

IMPLEMENTATION OF THE NATIONAL IRRIGATION PLAN IN THE REPUBLIC OF CROATIA

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Abstract

Based on the size of irrigated surfaces of approximately 13.000 ha in 2007, Croatia was among the last countries in Europe, meaning that the abundant water potentials and fertile soil are not sufficiently used. At the beginning of 2004, the Government of the Republic of Croatia initiated the National Project of Irrigation and Land and Water Management in the Republic of Croatia (NAPNAV). The National Project was fully developed by Croatian experts, both agricultural and hydrotechnical, and, following the conducted professional discussions and a public hearing, it was adopted by the Government of the Republic of Croatia at the end of 2005. In the system of water management, regional and local self-government and end users, the National Project implementation started in 2006. In this context, the organisational prerequisites were fulfilled by the competent ministry, Hrvatske vode, regional self-government and end users. It was determined in the National Plan that Croatia disposes of about 2.9 million ha of agricultural land, of which 244,000 ha are suitable for irrigation, and, with minor limitations, this number rises to over 800,000 ha. Within the Project, the priority ranking procedure for nominated projects was defined as well as stimulation measures and criteria for financing preparation of project documents and system construction.

To date, the implementation of the NAPNAV has been carried out in three phases: preparation of county irrigation plans, irrigation pilot projects and project documents for individual irrigation systems as well as the rehabilitation/reconstruction of the existing and construction of the new irrigation systems. The paper further presents the implementation of the National Irrigation Project, with a detailed overview of organisation, implementation method, implemented projects (period 2004-2007) as well as the action and investment plan for the period 2008-2010.

Keywords: *National Irrigation Project, contents and implementation of the Project, method and dynamics of implementation.*

1 INTRODUCTION

In global terms, the process of climate changes is generally present. Changes in mean annual temperatures or mean annual precipitation have been observed in Croatia as well. The trend of growth in multi-annual series of mean annual temperatures and decrease in mean annual temperatures at all meteorological stations in Croatia is only one parameter which confirms this. The appearance of

extremely dry years during the first decade of the 21st century, particularly in 2000, 2003 and 2007, particularly endangers the stability of agricultural production in Croatia. The damages recorded only during the last three major draughts amount to several billion Kuna, and are a very clear signal that there is need for changes within the agricultural sector, both in terms of agricultural production methods as well as in the development and implementation of an irrigation system within it. Based on these facts and the assessed unsatisfactory state and scope of irrigation in the Croatian agriculture (according to 2003 data, slightly over 9,000 ha of agricultural land were irrigated), in 2004 the Republic of Croatia initiated the implementation of the project entitled “*National Project of Irrigation and Land and Water Management in the Republic of Croatia (NAPNAV)*”. The development of this project was entrusted to Croatian experts headed by the Faculty of Agriculture and by the Faculty of Civil Engineering, University of Zagreb. About 30 leading Croatian agricultural and hydrotechnical experts participated in its preparation. Following widespread public and expert discussions, the document was adopted by the Government of the Republic of Croatia in December 2005. For purposes of supervision of the Project implementation, a National Team headed by the Prime Minister was appointed, whereas for operational implementation the sectoral minister appointed an expert team consisting of experts from all Croatia.

2 NATIONAL PROJECT OF IRRIGATION AND LAND AND WATER MANAGEMENT IN THE REPUBLIC OF CROATIA (NAPNAV)

Irrigation is a measure which can reduce damages caused by draught, or even fully avoid them in some areas. The average annual evapotranspiration, effective precipitation and water deficit in four characteristic towns in Croatia are shown in Fig. 1. Based on the quoted data, it is evident that the water deficit at annual level rises from the west towards the east, and from the north towards the southern coastal parts of Croatia.

