – IV.33+A6, are found on the territories of Dolj counties (Craiova municipality, Bechet, Dabuleni, Filiași and Segarcea cities, Almăj, Bistreț, Braloștița, Bratovoești, Brădești, Breasta, Bucovăț, Calopar, Catane, Calarasi, Cârna, Comagofenii din Dos, Comagofenii din Front, Dobrești, Drănic, Gângiova, Ghindeni, Gighera, Goicea, Ișalnița, Malu Mare, Măceșu de Jos, Mârșani, Ostroveni, Podari, Rojiște, Sadova, Scăești, Teasc,

Țuglui, Valea Stanciului and Vârvoru de Jos), Gorj (the towns of Turceni and Țicleni, respectively the communes of Aninoasa, Bărbătești, Bâlteni, Borăscu, Brănești, Dănești, Drăguțești, Fărcășești, Ionești, Negomir, Plopșoru, Săulești, Turburea, Țânțăreni and Urdari), Mehedinți (Butoiești commune) and Olt (lanca commune).

The protected natural area has natural sources of water, such as springs, rivers or lakes, which can be essential for preserving biodiversity and maintaining ecosystems. The capacity to produce drinking water and the quantity of water

distributed to consumers may affect these water sources. If the drinking water distribution network is extended in the protected area or there is a large drinking water production capacity, there may be a risk of affecting the quantity and quality of water available to the natural environment. At the same time, the total length of sewer pipes has a direct impact on water quality in the protected area. A proper and well-maintained sewage system is essential to prevent pollution and wastewater leakage into the ecosystem.

The expansion of the natural gas distribution pipeline network in the area can have a negative impact on the environment. The construction and maintenance of these pipelines involves excavation works, deforestation or other activities that may affect the natural habitat and biodiversity in the protected area. Proper management is required to minimize environmental impact during installation and maintenance of these pipelines.

METHOD AND MATERIAL

The paper was elaborated based on adequate documentation (by using official statistical data) and by using comparison in time and space that highlights the evolution in certain analyzed indicators, in dynamics and in regional context. The analysis refers to the period of time between 2017 and 2021, presenting comparatively the two years (dynamics indices, where 2017 is the reference term). The following indicators were used: length of city streets – of which in municipalities, cities, respectively modernized (km), total length of simple drinking water distribution network (km), total simple length of sewerage pipes (km), capacity of drinking water production facilities (cubic meters / day), total quantity of drinking water distributed to consumers (thousand cubic meters), total length of gas distribution pipes (km), quantities of natural gas

distributed (thousand cubic meters). The indicators are presented for ATUs in Dolj, Gorj, Mehedinți and Olt counties – included within protected areas, as well as by areas of residence (urban, rural) or field of use (domestic).

Please note that in Mehedinți and Olt counties, the area does not include urban localities, in Butoiești commune in Mehedinți county there is no sewerage network, and the distribution of natural gas and implicitly its consumption is not carried out in Butoiești (Mehedinți county) and Ianca (Olt County).

RESULTS AND DISCUSSIONS

Table 1 contains the data characterizing streets in urban areas, in terms of length and degree of modernization.

In Dolj County, the total length of streets varied from 651 to 669 km, of which approximately 65-69% are municipal streets and 31-35% are city streets. The modernized streets held shares of 64.67 and 76.38% of the total. (421 and 511 km respectively). The situation is determined by the inclusion of Craiova in the area, the other 4 cities being clearly below its level. Compared to 2017, in 2021 there are advances by: 2.23, 2.76, 3.63, 21.38 and 18.11% for municipal streets, total length of streets, city streets, degree of modernization respectively modernized streets (Figure 1). As such, we can talk about an improvement of the road infrastructure within the urban environment, for Dolj County.

At Gorj county level, we are talking about total lengths of city streets of 66 and 71 km respectively in 2017 and 2021 (+7.58%), indicators that are specific for the cities of Turceni and Ticleni. Of these, 92.42% were modernized in 2017 (61 km) and 94.37% in 2021 (67 km). Figure 1 shows the increases in indicators in 2021 compared to 2017 (2.11% for the degree of modernization, 7.58% overall and 9.84% for modernized segments).

