

MODERNIZATION AND REHABILITATION OF SECONDARY IRRIGATION INFRASTRUCTURE PLOT PPS10, CRIVINA - VÂNJU MARE, MEHEDINȚI COUNTY

Untaru Daniela Cristina¹

Man Teodor Eugen¹

Beilicci Erika¹

Cojocinescu Mihaela Ivona¹

Pasc Antonia Mariana¹

Abstract: The paper summarizes the EU / RO legislation - National Program for Rehabilitation of Secondary Irrigation Infrastructure in Romania, irrigation infrastructure component, sub-measure 4.3 - "Investments for the development, modernization or adaptation of agricultural and forestry infrastructure within NRDP 2014-2020 and how to prepare of the documentation for accessing the financing of the irrigation arrangements in WIUO-s patrimony, in order to rehabilitate and modernize them. It presents: the needs, the opportunities, the purpose, the technical requirements, the benefits, the economic potential and the financing sources for the modernization and refurbishment of the secondary irrigation infrastructure. For the case study: modernization of the plot related to PPS 10, representative for the current stage, belonging to WIUO Padina-Scapau, their initial state, the technical modernization solution and the situation after the modernization and refurbishment investment are presented.

Keywords: rehabilitation, modernization, secondary irrigation infrastructure, OUI

1. INTRODUCTION AND GENERAL CONSIDERATIONS

Irrigation systems, as part of the general agricultural policy, must constitute one of the main levers of constant and stable growth, year by year, of the production national agricultural products, with a positive impact on the general and individual economic results of agricultural producers;

It is known that the agricultural production of 2011-2016, had a special contribution to the Gross Domestic Product, national, in which the climatic and hydrological conditions were favorable to us;

The same cannot be said about previous years or the current one;

Restoration / rehabilitation of irrigation systems should have been one of the main ones coordinates of economic development and especially of Romanian agriculture;

Reducing and even eliminating the risk caused by drought on the expected productions, in parallel with the saving of electricity consumption for pumping and administration

Plant water are measures that can be solved and that can control a profitable activity in agriculture.

Another essential component is the impact on the environment, where irrigation of agricultural land has a special contribution on air and soil, on the normal development of agricultural crops, with a positive effect on working and living conditions of farmers and rural people in general.

In Mehedinți County, the irrigation infrastructure covers over 100,000 hectares of arable land, within two Crivina-Vanju Mare irrigation systems (including Ostrovul Mare) and Izvoarele-Cujmir (including Salcia), 80% of which are taken over by the two Organizations of Irrigation Water Users: WIUO Padina-Scapau and WIUO PPS 4 - PPS 5 Jiana) - with legal personality and by Associations of Water Users for Irrigation (AWUI) - without legal personality, which for various reasons cannot be transformed into WIUO and cannot be part of modernization / refurbishment projects for accessing EU funds [1,7].

Irrigation systems are completely inoperable, due to the very high costs of water supply, decommissioning of pumping stations, unmaintained, damaged mains, undamaged and with destroyed impermeability, which allow the loss of about 60% of water, as well as excessively high tariffs charged by NALI, which included in the costs the losses and inefficiency of water management for irrigation.

The lack of modernization / refurbishment projects of NALI for the adduction stations with energophagous electric motors, physically and morally obsolete pumps as well as in restoring the impermeability of the main canals and the water management delivered to the pressure pumping stations (PPS) have made the systems irrigation should not work in the last 12 years [1].

During this period, the lack of state support for the security and protection of the infrastructure as well as for the maintenance or commissioning from the moment of handing over-receiving the patrimony to WIUOs, according to the legal regulations: Law 138/2004 on land improvements, GEO 123/2006, approved by Law 125 / 2007- on financial support for agricultural producers in the land improvement sector and MARD Order no. 601/2007, left without result, as well as the impossibility of transforming the

¹ Politehnica University of Timișoara, Faculty of Civil Engineering, Hydrotechnical Engineering Department, 1A Spiru Haret Street, 300022, Timișoara, Timiș, Romania, e-mail: erika.beilicci@upt.ro

associations (AWUI), made them accumulate large debts, a part of their patrimony being executed by force, and approx. 60% of the pumping stations (PPS) are mostly disused, vandalized or with physically and morally obsolete installations.