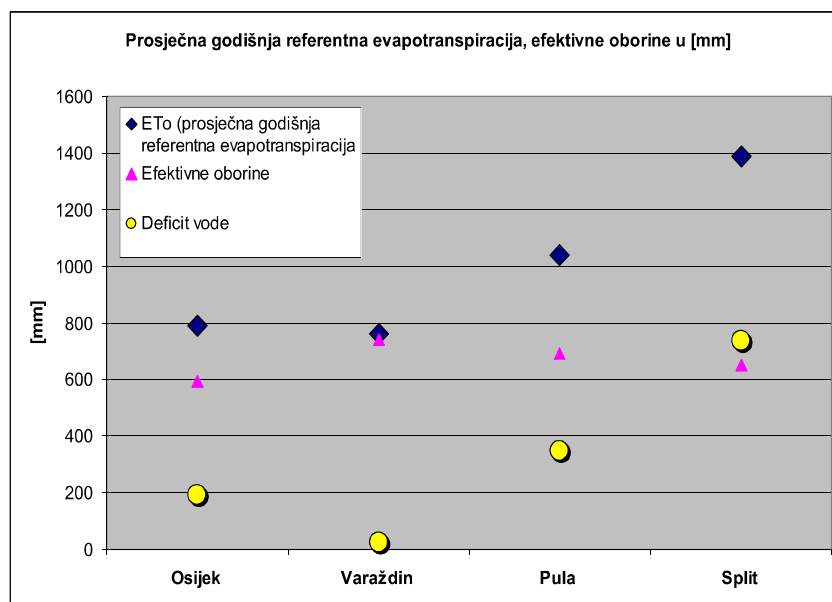


Fig. 1 Average annual evapotranspiration, effective precipitation and water deficit in four characteristic towns in Croatia

The yield reduction and water shortages for agricultural crops cultivated without irrigation (shown on the example of four characteristic crop yields in four characteristic regions in Croatia) are presented in Fig. 3. In average climate conditions, the yield reduction ranges from 10 to 60 %, rising in dry periods even up to 90% of the biological potential, depending on the crop, soil type and area. Additionally, the role of irrigation in the agriculture of the developed neighbouring countries lends sufficient credence to the statement that there is indeed a better perspective and a place for this measure in our agriculture and economy in general.