Table 1. Length of city streets (km)

Specification	Year		2021/2017 (%)***
	2017	2021	
Dolj County			
Total***, of which:	651	669	102.76
- municipalities *	403	412	102.23
- towns *	248	257	103.63
- upgraded **	421	511	121.38
- modernized share of the total ***	64.67	76.38	118.11
Gorj County			
Total***, of which:	66	71	107.58
- towns *	66	71	107.58
- upgraded **	61	67	109.84
- modernized share of the total ***	92.42	94.37	102.11
Total general***			
Total, of which:	717	740	103.21
- municipalities	403	412	102.23
- towns	314	328	104.46
- upgraded	482	578	119.92
- modernized share of the total ***	67.22	78.11	116.20

* processed after: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>, GOS104A– Length of city streets by counties and localities (12.05.2023)

** processed after: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>, GOS105A– Length of modernized city streets, by counties and localities (12.05.2023)

*** own calculations;

For the general level of the area, we are talking about the increase of the indicator, generally, from 717 km in 2017 to 740 km in 2021, a phenomenon that also manifests itself in the rest of the situations: 403 and 412 km municipal streets, 314 and 328 km city streets, 482 and 578 km modernized streets, 67.22 and 78.11% share of modernized streets in total. The relative increases in indicators are shown in Figure 1.

Table 2 contains data related to drinking water distribution networks and sewerage networks.

a. Total length of drinking water network (km). At the level of Dolj county, there is a variation in the total length of the drinking water network from 1181.9 to 1506.1 km, at which level the urban environment predominates with levels of 768.3 and 967.0 km. Sequentially, we are talking about increases between the two years of 27.43, 25.86 and 30.34% at general level, in urban areas and rural areas respectively (413.6 and 539.1 km). In the case of Gorj county we are talking about limits of 363.3 and 420.7 km for the drinking water network, of which 21.7 and 25.7 km in the urban area and 341.6 and 395.0 km in the case of the rural area

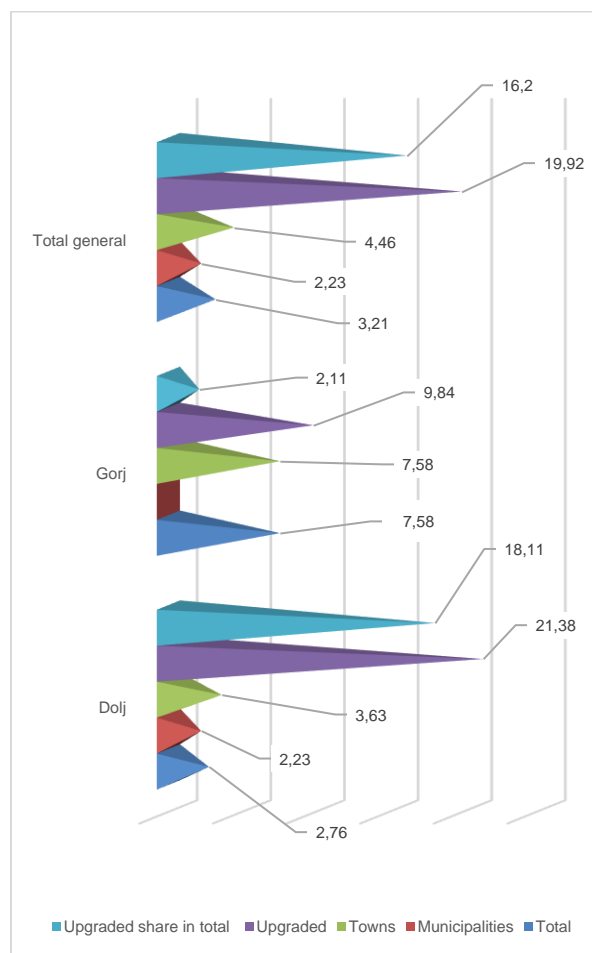


Fig. 1. Length of city streets, comparative situation 2021 vs 2017
(±% - processed after: www.inse.ro)