2. WORKING METHOD AND DESCRIPTION OF THE PROBLEM

2.1. Needs, Opportunities, Purpose

"Irrigation", representing the main input of plant production, by practicing it in conditions of a restoration / rehabilitation / modernization / refurbishment of the current structure, agricultural producers will improve their competitiveness and safety of a high production quantitatively and qualitatively, constant year by year, no longer having to import, but export a large part of agricultural production of maximum public utility, irrigation, will substantially contribute to combating the phenomenon of aridization and desertification in the south of the county with great impact on the environment [1].

Accessing European Funds through NRDP 20014-2020 [8], through Measure 4.3 I, is appropriate, as the provisions show that up to one million Euro is allocated for each WIUO and up to 1.5 million Euro FOWUI, for modernization / refurbishment / rehabilitation of secondary infrastructure of irrigation, following that NALI - administrator of the primary infrastructure to be rehabilitated by modernization and refurbishment at the level of irrigation system including main canals, supply stations and pumping stations.

It is necessary to amend some regulations of Law 138/2004 [6], including: the possibility of associations (AWUI), which cannot be transformed and obtain legal personality to affiliate or merge with existing organizations (WIUO) and the possibility that organizations (WIUO), there where there is the possibility of setting up federations (FOWUI and to be able to take over in concession / ownership the supply pumping stations from NALI that have the primary infrastructure.

The aim is to be able to access European Funds, both for the main infrastructure (basic pumping stations, discharge pipes, pipes and main water supply and transport channels for irrigation) belonging to NALI, and for the secondary one (PPS, network VDE pipes and antennas inside irrigation plots belonging to WIUO).

The two irrigation systems Crivina Vanju - Mare and Izvoarele - Cujmir from Mehedinti County or NALI, cover over 100,000 hectares of agricultural land. These systems are located along the Danube River, using river water and serving the vital needs of over 200,000 inhabitants, mostly farmers (farmers), agriculture being the main occupation of the population in the area.

The purpose of the project for modernization / rehabilitation of irrigation systems is mainly:

- the quantitative and qualitative increase of the agricultural production from the south and south-east of the county, corroborated with measures of storage, preservation, processing / industrialization, will make the value of the agricultural products increase four times;

- The inclusion of the population in this activity as well as in the related ones, will lead to the creation of at least 10,000 jobs in the area;

- diminishing the risk and uncertainty of the development of agricultural crops, by reducing the natural phenomenon from spring-summer-autumn;

- Reduction of the costs of water for irrigation delivered to the owners of agricultural lands by at least 50%;

- avoiding desertification in the plain area of the Danube, where the aridity index reaches up to 30%;

- Cultivation of those plants and crops with economic viability, cereals, vegetables, potatoes, technical and energy plants;

- increasing the degree of merging and increasing the economic value of the land, attracting investments in the fields of vegetable culture and raising animals;

2.2. Technical requirements - must follow:

- modernization / refurbishment of the aggregates, to ensure the improvement of the operating parameters, following the use of new and modern equipment, subassemblies and spare parts, as well as the replacement of some physically and morally used technologies with recent technologies in order to increase the exploitation indices. ;

- Increasing the electromechanical efficiency of the aggregates from 40% to 80-85%;

- Use of modern coupling / decoupling systems at start-up and in load, refurbishment of hydro mechanical installations (dampers, valves), repair or replacement of hydrant bodies;

- Reduction of water losses by at least 30%, from main canals by ensuring the impermeability of the walls, as well as the repairs to the buried columns and pipes and SPP stations;

- Reduction and replacement of conventional electricity consumption by at least

- 50%, this being achieved by:

- Replacement of pumping units (electric motors, electric pumps) with others with low energy consumption;

- Replacement of the water distribution network consisting of columns, pipes, antennas and hydrants to stop water losses; repairing, plugging and changing gaskets where appropriate.

