Intelligent water metering in Pałecznica Municipality

D.T2.1.3 Pre-investment report January 2019

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1. Introduction

Project index number and acronym	CE933 RURES
Responsible partner (PP name and number)	Pałecznica Municipality (PP4)
Project website	http://www.interreg-central.eu/RURES
Investment location	32-109 Pałecznica, Poland
Delivery date	January 2019

2. General description of pilot idea

Please write a short overview and description of the pilot idea, activities, purpose and goals.

The Pałecznica Municipality, performing tasks related to providing access to water for residents and institutions located in its area, is the owner and manager of the water supply network. Through a system consisting of a water intake, storage tanks, a water tower, pumping stations and a network with a length of approx. 80 km, it provides access to water for individual consumers as well as public institutions and other facilities.

Technological development in the water supply industry and in the area of remote monitoring of media consumption caused that the commune authorities consider the possibility of using smart metering and remote reading of water consumption. For this purpose, it will be necessary to replace devices (water meters, valves, pressure gauges, etc.) for those that allow remote, automatic reading of data and give the ability to control network parameters from the control panel, through a computer or mobile device (i.e. tablet, smartphone). Intelligent collecting of current readings would enable faster response to emerging failures, show current consumption of individual objects, and eventually allow smoother and faster settlements with recipients.

As part of the RURES project, the first step is planned: replacement of zone water meters, purchase of software for remote reading and analyzing of data, appropriate devices for storing information (control room, server) and purchase of peripheral devices for operating the system (laptop, tablet). Ultimately this investment will lead to the implementation of a larger investment: equipping all inhabitants of the

Pałecznica Municipality with intelligent reading of water consumption and combining them into one intelligent system cooperating with water intake and pumping stations and storage tanks.

In addition, the entire system would be connected to photovoltaic installations producing electricity. For the proper functioning of the water supply system for residents, it is necessary to create a network of digital connections that allow synchronization of all elements and optimize the use of electricity produced from own photovoltaic installations while pumping water.

The use of intelligent monitoring will contribute to a reduction of water consumption by approx. 20%, which will also reduce the amount of electricity needed to operate the pumps. The implementation of the investment will enable the connection of existing PV systems with the water supply network, which in turn will help to optimize work of the pumps and the use of electricity from renewable energy sources in moments of greatest demand.

3. Description of pilot investment

3.1. Technical analysis of the current state

Please describe current state in the area of planned pilot investment (current installed technology, usage regime, mode of use, etc.).

The Pałecznica Municipality covers around 48 km^2. There are 14 localities in its area, in which approximately 3660 people live. 93.1% of the commune's residents use the water supply system.[1]

The water supply system consists of a water intake (2 pumps with a capacity of 94 m3 / h), two storage tanks, a water tower, three pumping stations and a water supply network with a length of approx. 80 km. The Pałecznica Municipality has 1076 individual and 16 zonal water meter clocks registered. The commune is responsible for maintaining the network and settling accounts with recipients.

Currently, the collector receives once a quarter the location of the meter and personally controls its condition and indications. The data is then transferred to the unit responsible for the settlement and a settlement document is issued. The annual cost of employing collectors and paying their business trips within the commune to collect data from meters is about PLN 55 000.00.

[1] Data according to the Central Statistical Office, http://krakow.stat.gov.pl/statystyczne-vademecum-samorzadowca/.

The main identified investment problem is the limited degree of use of data potential in the field of water consumption and consumption. It is directly related to:

- lack of up-to-date information on the consumption of utilities, especially for the needs of the Municipality as a unit responsible for the entire system, but also for the needs of individual recipients (enabling individual savings in water consumption),
- lack of ongoing failure monitoring,
- limited access to services and data sets in the field of media management,
- extended customer service time ("manual" data collection, transfer to the accounting unit, filling in to the billing system, setting invoices).

In addition, the Municipality owns several photovoltaic installations located at the water intake, pumping stations and some public facilities. Currently, the total power of these installations is approx. 374 kW. Electric energy produced in installations is put into the external grid. Remote monitoring of electricity production from PV systems is not carried out.

Figure 1. Example of equipments parameters at water intake.
Source: own elaboration.

The figure above (Figure 1) presents the currently functioning, draft version of the system visualization, planned for implementation in the commune. It shows the basic parameters of the devices located nearby the water intake in

Pałecznica: the state pumps work, wells output, pressure, water level in the water tower, power and energy production in photovoltaic systems. The data is presented in the current time. This is only an element of the visualization of the entire system, planned to be build and use in the Municipality of Pałecznica. As part of the pilot investment, it is planned to connect the main zone water meters to the remote system created for these needs, enabling monitoring of flows in the current time.