Table 2. Drinking water distribution network and sewerage network

Specification	Total network length drinking water (km)*			Simple total length of sewer pipes (km)**		
	Year		2021/2017 (%)***	Year		2021/2017 (%)***
	2017	2021		2017	2021	
Dolj County						
Total, of which:	1181.9	1506.1	127.43	694.0	832.1	119.89
- urban	768.3	967.0	125.86	647.6	727.9	112.39
- rural	413.6	539.1	130.34	46.4	104.2	224.57
Gorj County						
Total, of which:	363.3	420.7	115.80	47.0	89.3	190.0
- urban	21.7	25.7	118.43	13.5	23.3	172.59
- rural	341.6	395.0	115.63	33.5	66.0	197.01
Mehedinți County						
Total, of which:	13.4	13.4	100.0	-	-	-
- rural	13.4	13.4	100.0	-	-	-
Olt County						
Total, of which:	31.0	31.0	100.0	-	14.6	-
- rural	31.0	31.0	100.0	-	14.6	-
Total general***						
Total, of which:	1589.6	1971.2	124.01	741.0	936.0	126.32
- urban	790.0	992.7	125.66	661.1	751.2	113.63
- rural	799.6	978.5	122.37	79.9	184.8	231.29

* processed after: <http://statistici.insee.ro:8077/tempo-online/#/pages/tables/insee-table>, GOS106B- Total length of the simple drinking water distribution network, by counties and localities (12.05.2023);

** processed after: <http://statistici.insee.ro:8077/tempo-online/#/pages/tables/insee-table>, GOS110A- Simple total length of sewer pipes, by counties and localities (13.05.2023)

*** own calculations;

(relative increases of 15.80, 18.43 and 15.63%). Butoiești commune has a water network with a length of 13.4 km, and at the level of lanca commune the indicator reached 31.0 km – invariable levels for 2017 and 2021. At the overall level of the area, the indicator increased from 1589.6 to 1971.2 km from 2017 to 2021, of which the urban area held 790 and 992.7 km respectively. The indicator increased in 2021 by 24.01, 25.66 and 22.37 overall, in Iraqi and rural areas, respectively. The relative changes in the indicator are shown in Figure 2.

b. Simple total length of sewer pipes (km). From the beginning, it should be noted that in Butoiești commune there is no sewerage network, and in the case of lanca, we have commune sewerage network with a length of 14.6 km in 2021. For Dolj county, the indicator increased from 694 to 832.1 km (+19.89%), and by residence areas the situation was as follows: 647.6 and 727.9 km in urban areas (+12.39%), 46.4 and 104.2 km in rural areas (+124.57%). Gorj County has limits of 47 and 89.3 km for the total simple

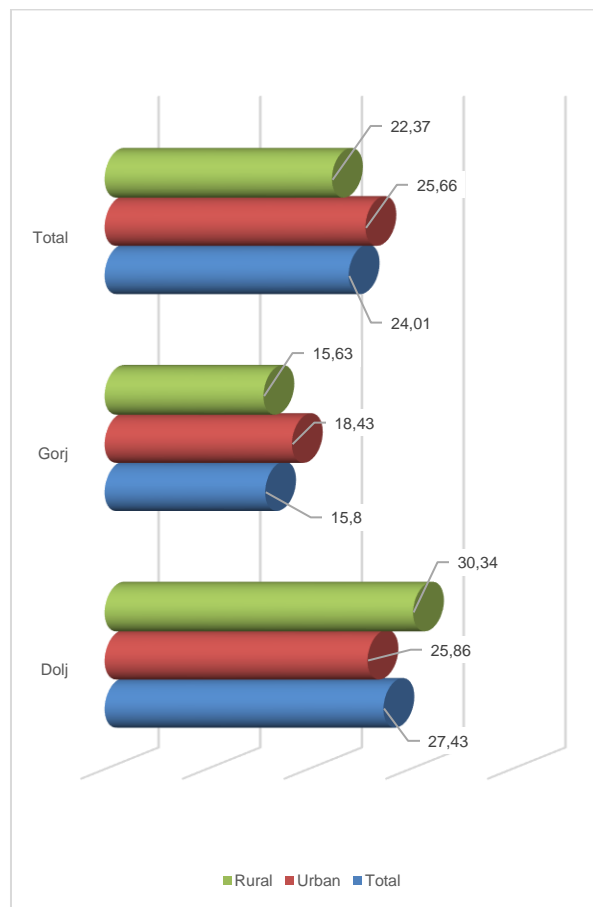


Fig. 2. Total length of drinking water network, comparative situation 2021vs2017 (±% - processed after: www.insee.ro)

length of sewer pipes (1.90 times ahead of 2017 in 2021), of which the rural area was mainly (33.5 and 66.0 km, 1.97 times increase), the urban area holding between 13.5 and 23.3 km (1.72 times ahead of us). At the general level of the area, the indicator increased from 741 to 936 km (+26.32% in 2021 compared to 2017), and for the two residence environments the situation was as follows (at the level of the two years – 2017 and 2021): 661.1 and 751.2 km in urban (+13.63%), 79.9 and 184.8 km in rural (+131.29%).