- the use of solar energy, being known that irrigations are used in the spring-summer-autumn months, where the solar exposure in the area is on average 14 hours / day, and in the summer period of 16 hours / day;

- Surplus energy or produced in the late autumn-winter-early spring months, and can be delivered to the National Energy System:

- The use of wind energy, the corridor (gorge) of the Danube River creating currents necessary to operate at the installed parameters;

- The use of recent studies for the conversion of hydro energy, the supply and location of the adduction aggregates being on the river bank;

- ensuring a modern management in the use, dispatching and sectorization of water on the main canals in the columns or buried pipes.

2.3. Benefits, economic potential

The beneficiaries of this project will be individual farmers, who own 50% of the agricultural area and exploit only 15% of it, as well as farmers organized in production, exploitation, trade associations who own 40% of agricultural land and exploit only 20% [8]. The difference between ownership and operation results from unstable annual productions or obtained with very high costs. The amounts invested can be amortized in 5-7 years [9, 10];

The increase of the individual value of the agricultural lands, the employment of the surplus labor force in the rural environment, the increase of the well-being of the farmers, constitute worthy benefits to be taken into account;

For the realization of the two restoration / rehabilitation projects, a financing of approximately 18 million Euros would be necessary, much less than the investments financed in the county by the previous governments, for unnecessary investments;

Adequate support from the Government, MARD, and Local Authorities, as well as increasing farmers' awareness that only the efficient use of hydrological resources (irrigation), can increase the viability of rural areas, can stop the continuous depopulation of villages, can contribute to merging and eliminating fragmentation arable land, for an efficient and modern agriculture, identical to that of Western European countries.

2.4. The sources of financing can be the following:

- European Funds under Measure 4.3 - Improvement and development of infrastructure related to agricultural development, objectives-modernization / refurbishment of irrigation systems and other land improvement works.

- Financing at national level, through public partnership (state) - private, or attracting foreign investments for the main irrigation infrastructure of NALI administration.

3. CASE STUDY: WIUO PADINA

With an infrastructure covering 10,612 hectares of agricultural land, it rehabilitated and modernized the PPS10 pressure station in the Crivina-Vanju Mare Irrigation Facility through Sub-Measure 4.3 "Investments for the development, modernization or adaptation of agricultural and forestry infrastructure" - irrigation infrastructure component, within the National Rural Development Program 2014-2020 (NRDP 2020) [1,2].

The targeted investment objective is called "Modernization and refurbishment of the secondary irrigation infrastructure PPS 10", a project financed by Sub-Measure 4.3 - Component - Irrigation.

The following works were carried out at the PPS 10 pressure station:

- building repairs and electrical annex;
- Fencing;
- Replacement of metal collector Dn 1000;
- Collector connection with discharge;
- Hydro mechanical, draining, electrical and metering installations;

- Installation of equipment and technological equipment.

3.1. Data on the need and opportunity of the investment

As the existing installations and equipment within the SPP10 plot from Arrangement Crivina-Vinju Mare are technically and morally outdated, having advanced wear (Fig.1, 2), it was necessary to replace them with modern, more efficient techniques and materials.



Figure 1. Overview of degraded SPP10 (Photo Cioclov)



Figure 2. Overview of the SPP10 side facade with missing impact demand (Photo Cioclov)

Thus, the main pipe made of asbestos-cement pipes combined with rubber ring sockets subjected to the aging process, led to very frequent shutdowns of the irrigation system, with important times necessary for the interventions. In the end, they led to losses of water, electricity, but also of the optimal time for the application of irrigation. The PPS 10 irrigation pumping station is in an advanced state of moral and physical wear and tear in terms of electrical and automation installations, pumping units and hydro mechanical installations. The station was built in 1978 and equipped with electrical equipment and automation in those years. Meanwhile, the design methods and types of electrical and automation equipment have evolved a lot (since 1955 and until now), as well as the increase in the efficiency of pumping units.

