КОМУНАЛНО ПРЕДУЗЕЋЕ
"ВОДОВОД" А.Д.
ГРАДИШКА

UMT: Graduation Project

IMPLEMENTATION OF THE PROJECT OF REMOTE MEASUREMENT OF WATER CONSUMPTION BY END USERS BASED ON THE LoRaWAN STANDARD

-DMA ZONE 7-

PU ''VODOVOD'' GRADIŠKA

(JANUARY 2022.)

MAY 2024.

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INTRODUCTORY DATA

50.000 RESIDENTS (90% of city population)	**700 km** (18 DMA ZONES)
2023	
2 933 169 m³ **1 870 152 m3** **36 % NRW**	**18 936 CONNECTIONS** **90%** HOUSE CONN **16 424 W. METERS**

<u>Types of meters for commercial use</u>

(D= **15-150mm**):

1. Multijet dry propeller water meters (INSA) - residental customers
2. Combined cold water meters (INSA) for industrial customers

- Most of the water metes are **3/4''** diameter
- <u>Installed water meters are not calibrated regullary</u> (by law - 5 years)

SMART METERING - THE NEED, THE POSSIBILITIES AND THE CHOSEN TECHNOLOGY

PROCEDURE OF READING WM	• Time and resource demanding • 11 readers, read data is entered manually
ACCURACY OF DATA	• Automating the reading would avoid the human factor and errors in data entry • Need to replace existing water meters – WM that can't be manipulated and can measure even minimal water consumption
NRW	• Need for reducing commercial losses

Remote data transmission possibilities considered:

LoRaWAN, 5G Network, NM – IoT, Data cards

LoRaWAN – most available at the time + smart w.meters with LoRaWAN technology include all needed options (remote reading without the need to go out into the field, ultrasonic measurement which is more accurate, the possibility of daily flow control, more alarms to warn both the company and the user, digital water meter with built-in battery power supply (10 years), any installation position..)

PROJECT AREA

DMA 7 – chosen due to its size, uniformity, good isolation and unchanged number of connections

- Urban area of the city, **I** height zone
- **3.34 km** of network
- PVC pipes Ø160,110,90,63 mm
- **412 connections** (404+8)
- Diameter of all meters **3/4''**
- Average age **30** years
- **90%** of existing w.meters have esceeded the limit of 5 year calibration
- Isolated in **2017** – electromagnetic flow and pressure meter **Ø110mm**
- 2020: measured consumption **64.811 m^3**, invoiced consumption **46.540 m^3,** NRW for DMA 7 **28%**

IMPLEMENTATION

May 2020: Tender

December 2020. and January 2021.:
replacement and installation of new **SMART LoRaWAN AXIOMA 1/2'', class ''C'' watermeters**
2 BASE STATIONS were built in order to obtain complete signal coverage
LoRaWAN NETWORK SERVER physically installed on the teritory of Bosnia and Herzegovina,
LoRaWAN APPLICATION SERVER executed on a virtual data center located within BiH

CHALLENGES:
- working in the winter period,
- cold and unafavorable weather,
- presence of underground water,
- hard-to-access shafts
- time to adapt software and the web application to the needs of the company

OUTCOME AND RESULTS

1) OPPORTUNITIES AND ADVANTAGES CREATED

- Wireless data transfer to the accounting software of KP ”Vodovod” a.d. Gradiška - reduced workload for water meter readers
- possibility of analysis of water consumption by end users on a daily, weekly, monthly level
- possibility to comprehensively analyze the average consumption of households, possible physical losses in water distribution, and all other influences that affect the commercial losses
- users were given the opportunity to monitor their own consumption through a web application
- the possibility of timely warning of users about leaks, malfunctions, as well as alarming the company itself in case of fraud attempts

