Interreg Danube Region

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NRGCOM

D3.3.1 Software solution with installation instructions for RECs

To the activity A.T.3.3 Development of technological solution for RECs involved in the project for a more resource and cost-effective operation

Project NRGCOM:
Creating appropriate operational conditions for renewable energy communities in the Danube Region

This project is supported by the Interreg Danube Region Programme, co-financed by the European Union and the Ministry of Investments, Regional Development and Informatization of the Slovak Republic

Document Content

1. Baseline data on task performance

Organizer and guarantor of activity processing: PP12 NEK – Slovakia

Objective of the activity: The submitted and solved activity falls into the SO3 task group in the NRGCOM project for the 2nd period from 01.07.2024 to 31.12.2024

SO3: Enhancing production and use of renewables through pilot testing in potential and existing RECs

A.T.3.3: Development of a technological solution for RECs involved in the project for a more resource and cost-effective operation

Predkladaná a riešená aktivita spadá do skupiny úloh SO3 v projekte NRGCOM a to pre obdobie 2. periódy od 01.07.2024 do 31.12.2024

Samostatným odborným výstupom projektu D.3.3.1 je autormi aktivity vyvinutý softwérový nástroj a pokyny pre vybraných účastníkov na testovanie v nadchádzajúcom období ďalšej periódy projektu.

Autori pomenovali navrhnutý SW nástroj pre riadenie a rozhodovanie manažmentu energetických komunít v praci pracovne ako: :Expertný nástroj manažmentu energetických komunít - Expert tool for the Management of Energy Communities" akronym: ETMEC

The authors named the proposed SW tool for management and decision-making of energy communities in the workplace as:

"Expert Tool for the Management of Energy Communities"

acronym: *ETMEC*

The presented and solved activity falls into the group of tasks SO3 in the NRGCOM project for the period of the 2nd period from 01.07.2024 to 31.12.2024

A separate professional output of the project D.3.3.1 is a software tool developed by the authors of the activity and instructions for selected participants for testing in the upcoming period of the next project period.

2. Analysis of individual data and inputs from the countries of the project partners

2.1 Brief description of the solution according to the NRGCOM project assignment

In the framework of A1.2 and A1.4, the partners will seek solutions for sustainable energy savings and efficient energy management. PPs will design a software solution applicable to the target energy communities, in order to help them overcome their technical barriers and enhance their effective operation.

The ideas of the PPs will be further developed and transformed into a final, physical solution. NEK, having significant experience in software development for the enhancement of the energy efficiency of institutions, will be responsible to develop the innovative technological software and provide instructions to the solution to be tested in operating RECs.

The aim of the software tool will be mapping, data processing and monitoring of alternative and critical inputs to improve efficient energy management and simplify the everyday operation of RECs involved. The tool will function as a finished control expert module for monitoring and correcting the measured inputs and the related state of the energy economy of the given organisations/members within the energy community concerned.

In order to ensure a more effective operation, the software will provide solutions, such as a set of identification of simultaneously available technical, energy, environmental, social and economic data and their processing by analytical methods into the input database for the given environment, a comparative set of statistical and operational data of production, consumption and redistribution of energy resources based on the participation of energy records from the environment of large national and international administrators and distributors of energy networks and systems, a set of criteria for the internal operation of the software and comparative levels for evaluation, taking into account statistical significance and at the same time the probability of energy changes and fluctuations caused by the external environment.

The PPs will test the device while taking into account the specific circumstances, conditions and arising expenditures of the target countries/regions. In addition to the software, NEK will prepare a manual on the installation and use of the software as well. NEK will share the software with the respective partners STRIA, JAIP, KSSENA and FORSCHUNG will be involved in the activity who have a greater understanding of the operative operations of RECs and technological solutions that could be applicable for the improvement of their efficiency. The solution will be tested to contribute to

increase resource- and cost efficiency of the RECs operating in: Luče, Slovenia, in Burgenland in Austria, in South Bohemia, the Czech Republic, with close cooperation with KS MAS (ASP6) and in the Bratislava region in Slovakia.

D3.3.1 Software solution with installation instructions for RECs NEK will develop a software solution and provide instructions to the PPs testing the solution in Slovenia, Austria, the Czech Republic and Slovakia, in the framework of A3.4.

2.2 Methodology of task processing A.T.3.3.

1. The aim of the software tool will be to map, process data and monitor alternative and critical inputs to improve efficient energy management and simplify the daily operation of the involved RECs. The tool will function as a ready-made management and control expert module for monitoring and correcting measured/detected inputs and the related energy efficiency status of the given organization/members within the concerned energy community

2. The software will provide solutions such as a set of identification of currently available technical, energy, environmental, social and economic data and their processing by analytical methods into an input database for the given environment and a comparative set of statistical and operational data on production, consumption and redistribution of energy resources based on the participation of energy records from the environment of large national and international administrators and distributors of energy networks and systems.