The relative developments of the indicator are shown in Figure 3.

Table 3 presents specific data for drinking water production capacities (cubic meters/day) and total quantity of water delivered to consumers (thousand cubic meters).

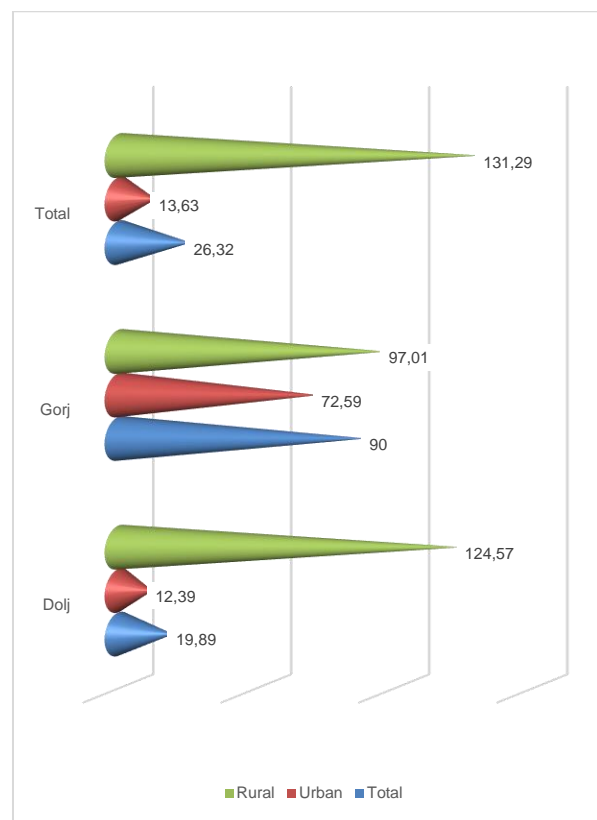


Fig. 3. Simple total length of sewer pipes, comparative situation 2021vs2017 (±% - processed after: www.inse.ro)

Table 3. Drinking water

Specification	Capacity of generating installations drinking water (mc/day)*			Total amount of drinking water distributed to consumers (thousand cubic meters)**		
	Year		2021/2017 (%)***	Year		2021/2017 (%)***
	2017	2021		2017	2021	
Dolj County						
Total, of which:	325,687	327,454	100.54	18,098	18,386	101.59
- urban	316,747	316,747	100.0	16,869	16,817	99.69
- rural	8,940	10,707	119.77	1,229	1,569	127.66
Gorj County						
Total, of which:	14,907	13,981	93.79	2,488	1,471	59.12
- urban	2,784	3,506	125.93	353	239	67.71
- rural	12,123	10,475	86.41	2,135	1,232	57.70
Mehedinți County						
Total, of which:	538	538	100.0	57	57	100.0
- rural	538	538	100.0	57	57	100.0
Olt County						
Total, of which:	360	360	100.0	27	42	155.56
- rural	360	360	100.0	27	42	155.56
Total general***						
Total, of which:	341,492	342,333	100.25	20,670	19,956	96.54
- urban	319,531	320,253	100.23	17,222	17,056	99.04
- rural	21,961	22,080	100.54	3,448	2,900	84.11

* processed after: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>. GOS107A– Capacity of drinking water production installations, by counties and localities (12.05.2023);

** processed after: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>. GOS108A– Quantity of drinking water distributed to consumers, by counties and localities (12.05.2023);

*** own calculations;

a. Capacity of drinking water production facilities (cubic meters/day).

In the case of the capacity of drinking water production installations, at Dolj county level, it is noted its increase by 1,767 cubic meters / day

in 2021 compared to 2017, an increase due to the situation in rural areas (8,940 cubic meters / day in 2017 and 10,707 cubic meters / day in 2021), while at the level of the urban area the indicator remained constant (316,747 cubic meters / day in both situations). The exceedances of the reference deadline were 0.54 and 19.77% at general level and for rural areas. In Gorj county, the indicator increased by 25.93% in the urban area (from 2,784 to 3,506 cubic meters/day – 2017 and 2021, respectively), while at general level and for rural areas the indicator recorded decreases from 2021 to 2021 (14,907 and 13,981 cubic meters/day overall situation, 12,123 and 10,475 cubic meters/day in rural areas). In Butoiești commune, the indicator was constant, at the level of the two years (538 cubic meters / day), a similar situation being found in Ianca commune (360 cubic meters / day). At the general level of the area, the indicator increased by 802 cubic meters / day (+0.25%, 341,492 and 342,333 cubic meters / day in 2017 and 2021 respectively), the situation being similar both in urban areas (+0.23%) and in rural areas (+0.54%). Figure 4 shows the comparative situation of drinking water capacity.