2) PROBLEMS – SOLVED AND ONGOING

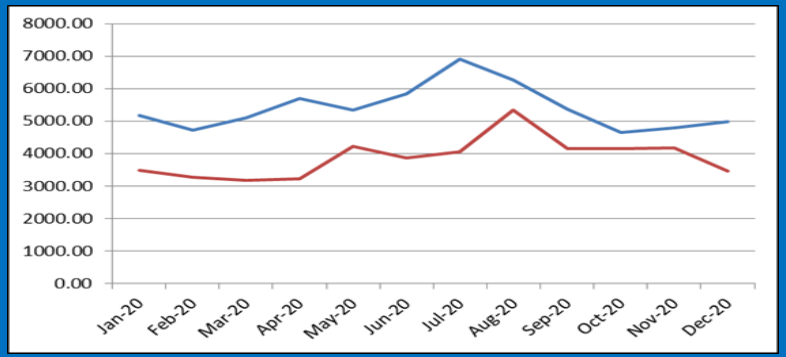
- insufficient signal coverage – solved by building another Gateway
- certain percentage of new water meters do not send a signal – they still have to be read in person - some of them due to the unfavorable position of the shaft, the depth of the shaft, Faraday cage – this percentage reduced to **7%**
- 2% of new water meters did not work at all, needed replacement,
- in the case of a small number of water meters, the wrong setting was made during installation, which led to a decrease in the battery level
- Recently, a number of WM stopped working because of a fabric malfunction (manufacturer)

OUTCOME AND RESULTS

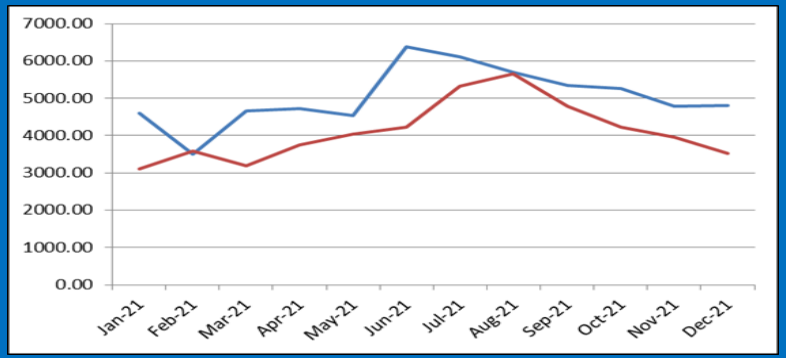
3) ACCURACY IN MEASUREMENT – REDUCTION OF LOSSES

By replacing the old water meters and resizing the new ones (from 3/4'' to 1/2''), the measurement accuracy was increased, which led to an obvious reduction of commercial losses in DMA zone 7.

2020: supply to the zone **64.812m³**;
invoiced consump. **46.540m³**



2021: supply to the zone **57.529m³**;
invoiced consump. **49.341m³**



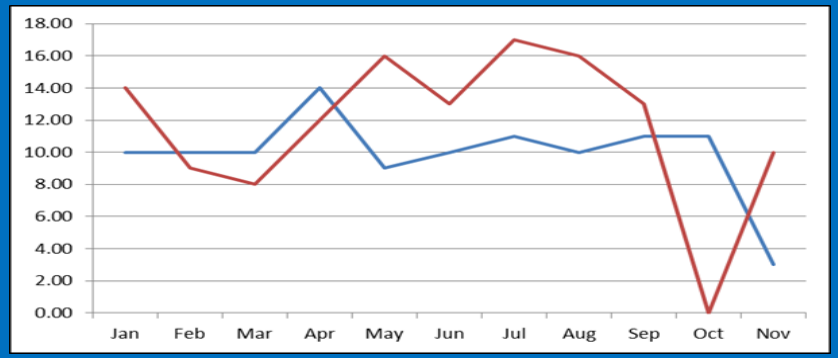
Increase in total invoiced - read consumption in 2021. was **6%** - compared to 2020, while the total amount of water that entered the zone was **9%** lower in 2021 than in 2020.

OUTCOME AND RESULTS

Example of individual connections with a change in measured - invoiced consumption:

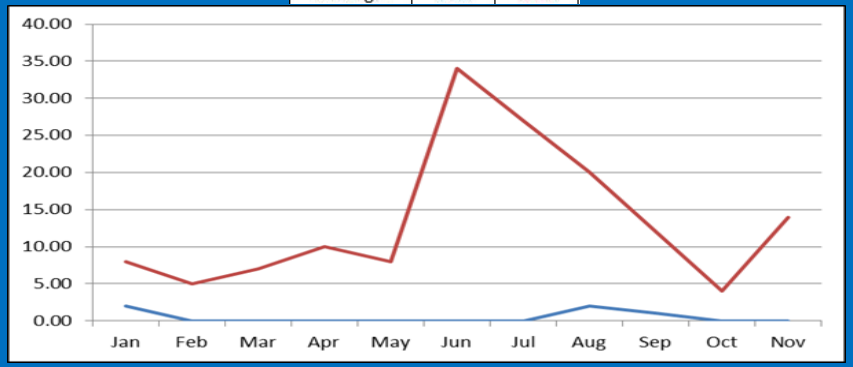
Increase of invoiced consumption by **15%**