Because of these, WIUO Padina members have difficulty providing the water needed for timely and sufficient irrigation on large areas of cultivated land.

The major deficiencies of the existing situation are the following:

- Significant water losses from the system;
- Relatively high electricity consumption;
- Frequent stops for necessary repairs;
- Labor consumption;

- Loss of the optimal irrigation period, which leads to production losses;
- Repeated failures in the water distribution network;
- Increased costs with maintenance and repair operations;
- Low reliability of electrical and automation equipment;
- Uneven wear of the pumps;
- Impossibility to make a preventive maintenance plan.

3.2. The specific objectives of these investments are the following [1]:

- Increasing the efficiency of agricultural activity through the safety of a high and relatively stable production from year to year;
- Reducing the risk and uncertainty in agriculture by reducing the incidence of natural phenomena caused by drought-soil erosion, aridization, floods.

The priorities considered are:

- Reduction of water losses by replacing the sections of the used pipe;
- Reduction of load losses on the distribution network;
- The use of modern irrigation equipment and the reduction of the return time on the initial position;
- Reduction of electricity consumption.

3.3. Data on the proposed solutions

In the current stage, the proposed works will be limited to the refurbishment and modernization of the station for the SPP10 plot [1].

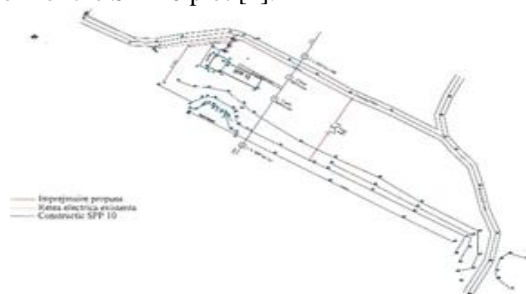


Figure 3. Plot situation plan SPP10 [1]

In the Technical Expertise report, two variants were analyzed.

In order to achieve the proposed electricity saving, the solution for purchasing frequency converters was chosen, which meet the operating parameters of the station regarding the reduction of energy consumption and also have a lower purchase price than that of progressive starters.

The advantages of the recommended scenario for the modernization / rehabilitation of the pumping station in Plot PPS 10 (Fig.4) are the following:

-the actuation and control of the pumps is done with frequency variations which also perform the function of slow starting and stopping of the electric motor, thus eliminating the occurrence of shocks in the hydraulic installations (ram stroke).

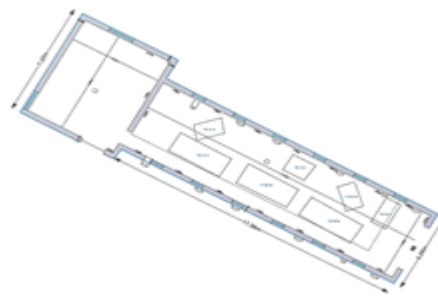


Figure 4. Surveying SPP 10 [1]

- reduces the wear of the electric pump, of the motor pump couplings, as well as the electricity consumption.

The following categories of works were proposed and carried out:

- Electrical utilities insurance installations: - Post-transformation 1600KVA and 380V, 40K.VA, 32kW three-phase photovoltaic system.

- Repairs of the electrical annex building SPP 10, including: Removing the plasters on the facades and consolidating the load-bearing brick masonry; Painting (washable paints) with polyvinyl acetate paint for the exterior; Interior plaster repairs; Painting (washable paints) with polyvinyl acetate paint for interiors; Unfolding and re-covering 2 layers of bituminous membrane (7.2 m x 6, 1, 1 = 44sqm); 0.5 mm an sheet metal covers including doles and aprons; Galvanized sheet metal gutters 0.5 mm thick, semi-round with a diameter of 12.3 cm; Galvanized sheet pipes of 0.5 mm round thickness with a diameter of 12.3 cm; Procurement and installation of metal doors; Purchase and installation of PVC windows attached to it. ground floor and first floor; Removing broken windows for replacement, including wands and putty cleaning; Procurement and installation of glass (Nevada tiles); Greek dismantling, of simple concrete (sidewalks); Concrete slabs B200 100 x 100 x 10; Installation of prefabricated straight boards for cable channels; Purchase and installation of axial fan Q = 2250 m³ / h; Hand-made suction basin embankments; Metal constructions (balustrades + stairs); 15 - 19tf wheeled crane.