b. Total quantity of drinking water distributed to consumers (thousand cubic meters). For Dolj County, there is an increase in the capability of drinking water distributed from 18,098 to 18,386 thousand cubic meters from 2017 to 2021 (+1.59%). The phenomenon was decisively marked by the specific situation of the rural area (+27.66%, increase from 1,229 to 1,569 thousand cubic meters at the level of the two years – 2017 and 2021), while for the urban area we are talking about an involution of the indicator from 16,869 to 16,817 thousand cubic meters (-0.31%).

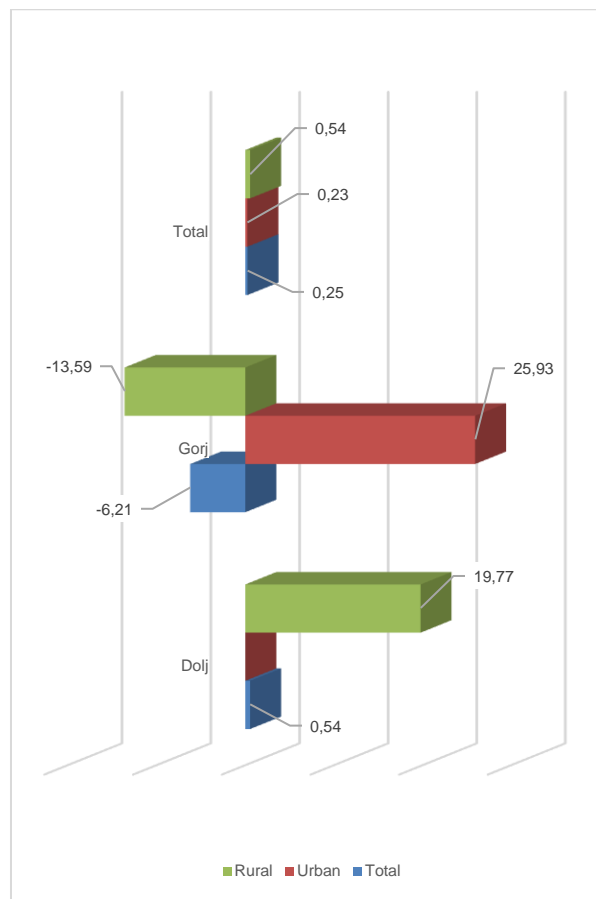


Fig. 4. Capacity of drinking water production facilities, comparative situation 2021vs2017 (±% - processed after: www.inse.ro)

In Gorj County, there is a drastic decrease in the indicator, for all reference levels: - 59.12% at general level (from 2,488 to 1,471 thousand cubic meters in 2017 respectively 2021), -32.29% in urban areas (from 353 to 239 thousand cubic meters in 2017 respectively 2021), - 42.30% in rural areas (from 2,135 to 1,232 thousand cubic meters in 2017 and 2021, respectively). In the case of Butoiești commune, in Mehedinți county, the indicator was equi-unitary for 2017 and 2021, respectively (57 thousand cubic meters), while at the level of Ianca commune (Olt county) the indicator increased in 2021 by 55.56% compared to 2017 (42 compared to 27 thousand cubic meters). At the general level of the area, the following aspects are observed: decrease in the total amount of drinking water distributed to consumers from 20,670 to 19,956 thousand cubic meters (- 3.46%), a downward trend in urban areas

(-0.96%, from 17,222 to 17,056 thousand cubic meters for 2017 respectively 2021), decrease of the indicator in the case of rural areas (the most pronounced, in relative units, -15.89%, from 3,448 to 2,900 thousand cubic meters in the case of the two years).

Figure 5 shows the relative changes of the indicator between 2017 and 2021.