Invoiced consumption	2020 m^3	2022 m^3
Jan	10.00	14.00
Feb	10.00	9.00
Mar	10.00	8.00
Apr	14.00	12.00
May	9.00	16.00
Jun	10.00	13.00
Jul	11.00	17.00
Aug	10.00	16.00
Sep	11.00	13.00
Oct	11.00	0.00
Nov	3.00	10.00
Total	**109.00**	**128.00**
Average	9.91	11.64



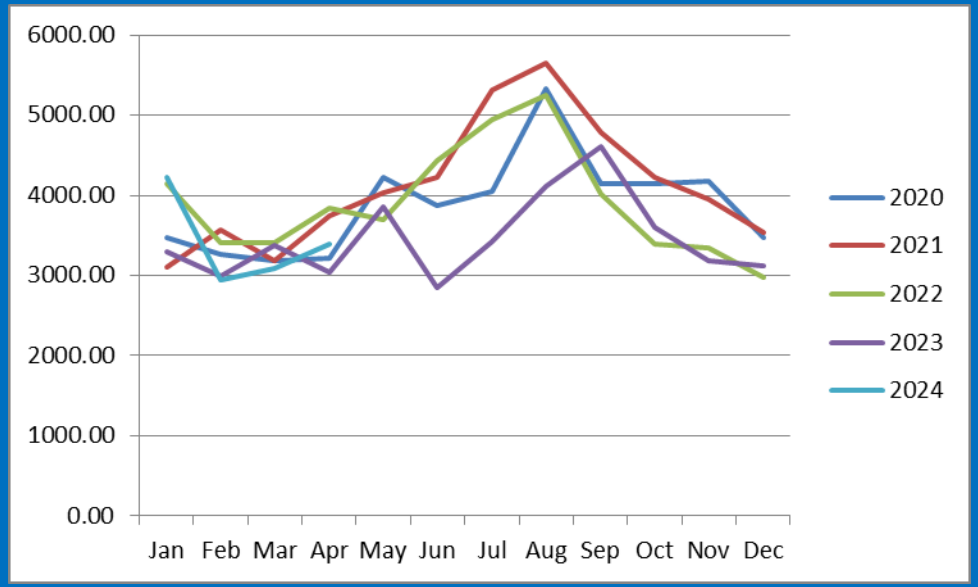
Increase in invoiced consumption by **96%**

Invoiced consumption	2020 m^3	2022 m^3
Jan	2.00	8.00
Feb	0.00	5.00
Mar	0.00	7.00
Apr	0.00	10.00
May	0.00	8.00
Jun	0.00	34.00
Jul	0.00	27.00
Aug	2.00	20.00
Sep	1.00	12.00
Oct	0.00	4.00
Nov	0.00	14.00
Total	**5.00**	**149.00**
Average	0.45	13.55



OUTCOME AND RESULTS -PRESENT

Invoiced consumption through years 2020-2024:



46540.00	49341.00	46837.00	41425.00
2020	2021	2022	2023

In 2023 – problem with a number of WM – due to a fabric malfunction (manufacturer) – *decrease in invoiced consumption*

2024. - the WM are replaced – *increase in consumption*

CONCLUSION AND FUTURE PLANS

In total, the pilot project was successful:

- it led to a reduction in commercial losses
- eased working conditions
- as well as enabling better communication and transparency with customers
- It brought positive changes within the company, in cross-sector cooperation
- gave direction, guidelines and view of opportunities for further work

FUTURE PLANS

- Connecting to the city's LoRaWAN network
- Replacing WM in the first altitude zone with SMART LoRaWAN WM, while in te 2nd, 3rd, and 4th altitude zones with new drive by WM
- A water meter replacement plan

Thank you kindly for your attention!