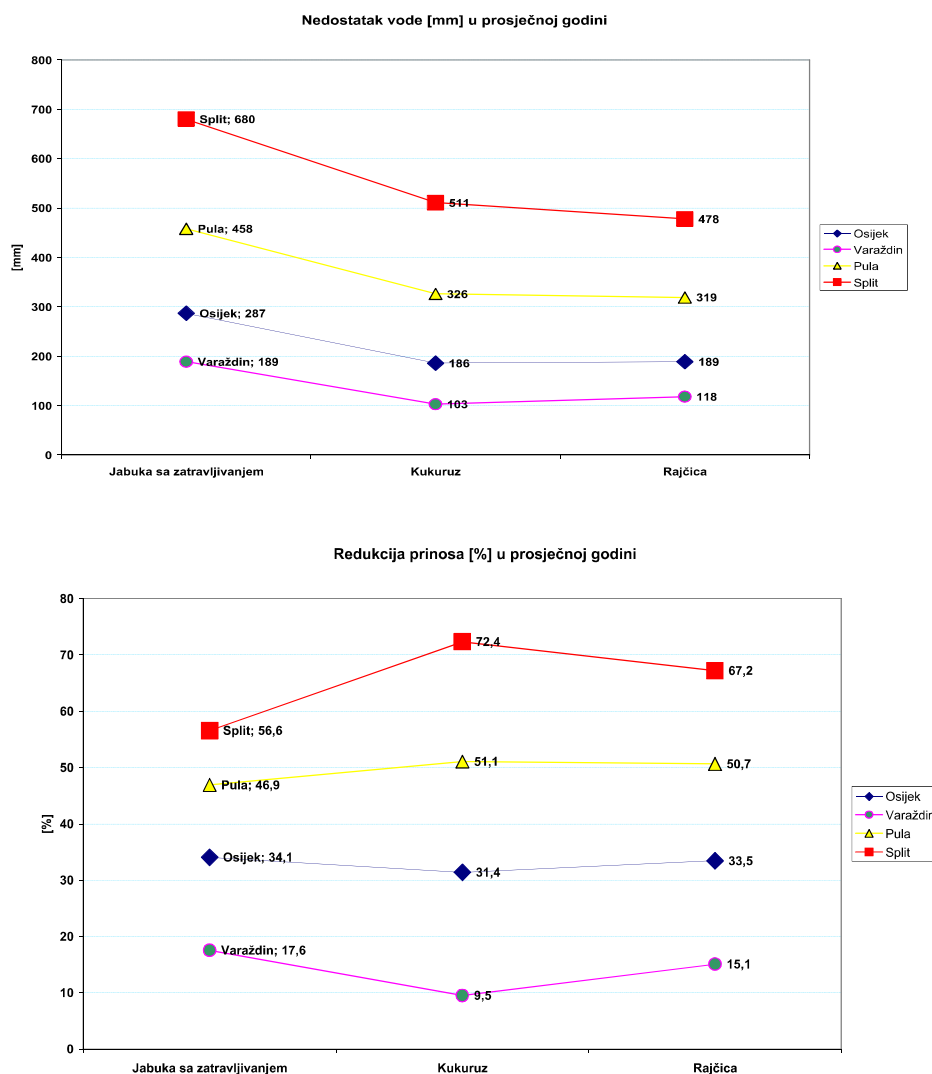


Fig. 3 Yield reduction and water shortages for agricultural crops cultivated without irrigation, shown on the example of four characteristic crop yields in four characteristic regions in Croatia

One of important starting points for irrigation planning is the determination of availability and quality of water resources. At present, less than 1 % of renewable water resources are abstracted for all uses in Croatia. The total water potential seen through six categories is presented in Fig. 4. In terms of irrigation development, it

primarily determines the method and conditions for ensuring necessary water quantities in dry season as well as conditions for its rational use.



Fig. 4 Potentials of water resources Croatia

In terms of land resources, it has been determined that Croatia disposes of approximately 2.9 million ha of agricultural land, of which 828,000 ha are suitable and moderately suitable for irrigation. The available suitable soils within the four basic regions in Croatia are presented in Table 1.

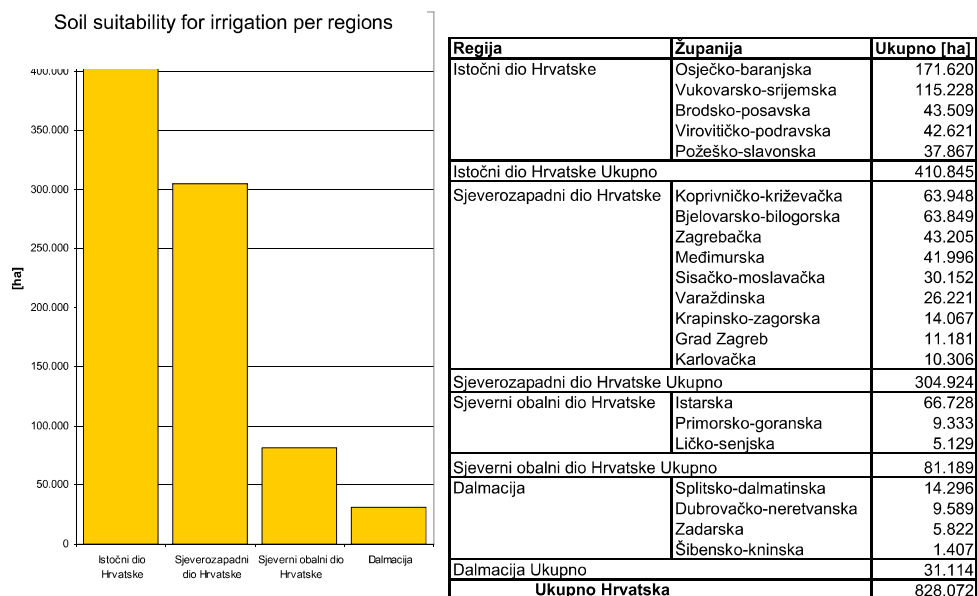


Table 1 Presentation of available suitable soils within the four basic regions in Croatia

The main goals of the NAPNAV as the strategic basis for its implementation are as follows:

- analyze and quantify potentials for systematic introduction of irrigation into the Republic of Croatia;
- define rights and obligations of all participants in the irrigation system;
- the document should serve as a quality planning basis for introduction of the irrigation system, construction of infrastructure and implementation of production plans for agricultural crops in new conditions of organised and supervised implementation of irrigation.

Special goals of the NAPNAV are defined as follows:

a) Short-term goals:

- development of county irrigation plans;
- establishment of pilot projects for irrigation.

b) Long-term goals:

- supervision and ranking of further projects for implementation of irrigation at county and national levels;
- definition of organisation and status of institutions for project planning, financing, implementation and monitoring;
- proposal of dynamics of systematic introduction of irrigation into the RoC by 2020.