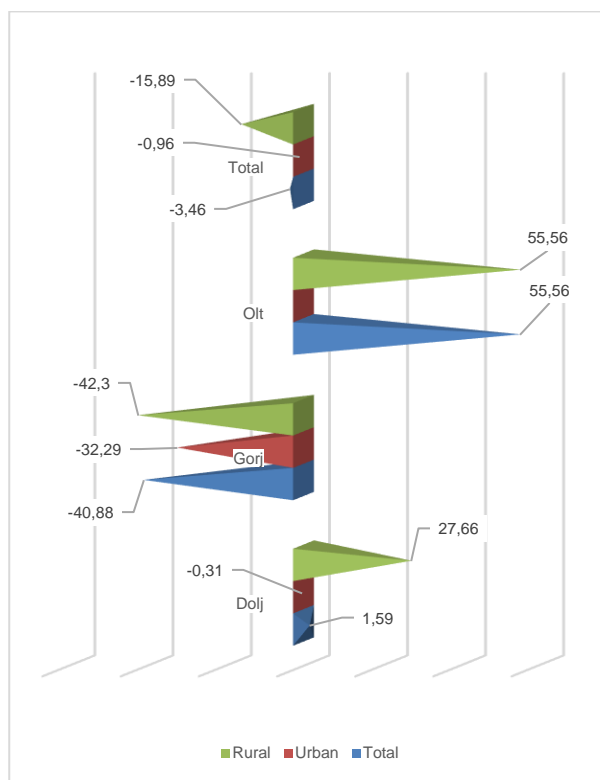


Fig. 5. Total quantity of drinking water distributed to consumers, comparative situation 2021 vs 2017

(±% - processed after: www.inse.ro)

Table 4 shows the evolution of the total length of gas distribution pipelines (km) and the quantity of natural gas distributed to consumers (thousand cubic meters). It should be noted that the ATUs in Mehedinti and Olt counties, included in the area, do not have natural gas distribution networks, and in terms of consumption the level of domestic uses is presented.

a. Total length of gas distribution pipelines (km). For Dolj County, the length of the distribution network increased by 54.5 km from 2017 to 2021 (+9.89%, from 551.1 to 605.6 km in 2017 and 2021, respectively), a phenomenon that manifested itself both for urban areas

(+6.98%, 489.9 and 524.1 km respectively in the two years) and for rural areas (+33.17%, from 61.2 to 81.5 km in 2017 and 2021, respectively). In the case of Gorj county, the indicator recorded an upward trend, for all reference levels, as follows: +22.0 km overall (+7.04%, from 312.6 to 334.6 km in 2017 and 2021), +0.1 km for urban areas (+0.09%, 116.2 and 116.3 km respectively in the two years), +21.9 km for rural areas (+11.15%, from 196.4 to 218.3 km in 2017 and 2021 respectively). Overall, the area recorded upward trends in the total length of natural gas distribution pipelines, as follows: +76.5 km overall (+8.86%, from 863.7 to 940.2 km in 2017 and 2021), +34.3 km for urban areas (+5.66%, 606.1 and 640.4 km respectively in the two years), +42.2 km for rural areas (+16.38%, from 257.6 to 299.8 km in 2017 and 2021 respectively).

Figure 6 shows the comparative situation of the total length of natural gas distribution pipelines between 2021 and 2017.

b. Quantity of natural gas distributed (thousand cubic meters). If we refer to the specific situation of Dolj county, there are upward developments of the indicator, as follows: +13,235 thousand cubic meters at general level (+13.94%, from 94,956 to 108,193 thousand cubic meters in 2017, respectively 2021), +9,330 thousand cubic meters for the urban area (+10.06%, 92,701 and 102,031 thousand cubic meters respectively at the level of the two years), +3,907 thousand cubic meters for the rural area (+173.26%), from 2,255 to 6,162 thousand cubic meters in 2017 and 2021, respectively), +10,588 thousand cubic meters at the level of household consumers (+18.67%, from 56,699 to 67,287 thousand cubic meters in the case of the two years). Regarding the situation characteristic of Gorj County, there are increases in the quantities of gas distributed, as follows: +6,238 thousand cubic meters at general level (+33.52%, from 18,609 to 24,847 thousand cubic meters in 2017, respectively 2021), +3,285 thousand cubic meters for the urban area (+21.03%, 15,621 respectively