3.2. Presentation of implementation of planned pilot investment

Please specify technical solutions planned to be installed, goals, target groups and activities of planned investment.

Please describe procedures and working methods that will be used while implementing the pilot installation and additionally through the maintenance of the same.

Due to the limited budget of the RURES project, it is foreseen to carry out the necessary works at the water intake in Pałecznica and in pumping stations, consisting of:

- exchange of approx. 16 zone water meters with fittings on the water meters with pulse reading and the possibility of data transfer (via the Internet or GSM network);
- purchase of software for collecting data from water meters and making them available on PCs/smartphones and for preparing settlements, ultimately for the entire reading system of all measurement points in the municipality;
- purchase of a control cabinet equipped with an intelligent system for collecting data, photovoltaic installations, water treatment stations and the amount of water in storage tanks;
- purchase of monitors, computers / tablets (4 devices) for remote reading and control of the system;
- replacement of existing analogue measuring devices with digital ones (pressure gauges, thermometers, chlorator control and power generator).

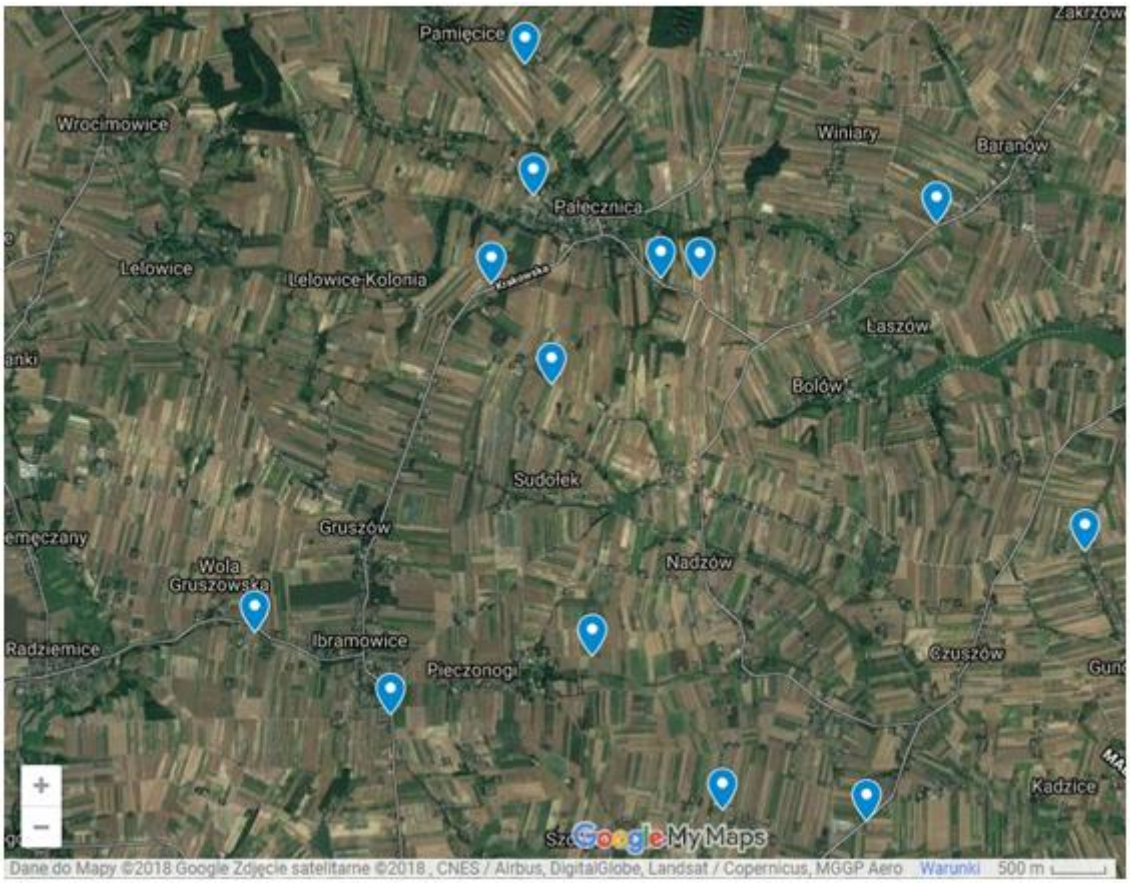

Figure 2. Investment location – main water spots in Pałecznica municipality.
Source: own elaboration with support of www.google.com/maps.

The Pałecznica Municipality has human resources and equipment needed to exchange water meters, operate and maintain the water supply system. However, it will be necessary to understand the market regarding the prices and capabilities of water meters with pulse transmitters and to determine the functionality of the data collection, transmission and analysis system.