- Replacement of the metal collector Dn 1000: Earthworks for collector decommissioning; Pipe cutting with oxyacetylene flame of pipes DN1000 (6pcs), DN500 (4pcs), DN300 (2pcs); Lifting pipes, loading, transporting and unloading materials; Purchase and installation of pipe DN 1000 (collector replacement); Procurement and installation of flat flange PN10 DN 1000 (blind - one piece, manual - 1 piece); Round cutting with DN300, respectively DN500, by cutting with oxyacetylene flame in the DN 1000 pipe; Launch and center OL connection parts for the south. G.50 - 100 kg; Anti-corrosion preparations and paints for pipes; Procurement and installation of DN 1000 / DN350 reduction; Wheel crane 10 - 14.9 ft.; Transport materials with dump truck dist. = 30 km; Procurement and installation of ultrasonic flow meter; Chimneys for flow meters. - Hydro mechanical installations and protection assemblies (Fig.5, 6): Pump discharge with Dn = 350mm; Launch and center tied parts. OL G = 100 - 300kg, made DN500 / DN350 reductions;

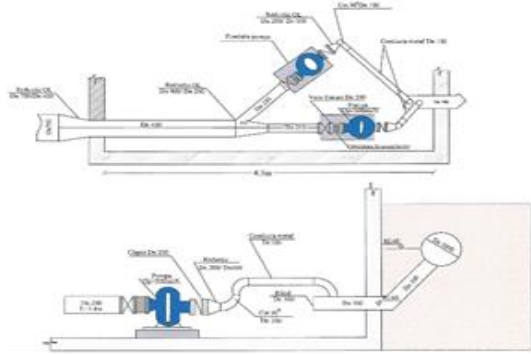


Figure 5. Hydro-mechanical installations at SPP10 [1]

Procurement and installation of flange DN500, Procurement and installation of flange DN350, Procurement and installation of protection assemblies (Vtl + CL + CM) DN500; DN500 pipe section (3m pump connection + 7m for By Pass); Procurement and installation (Ibuc- Vfl + Ibuc CM) for By Pass, joint with flange pieces connected. DN500, joint with flange parts connected. DN350; DN500 pipe preparations and painters; Suction pumps with Dn 400mm: Procurement and installation of metal cond. DN400, L = 2m; Launching and centering of the connecting parts, from OL G = 100-300kg, Procurement and installation of DN400 flat flange, Procurement and installation of suction protection assemblies (Vfl + CM), joining of flanges of connecting parts, with DN400, Preparations and dyeing of pipes with DN400.

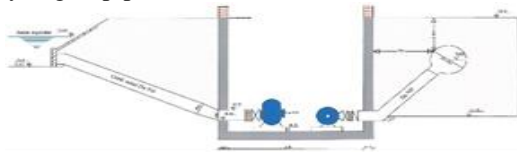


Figure 6. Cross section through SPP10 after modernization [1]

- Fencing - L = 137 m.

-Interior and exterior electrical installations: Replaced electrical panel of utilities; Indoor installation composed of: electric cable CYY 3 x 2.5; Pillar foundations; Testing of power cables of max. 1 kV; Procurement and installation of lightning protection installation; Purchase and installation of CYABY 0.6 / 1 kV 2 x 4 cable in the ditch on a sand bed; Manual digging and compact filling; Checking the earthing sockets.