Table 4. Natural gas

Specification	Total length of gas distribution pipelines (km)*			Quantity of natural gas distributed (thousand cubic meters)**		
	Year		2021/2017 (%)***	Year		2021/2017 (%)***
	2017	2021		2017	2021	
Dolj County						
Total, of which:	551.1	605.6	109.89	94,956	108,193	113.94
- urban	489.9	524.1	106.98	92,701	102,031	110.06
- rural	61.2	81.5	133.17	2,255	6,162	273.26
- household	-	-	-	56,699	67,287	118.67
Gorj County						
Total, of which:	312.6	334.6	107.04	18,609	24,847	133.52
- urban	116.2	116.3	100.09	15,621	18,906	121.03
- rural	196.4	218.3	111.15	2,988	5,941	198.83
- household	-	-	-	4,733	8,143	172.05
Total general***						
Total, of which:	863.7	940.2	108.86	113,565	133,040	117.15
- urban	606.1	640.4	105.66	108,322	120,937	111.65
- rural	257.6	299.8	116.38	5,243	12,103	230.84
- household	-	-	-	61,432	75,430	122.79

* processed after: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>, GOS116A- Total length of gas distribution pipelines, by counties and localities (13.05.2023)

** processed after: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>, GOS118A- Natural gas distributed by destination, by counties and localities (13.05.2023)

*** own calculations;

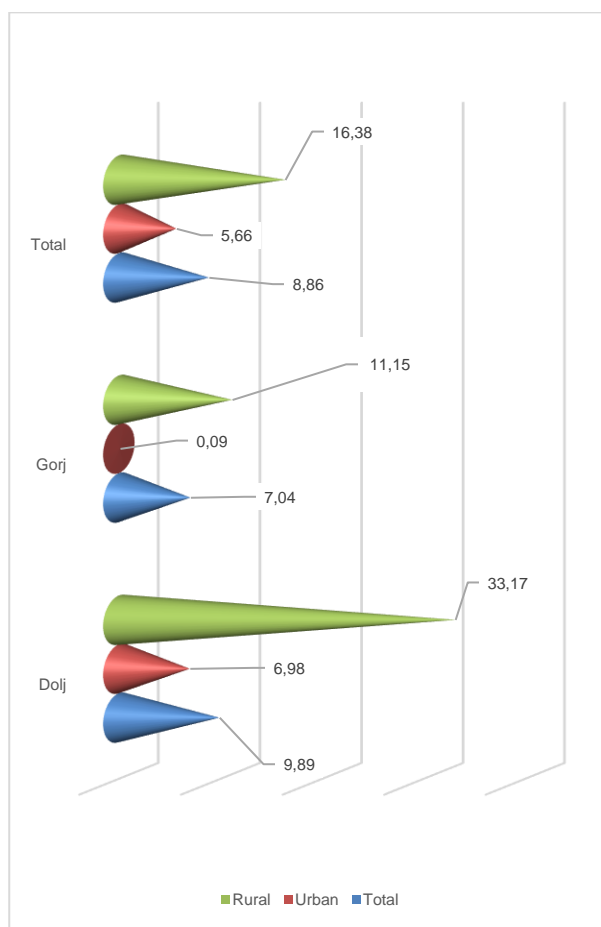


Fig. 6. Total length of gas distribution pipelines, Comparative situation 2021vs2017 (±% - processed after: www.insse.ro)

18,906 thousand cubic meters at the level of the two years), +2,953 thousand cubic meters for the rural area (+98.83%, from 2,988 to 5,941 thousand cubic meters in 2017 and 2021, respectively), +3,410 thousand cubic meters at the level of household consumers (+72.05%, from 4,733 to 8,143 thousand cubic meters in the case of the two years). At the general level of the area, the upward trend of the indicator is maintained, as is normal after the sequential situations (Dolj and Gorj) presented above. The following aspects are found: +19,475 thousand cubic meters at general level (+17.15%, from 113,565 to 133,040 thousand cubic meters in 2017 respectively 2021), +12,615 thousand cubic meters for the urban area (+11.65%, 108,322 respectively 120,937 thousand cubic meters at the level of the two years), +6,860 thousand cubic meters for the rural area (+130.84%, from 5,243 to 12,103 thousand cubic meters in 2017 respectively 2021), +13,998 thousand cubic meters at the level of household consumers (+22.79%, from 61,432 to 75,430 thousand cubic meters in the case of two years). Figure 7 shows the relative changes in the indicator between 2017 and 2021.