The facilities in which the investment will be implemented have access to electricity for the most part (in some cases, it will be required to raise electricity from nearby objects). The data transmission will be carried out, if possible using cable wires (greater stability, no impact of weather conditions) or via the GSM network, which covers practically the entire municipality (about 98% of the commune's area has access to the network). In the latter case, it will be necessary to install relays with pre-paid cards, which is associated with additional costs of maintaining the system (about 5 PLN / month / point). The location of objects at various points may require the use of masts, amplifiers or signal concentrators.

The investment should be carried out on two equal levels:

1. **Market research, purchase and assembly of water meters with transmitters, pressure meters, thermometers, etc.**
   There are several types of water meters on the market with the possibility of remote data reading. The "standard" water meters are the most popular - mechanical, wing type. There are also ultrasonic water meters, which use sound waves to measure the water flow. Water meters have the function of direct signal transmission or through an overlay mounted on their casing. It is worth paying attention to the longer life of ultrasonic water meters, which has a significant impact on the maintenance costs of these devices.
   Solutions for data collection and reading are similar for all types of water meters: reading and data transmission can be carried out by radio or using digital transmission (eg M-bus). The planned pilot investment will use the second of these methods. The data transfer will be carried out using cables or GSM networks.
2. **Analysis of needs and creation of a tailored system for intelligent monitoring of media consumption.**
   The planned system is designed to collect data directly from water meters, or through a set of concentrators and signal amplifiers, using Internet access (cable or GSM connection). Data will be stored and processed in the control panel, allowing for generating reports, viewing consumption or monitoring of alarms and failures. Access to data (after logging in) through a readable program will have employees obliged to maintain the water supply network and end users. The ideal solution would be the ability to remotely monitor all objects without the need to leave the employee (possibly for a check). However, at the extreme points (at a large distance, poor coverage) the only possible solution may be the visit of a collector. In this case, the water meter should also be read remotely (without the need to enter the facility), when passing near a given object.

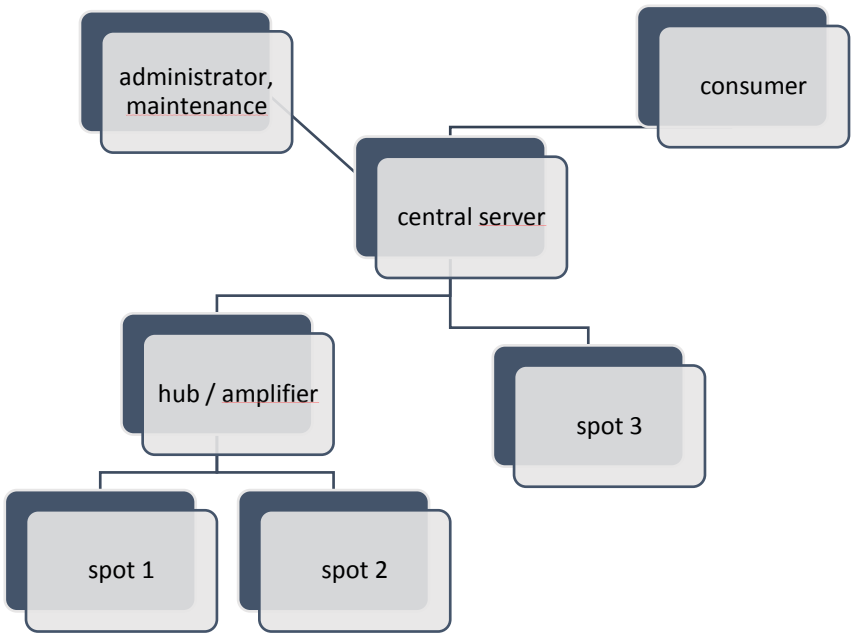

Figure 3. Example of intelligent water metering scheme.
Source: own elaboration.

The implementation of the pilot investment, then the maintenance, development and operation of the intelligent monitoring system lies on the side of the Pałecznica Municipality, which means that the durability of the project will remain unchallenged.

The RURES project enables the implementation of the first stage of a larger project: the municipal authorities plan in the next stages to expand the system by connecting all water recipients in the commune to it and making the data available to individual users - then the system will achieve full maturity and functionality.

3.3. Energy and emission analysis

Please include calculations to show reduction of energy consumption and the CO2 emission achieved by the pilot implementation. Please describe the results.