-Power and automation electrical installations: Installation of panels, desks, cabinets, boxes with G = 300 - 500 kg; OL37 prefabricated metal constructions; Procurement and installation of consoles and gutters for supporting and protecting electrical cables; Procurement and installation of pressure transducers and level probes; Procurement, installation and wiring of electrical and automation installations; Manual digging in trenches for electric cables; Sand layer for cable protection; Purchase and installation of MYF 1 x 240 cable; Procurement and installation of PVC tape for signaling; No terminal; Compacted manual fillings; Tests, tests and trials of the electrical and automation

installation; Variable frequency configuration; PLC configuration.

-Installation of technological machinery and equipment: Installation on the existing position of centrifugal pumps with horizontal shaft Dna = 400 - 600 mm; Mounting on existing pedestals of electric motors with a power of 250 - 400 kW; Mounting on the existing position of the centrifugal pumps with horizontal shaft Dna = 250 - 350 mm; Mounting on existing pedestals of electric motors with a power of 100 - 200 kW; Wheel crane 10 - 14.9 ft.; Mounting on the existing position the pump with vertical shaft for exhaust type ACV; Mounted overhead crane with G = 1 - 5 t, h < 15m.

-Procurement of technological equipment: Electric pump with horizontal axis QP = 1200 m³ / h - 3 pieces; Electric pump with horizontal axis QP = 300 m³ / h - 4 pieces; Exhaust electric pump with vertical shaft QP = 50 m³ / h - 1 piece; Overhead crane L = 3300 m - 1 piece.

Figures 7 - 11 show images with the suction basin, the electric power supply station, the newly installed pumps, the inside of the pressure pumping station and the new SPP enclosure protection fence.



Figure 7. Suction basin view after rehabilitation (Photo Cioclov)



Figure 8. Interior view SPP10 after installation of new pumps and related fittings (Photo Cioclov)



Figure 9. Interior view SPP10 after the rehabilitation of the infrastructure (Photo Cioclov)



Figure 10. Post Impact at SPP10 (Photo Cioclov)



Figure 11. New fence detail SPP10 (Photo Cioclov)

4. CONCLUSIONS

By accessing Measure 4.3.1 by OUAI Padina, the SPP10 irrigation plot has been rehabilitated and modernized. As it could be financed in the amount of one million Euros approved for such projects, the rest of the underground network will be rehabilitated within another financing project (stage 2).

After upgrading and technologizing the irrigation Plot SPP10 belonging to the OUAI Padina, it will ensure the irrigation of the surface of 1,010 ha to the projected parameters, ensuring its efficiency in energy and water economy.

Figures 1-2 present comparatively images with SPP10 before and Figures 7 – 11 after modernization. Currently, in Romania, there are several hundred irrigation plots funded by Measure 4.3. - AFRI, NPRD

Program 2014-2020, under the EAFRD undergoing rehabilitation / modernization.

We mention the fact that WIUO Padina, which is part of the Crivina - Vanju Mare Development, Mehedinti County: with an infrastructure covering 10,612 hectares of agricultural land, will continue the rehabilitation of secondary irrigation infrastructure with water distribution network (consisting of main pipes, antennas, manholes, hydrants), and in parallel NALI must continue the rehabilitation of the main irrigation infrastructure to provide water to the WIUO patrimonial irrigation plots.

OUAI Padina submitted 7 projects in 2019 under Measure 4.3 - Improvement and development of the infrastructure related to the development of agriculture, of which 4 have already been declared eligible for funding.

ABBREVIATIONS :

- AFRI – Agency for the Financing of Rural Investments
- MARD - Ministry of Agriculture and Rural Development
- NALI - National Agency for Land Improvements
- PPS - Pressure pumping stations
- AWUI - Association of water users for irrigation
- FOWUI - Federations of Organizations of Water Users for Irrigation
- IWUO - Irrigation Water Users Organization
- NRDP - National Rural Development Program
- UE - European Union
- AWUI - Association of water users for irrigation
- DAIW- Documentation approving investment works

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