The project also defines the priority ranking procedure for nominated projects, where besides the criterion of availability of natural resources, the following criteria shall also be considered:

- analysis of economic feasibility (profitability);
- relative return increase per surface unit;
- co-financing;
- social criteria (number of households and other project stakeholders, employment opportunities, development of rural areas, etc.);
- development level of surfaces planned for irrigation;
- user consent.

The NAPNAV also defines the types of irrigation systems and their size, which is directly related to potential users. The present-day farms in Croatia are mostly family-owned agricultural farms, which are predominant in the agricultural structure with the average plot size of 0.45 ha. Economic subjects in agricultural production use significantly larger surfaces per subject in comparison with agricultural households, with smaller number of plots per subject and larger average plot size. All of them may be interested in the implementation of irrigation. In the category of the **very small** systems, there are irrigated surfaces under 5 ha, while the **small** ones are considered those with surfaces ranging from 5 to 10 ha. These are predominantly one or more commercial family-owned agricultural farms. The **medium-size** systems are related to irrigated surfaces from 10 – 200 ha, whose potential users are one or more family agricultural farms, one or more cooperatives and companies. **Large** systems are considered those constructed for irrigation of surfaces over 200 ha.

The National Irrigation Project precisely defines institutions included in the Project implementation (Fig. 5), i.e. the procedure of nomination and financing of individual projects.

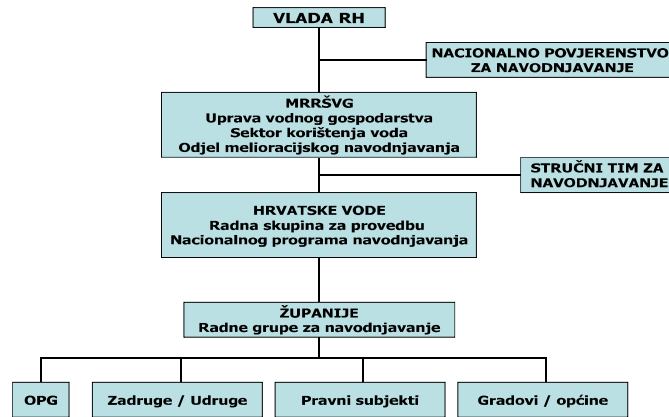


Fig. 5 Institutions included in the implementation of the National Irrigation Project

The NAPNAV recommends that the state should co-finance the construction of water supply to plots, whereas the end user finances the construction on the plot. The level of state co-financing will depend on the property size for which the water supply system is constructed. The construction of systems for small, fragmented and isolated properties makes both construction and maintenance difficult and significantly more expensive. Thus the state should stimulate, by means of co-financing levels, the grouping and association of agricultural producers, which eventually leads to a more rational management of constructed systems. Fig. 6 shows co-financing of construction of water supply pipeline to the plot.