The commune does not have data on the consumption of electricity for the needs of the entire water supply system. However, it is estimated that the use of intelligent monitoring will reduce water consumption by approx. 20%, which will also reduce the electricity consumption needed to run the pumps. In addition, the implementation of the investment will enable the connection of existing PV systems with the water supply network, which in turn will

contribute to the optimization of pump work and the use of electricity from renewable energy sources in moments of greatest demand.

3.4. Social analysis of pilot investment

Please specify users and potential users, describe impact of the planned installed pilot and benefits for relevant fields (society, environment, economy), stakeholders and RURES project.

Maintenance and extension of the intelligent monitoring system of water consumption is in the interest of the Pałecznica municipality, acting here as a water supply company, and also in the interests of water recipients.

In the first case, the commune gains a tool to optimize the use of the water supply system and settlements with recipients. Remote monitoring will enable adapting the network capabilities to the needs of recipients and will facilitate supervision of the water supply system in the current time. This stage will be achieved as part of the RURES project.

In the second stage, the recipients will get access to current data on water consumption, which will allow planning the savings activities on their own.

In both cases, the remote system allows faster detection of failures, thus avoiding unnecessary and unforeseen costs of maintenance. It is also a response to the growing demand for so-called e-services and increased use of ICT devices in everyday life (Internet of Things).

Ultimately, the pilot investment will allow to reduce water consumption, optimize the work of the entire water supply system with the support of photovoltaic installations. Thus, there will be a reduction in the energy demand for pumps, which in the light of progressing climatic changes is an overriding objective for the implementation of the RURES project.

3.5. Building and technical legal requirements

Please specify and describe all of the legal requirements regarding potential building and technical permits.

The scope of the planned investment, replacement of water meters and installation of a remote media consumption monitoring system, does not require any special construction or technical permits. However, for the efficient implementation of the project, it is necessary to pay attention on some aspects, in particular the exchange of water meters (at functioning

system) and the application of appropriate safeguards for data storage and processing (i.e. according to General Data Protection Regulation).

4. Timeframe of investment

Start date (dd.mm.yyyy.)	2.11.2018
End date (dd.mm.yyyy.)	30.04.2018

5. Financial analysis of the pilot investment

Please define the cost of the pilot investment, potential revenues, describe financing method as well as the possibilities of financing similar projects in your region and country. Here you can use the deliverables from WP1 for each specific pilot investment as well as the calculations from point 3.3.

Due to the limited budget available under the RURES project, the necessary work needed to run the remote water monitoring system is planned. The initial costs of implementing the activities have been estimated at around 40 000 €, including:

- exchange of 16 zonal water meters with fittings for electric meters with GSM readers – 9 500 €;
- purchasing of dedicated software required to data gathering, archiving, and sharing with PC/laptops/tablets/smartfons with pre-invoices possibility – as a target software should be able to cover all 1100 meters – 14 500 €;
- purchasing of control cabinet with intelligent system of data metering from: 2 pumps (flow efficiency: 94 m^3/h each one), 180 kWp PV installation, water treatment station and water storage tanks – 8 000 €;
- purchasing of 4 monitors/tablets/laptops (mobile equipment for vehicles) for data receiving and the intelligent water metering system remote control – 6 000 €;
- replacement of existing equipment (pressure gauges, thermometers, control equipments) from analogue into digital ones – 2 000 €.

Co-financing from the Interreg Central Europe Program is a reimbursement of 85% of the costs incurred (approximately € 34 thousand).

Other examples of co-financing of this type of investments at the regional level:

- as part of bigger project under action No. 11.2 Renewal of rural areas, Regional Operational Program for the Małopolska Region 2014-2020;
- loan / subsidy from the Regional Fund for Environmental Protection and Water Management in Krakow.

Similar opportunities are offered to beneficiaries in other parts of Poland. In addition, the expansion of water supply networks is supported by the National Fund for Environmental Protection and Water Management. However, it should be noted that in the above-mentioned proposals, the financing concerns rather the expansion / reconstruction of water supply systems, and not the systems for intelligent monitoring of water consumption.

6. SWOT analysis

Strenghts	Weaknessess
• Implementation of investment on infrastructure belonging to the commune. • High knowledge of the municipal employees in the area of water supply network functionality. • Capable specialists, able to install new water meters and use a remote reading system. • Municipality ensures the sustainability of investments. • Further plans to expand the remote monitoring system (ultimately - all water recipients in the commune). • Easy to replicate in other regions. • The investment does not require special technical and construction permits.	• Dispersion of facilities - necessity to implement in several places. • Variety of water meters and transmission technologies - difficult selection of the optimal solution without proper knowledge. • The need to synchronize different solutions and devices.
Oportunities	**Threats**
• Development of telemetry technologies. • Increasing the availability of wired and wireless internet. • Continuous development of remote media management systems. • An increasing trend to use mobile devices, e-services and online platforms in everyday life. • Development of the information society.	• Difficult access to the network (electricity, GSM) in some places. • Hilly terrain that hinders data transfer. • Necessity to implement on a working installation.