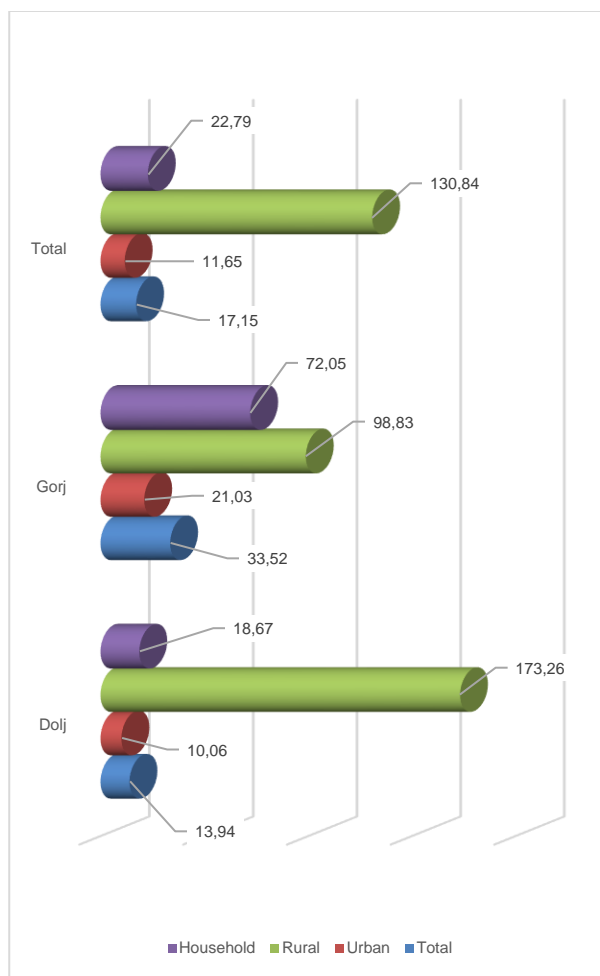


Fig. 7. The quantity of natural gas distributed, Comparative situation 2021vs2017
(±% - processed after: www.inse.ro)

CONCLUSIONS

For the length of city streets, the strictly upward trend of the indicator is noted, differing from moderate increases and more pronounced increases in their modernization.

The length of the drinking water distribution network has generally increased, except for Butoiești and Ianca communes where the indicator has been constant. The increases were significant, from 15.63% in the rural area of Gorj county to 30.34% in the rural area of Dolj county, at the general level of the area the urban area showing a higher relative growth than the rural area. In the structure of the indicator, there is a certain balance between urban and rural areas (50.36 or 49.64% in 2021).

Regarding the length of sewer pipes, it is worth highlighting the predominance of the urban environment (80.25% of the total in 2021), specifying that the upward trends are more pronounced in rural areas (it aims to increase the standard of living, the comfort level of the rural population).

The drinking water production installations have increased their capacity at the general level of the area, but the sequential developments are contradictory: decreases for Gorj County in rural areas and at general level, constant maintenance for the urban area in Dolj County and at the level of ATUs in Mehedinți and Olt, low increases for other situations (except for the 25.95% increase specific to the urban environment in Gorj County). The urban area dominates the general situation – 93.55% of the total, 14.50 times ahead of the situation in the rural environment.

Water consumption generally declined (timid decreases for the entire area, but accentuated in Gorj county), except for the equi-unitary evolution in Butoiești and the general and rural increases in Dolj county and Ianca. In rural areas, the indicator accounted for only 14.53% of total consumption (2021).

Regarding the endowment of the territory with natural gas distribution networks, its upward evolution is noticeable, a somewhat temperate one, except for the specific one of the Dolj rural area. In general, the urban area holds about 2/3 of the indicator, and the rural area about 1/3 of its level.

The quantities of gas consumed have evolved upwards, with sharper increases manifesting themselves in rural areas, respectively for household consumption.

It can be appreciated that the mayors of the ATUs related to the analyzed area were involved in improving the living conditions of the population, but some of these aspects may have negative influences on the conservation of the environment at the level of the analyzed protected areas.

ACKNOWLEDGEMENTS

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GOS108A– Quantity of drinking water distributed to consumers, by counties and localities
- <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>,
GOS110A – Simple total length of sewer pipes, by counties and localities
- <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>,
GOS116A– Total length of gas distribution pipelines, by counties and localities
- <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>,
GOS118A- Natural gas distributed by destination, by counties and localities