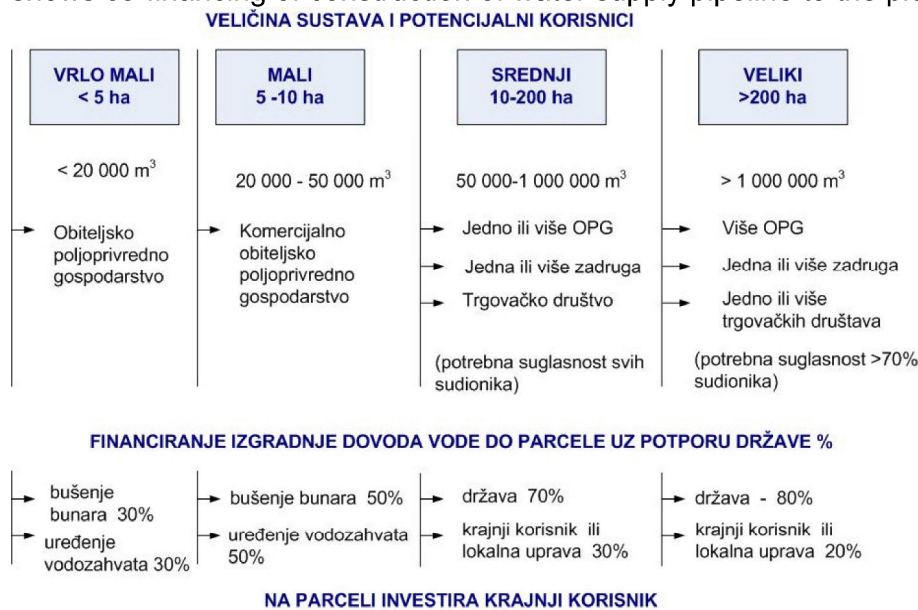


Fig. 6 Presentation of co-financing of construction of water supply to plots

The total investment by 2010 is estimated at 318,500,000 Euro, and by 2020 at 591,500,000 Euro. It is assumed that the construction of water abstraction sites and distribution network shall be financed by the Government of the Republic of Croatia, while the end user invests into the irrigation system. Therefore, the total state investment by 2010 amounts to 213.4 million Euro, and by 2020 to 396 million Euro. For purposes of financing of this Project, the following sources are planned:

- State budget of the Republic of Croatia,
- EU pre-accession funds, World Bank,
- Commercial loans with state guarantee,
- Local administration,

and by 2010 the construction of further irrigation systems is planned for additional 35,000 ha of agricultural surfaces, i.e. by 2020 the total is 65,000 ha.

3 IMPLEMENTATION OF THE NATIONAL IRRIGATION PROJECT WITHIN CROATIAN WATER MANAGEMENT

With the aim of further dynamization of the NAPNAV implementation in terms of organisational prerequisites, the following decisions have been made:

- By the Ordinance of the Government of the Republic of Croatia on internal organisation of the Ministry of Agriculture, Forestry and Water Management, the **Department of Ameliorative Irrigation** was established within the Water Management Directorate – Department of Water Management.
- Within Hrvatske vode, by the Decision of the General Manger, the **Work Group for the Implementation of the National Irrigation Project** was established,
- At the county level, **work teams for coordination and monitoring of the development of County Irrigation Plans** are established (also involved are the representatives of the Ministry, Hrvatske vode and competent experts from county departments: agriculturists, civil engineers/hyrotechnics).
- Through these work teams, the end users express their needs and interests in the introduction of irrigation on their agricultural land.

The implementation of the **NAPNAV** has begun by the performance of the following activities:

- Development of county irrigation plans,
- Establishment of the national irrigation pilot projects,
- Preparation of project documents for individual irrigation systems for known agricultural producers,
- Rehabilitation/reconstruction of the existing and the construction of new irrigation systems for which the construction permit has been obtained.

Apart from above activities, public and expert promotion of the **NAPNAV** has been initiated by means of presentations, panels, expert meetings and media.

Irrigation plans present the central planning document for an individual county, defining potentials of irrigation development (soil suitability and available water quantities) as well as the existing spatial limitations for irrigation development (protected areas according to nature protection provisions, water protection areas, potentially still mined areas). The said plans are harmonised with all physical planning documents in force and respect the expressed needs of the existing agricultural producers. For purposes of implementation of these plans, all involved counties have formed work groups for coordination of development and adoption of these plans. They include representatives of the MAFWM, Hrvatske vode and competent county departments. All plans undergo expert review by experts from leading agricultural and civil engineering institutions in Croatia. In the conclusions of plans, the priority projects for irrigation system development within the county are also determined.

As part of the capital investments in economic infrastructure, some countries normally establish the so called pilot projects, which should result in final conditions for construction, in this case, of the irrigation systems in the Republic of Croatia. The expected effects of the national pilot projects can be summarized as follows:

- it is a relatively quick procedure for analysis of costs and economic justification and introduction of irrigation systems;
- optimisation of research and measurements necessary for design and implementation of the system;
- definition and optimisation of management measures in given agro-ecological conditions;
- Expected benefits from the national pilot projects;
- it is a procedure which can offer a relatively quick feedback,
- assessment of investment justification,
- securing the base for enactment of legal regulations to govern the issues of construction, maintenance and management of irrigations systems;
- identification of projects which might be sufficiently valuable for further research;
- education of participants in the system and a raise the general level of knowledge and skills of staff at local levels;
- monitoring of ecological impacts of irrigation;
- testing of new technologies of irrigation and cultivation in such conditions.