7. Transferability of pilot investment

Please describe ways to implement described kind of investment in similar areas/objects. You can link this description to point 3.4.

The indicated pilot investment can be implemented in any region of Europe, especially in communes that own water-supply systems or by water-supply companies. The development of ICT systems means that such investments will in the future be the basis for measurements and billing for media consumption. The method of implementation of a similar investment in other regions should proceed in the same way as indicated in chapter 3.2: it requires the inventory of available resources, equipment installation and adaptation of the appropriate, remote data reading and analysis system.

8. Conclusion and further suggestions

Please write a conclusion based on all of the previously described elements of the pilot investment, and also any suggestions you feel necessary.

Conception of sustainable development assumes development of relations between economical growth, improvement of life quality and environment care at the same time. Implementation of pilot investment in this spirit may be considered in several aspects, like:

1. **Socio-economic development**

At the time of huge technological progress it is impossible to turn off the access to information and communication technologies (ICT). Internet of things, foreseen as use of electric equipment for data gathering, processing and usage, is implemented more and more in everyday life. Intelligent metering of building or lighting systems is no longer a curiosity. Following that trend, in Pałecznica Municipality decided to use the very new technologies in water metering for creation of intelligent water metering system.

Continuous improvement of the water supply network allows for exploitation at a high level of efficiency and prevents potential failures. In the case of Pałecznica, this is additionally important because the commune provides water not only to recipients in its area, but also to neighbouring municipalities. However, monitoring of consumption and demand cannot be done smoothly without access to data. This problem can be solved by automatic access to current readings jointly with feedback for managers and recipients.

Another aspect of the planned investment is the inclusion in the nationwide (as well as European) tendency to develop an information society, where information is a

special and valuable intangible asset. Having information about resources and water availability has a great importance in rural areas, where water is used not only for the needs of residents, but also for maintaining farms and growing.

2. **Life quality improvement**

The basic aspect of the planned investment is to enable end users to access current data on water consumption. Ultimately, this contributes to a better understanding of the daily water demand and planning its partitions in an optimal way, due to the needs of consumers. This will allow savings not only on the side of water supply - ultimately, the development of the system throughout the commune will give every citizen the opportunity to actively track data on water consumption and notify about failures or spills and allow for faster action to avoid unnecessary and unforeseen costs. So there will be real savings of financial resources. In addition, the implementation of an intelligent monitoring system will allow the analysis of current costs, which will facilitate the management of the budget.

From the point of view of the billing system, the process of collecting data and invoicing will be accelerated. The current water meter reading system ("manual") means that every quarter the collector must visit each recipient in order to verify the meter readings. It is a time-consuming process - it is not always possible to collect information from all objects, you have to go back and repeat visits. Although the employees strive to make the visits as least burdensome, it is undoubtedly a kind of burden for the residents. The collected data is then sent to the unit of account where the invoices are prepared. The annual cost of employing collectors and paying their business trips within the commune to collect data from meters is approx. PLN 55 000.00. With a remote reading, the whole process can be accelerated - the data reaches directly to the unit of account, without the need to visit the customer. The implementation of the investment gives the opportunity to eliminate visits to recipients, and thus less interference in their privacy. In addition, it contributes to savings in the commune budget (about PLN 55 thousand per year), which can be used to implement other objectives that increase residents' quality of life.

3. **Environment care**

The implementation of the pilot investment will not have a negative impact on the natural environment. Replacement of devices and installation of the remote reading system will take place on the existing water supply system. In addition, it is estimated that as a result of remote monitoring, including earlier detection of failures, water consumption will be reduced by approx. 20%, which is of great importance in the scope of the depletion of fresh water resources in Poland. Limiting and streamlining the work of the pumps will also allow to reduce the use of electricity needed to drive them. In addition, the ability to synchronize the operation of pumps with existing

photovoltaic installations in the municipality will contribute to a better use of energy from renewable sources. This will increase the energy efficiency of the water supply system.

9. Appendices – project documentation related to pilot investment and all necessary permits in national language

Please enclose a list of all relevant project documentation that had to be produced before the beginning of the pilot investment as well as all permits that were necessary to obtain.

Planned pilot investment does not require special permissions (technical, construction permits, etc.). For efficient implementation there is need to:

1. Research of impulse water meters market.
2. Adapt the functionality of water metering system.
3. Prepare the agenda of water meters replacement with information to customer about possible breaks in water supply.