With regard to agro-ecological conditions in the continental Croatia, irrigation is generally a supplemental cultivation measure (although it can be mandatory for some cultures), whereas in the coastal area it is a mandatory cultivation measure for most cultures. For stated reasons, the four national pilot projects have been established in Croatia - two in the continental part and two in the coastal part of Croatia, as shown in Fig. 7. Based on the **NAPNAV**, the determined four national pilot projects are the following:

- Irrigation system Opatovac (Vukovar-Srijem County)
- Amelioration canal for irrigation of the Biđ-Bosut polje (field)
- Irrigation system of Kaštela-Trogir-Seget (Split-Dalmation County)
- Irrigation system of the Lower Neretva (Dubrovnik–Neretva County).



Fig. 7 Spatial distribution of the national pilot projects

For known irrigation users and locations, the development of project documents has been initiated at preliminary and detailed project level, and obtaining of appropriate location and constructing permits. In this phase, 12 counties with about thirty projects have been included, within which there is a cca 50,000 ha of agricultural land. The spatial distribution of the projects is shown in Fig. 8. The projects are financed by the MAFWM through Hrvatske vode in the amount of 50% of their value, while the remaining part is secured by the regional and local administrations or end users.



Fig. 8 Spatial distribution of the projects in all Croatia

In the period until the completion of the necessary technical documents and the issue of necessary permits for construction of the new systems, the rehabilitation of the existing irrigation system has been started. In the period of 2004 -2007, several rehabilitated systems have become operational, thus creating the conditions for irrigation of cca 10,000 ha, whose distribution can be seen in Fig. 9.



Fig. 9 Rehabilitated irrigation systems in all Croatia

At the beginning of July, the works on the construction of the Irrigation System Gat-Belišće have started. This is a completely new irrigation system on 500 ha of agricultural surfaces, with water abstraction from the Drava River. The users of the future system have formed a cooperative and are contractually obliged to use the future system. The total value of the investment is 5,000,000 Euro, with funds secured by the MAFWM, the Regional Development Fund and Hrvatske vode. The contractual deadline for works completion is July 2008. The system was designed and is constructed by Croatian companies.

In the period of 2004 -2007, the total investment into the stated phases of the NAPNAV implementation equalled 21.17 million EUR. The distribution per year can be seen in Table 2 and Fig. 10.

Position/ Year	1. County irrigation plans	2. Pilot projects	3. Project documents	4. Repair and construction	TOTAL
2004	0,33*				0,33
2005	0,40	0,16	0,06	1,61	2,23
2006	0,37	0,40	0,57	3,57	4,91
2007	0,55	8,13	1,60	3,42	13,70
2004-2007	1,65	8,69	2,23	8,60	21,17

*in million Euro (HNB currency list on 27 Feb. 2008)

Table 2 Investments in irrigation per years and projects

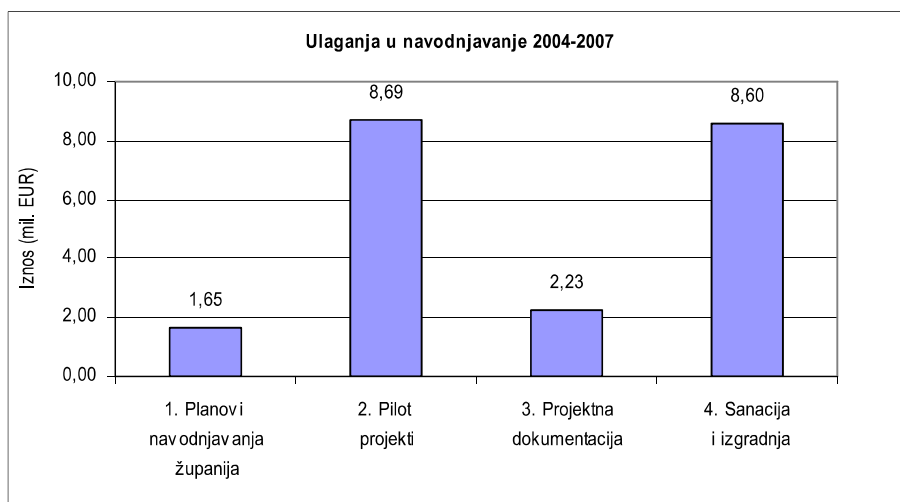


Fig. 10 Investments in irrigation development in the period of 2004-2007

The estimated necessary investments in irrigation of cca 40.000 ha in the period by 2010 are given in Fig. 11.

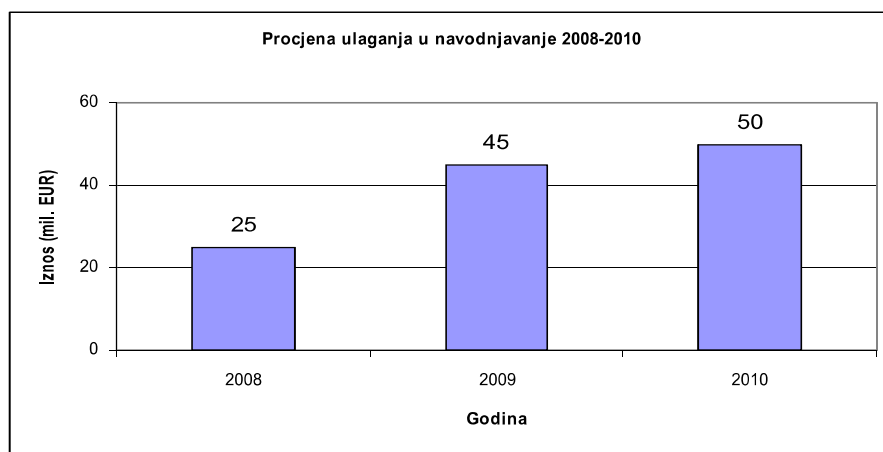


Fig. 11 Assessment of irrigation investments for the period of 2008-2010

Apart from the previously described activities, in the framework of the NAPNAV implementation a series of scientific and expert meetings, lectures and presentations took place. By far the most important was organized at the Croatian Academy of Sciences and Arts, where, in collaboration with the Croatian Society for Drainage and Irrigation, a scientific meeting was organized with the topic „Amelioration Measures Aimed at Improvements of Rural Areas with Focus on the National Irrigation Project” (Zagreb, 23 Jan. 2007). The event included 10 presentations by eminent experts from all Croatia, followed by the publication of the Proceedings and the separately published adopted conclusions. The Faculty of Civil Engineering – University of Rijeka, in collaboration with the Croatian Hydrologic Society, Croatian Society for Drainage and Irrigation, Croatian Society for Water Protection, Croatian Society of Civil Engineers and Society of Civil Engineers Rijeka, organized the Symposium entitled „Water management aspects of irrigation development in the coastal areas

and karst hinterland of Croatia” (Rijeka, 22 and 23 Feb. 2007). At the Symposium, the National Irrigation Project was presented before about one hundred participants. The Symposium Proceedings were published in digital format. At the Fourth Croatian Water Conference, entitled „Croatian Water and European Union - Challenges and Possibilities” (Opatija, 17-19 May 2007), the National Irrigation Project was also presented, and over 400 Conference participants were acquainted with the issues of irrigation development in Croatia.

As part of the lifelong education of civil engineers, a series of presentations on irrigation development and the role of civil engineers in its implementation took place (Dubrovnik, Osijek, Rijeka). At the last annual meeting of the Croatian Chamber of Architects and Engineers in Civil Engineering (Opatija, June 2007, 1,000 participants), a special topic was dedicated to the implementation of the National Irrigation Project.

As part of the public hearing and adoption procedure of county irrigation plans, a series of short presentations about the National Irrigation Project was held at town governments and county assemblies. For further promotion, experts from the MAFWM, Hrvatske vode and scientific institutions involved in the Project preparation, participated in numerous television shows and interviews with media representatives. In collaboration with the MAFWM and Hrvatske vode, a promotional leaflet was published to explain to the end users the procedures and provisions of the National Irrigation Plan in terms of project nomination, preparation of technical documents and system construction. The preparation of an education programme for agricultural experts, advisory services and end users is in progress.

4 CONCLUSION

Significant advances have been made in the framework of the National Irrigation Plan implementation in Croatia. The started process is unstoppable, and the number of interested agricultural producers and companies is increasing. Irrigation is functionally connected with amelioration drainage and with the process of grouping of agricultural land. By systematic solution of these issues, the prerequisites shall be fulfilled for successful, profitable agriculture as an important segment of Croatian economy.

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