3. It will be a set of criteria for the internal operation of the software and the benchmark levels for evaluation, taking into account the statistical significance and at the same time the probability of energy changes and fluctuations caused by the external environment.

4. PPs will test the device, taking into account the specific circumstances, conditions and incurred expenses of the target enterprise/country/region.

3. Conclusion

3.1 Overview of results and findings from the creation of activity A.T.3.3

Brief summary of content	The analysis and presented results of the task A.T.3.3 contain an overview of the current development of energy communities in selected partner countries with regard to the application of renewable energy sources in their local and regional operation. At the same time, they point to the available organizational structures and initial capabilities of individual partners in individual countries of the implemented sphere of this NRGCOM project. The analysis includes an analysis of 30 questions specially created by the guarantor of the task NEK to provide an overview of the issue, as well as a summary and opinions of individual partners on the knowledge addressed. The following was found - a brief summary of the essential findings from the questionnaire according to the question groups: The evaluation and significance of the individual answers and statements of the partners of the activity A.T.3.3 are summarized and marked according to significance as follows: A- crucial for SW B - variable parameter C - irrelevant for SW The general question group (questions no. 1 to 15) has the following results: Questions no.: 1, 2, 5, 6, 8, 15 are in the result group A Questions no.: 3, 4, 7, 9, 12, 13, 14 are in the result group B

	Questions no.: 10, 11 are in the result group C The operational question group (questions no. 17 to 24) has the following results: Question no. 24 is in result group A Questions no.: 17, 20, 22, 23, 25, 27, 28 are in result group B Questions no.: 18, 19, 21 are in result group C The question set (questions no. 25 to 30) for management has the following results: No question is in result group A Questions no.: 27, 28 are in result group B Questions no.: 26, 29, 30 are in result group C **Note:** Question no. 16 was not included and answered in the questionnaire.
Evaluation of goal and activity fulfillment A.T.3.3	The objective of the activity, defined in part 1. The initial data on the fulfillment of the task of this document, namely the creation of a database of analytical data on possible and legislative, operational and product options for energy communities, their creation and development, was successfully fulfilled in this activity A.T.3.3. The solution to the task A.T.3.3 was managed by fulfilling the partial tasks assigned by the PP12 – NEK processor, namely: 1. Research on the issue and mapping the current state of the topic from the perspective of the addressed partner countries. 2. Extensive theoretical research and mapping of the situation in individual countries participating in the project based on internal information from individual PP partners in the form of an overview table with a questionnaire with 10 questions. 3. Development of the professional output of task A.T.3.3, namely D3.3.1 Creation of an expert SW tool for energy community management with instructions for subsequent testing by partners JAIP, FORSCHUNG, STRIA, NEK, KSSENA

	These partial tasks were fulfilled in the document. Despite the fact that the building of energy communities and companies, especially with an emphasis on the implementation of renewable energy sources in their production and distribution to end consumers and community members themselves, is generally only in its early stages, it is obvious that a high level of professional organizational activity already prevails for the successful development of this issue, which will also have an impact on the application itself and subsequent updates of the proposed SW tool for practice within the NRGCOM project. Looking at any known methodology or management tool, if even the most sophisticated model of the organization's functioning is analyzed, there are still perceptions and feelings as if something is missing. As the authors of this analytical and implementation work within the framework of the processing of task A.T.3.3 of the NRGCOM project, but especially our long-term professional research, business and consulting activities in connection with our own comprehensive research, we see promising areas of application and development of this topic in management consulting operating models of energy communities in the future as: 1. Research into models of organizational systems and structures based on the innovative and inventive capacity of energy communities and the enterprises and organizations involved in them, especially from the SME environment, specifically in the area of designing and applying RES to an appropriate extent in the production and energy economy of energy communities and the production and distribution of energy within their scope. 2. Creation of inspection and management databases and subsequently expert systems for identifying and quantifying innovative and product qualities in the energy operating system of enterprises in energy communities.

Recommenda-tions and suggestions	Several partners are only at the beginning of building energy communities, and therefore do not have the opportunity to obtain an external expert and information database, but they have effectively and very successfully used a similar structure of possible knowledge from the field of industrial production of energy based on RES, mainly in SMEs. To ensure the effective and sustainable development of community energy, the following steps can be defined: **Financial and technical incentives:** Adequate financial incentives for participants and founders of the ES and ES to optimize production facilities and effectively prepare for project operation. This also includes the application of such a tool and management control tool as the SW called ETMEC in practice. **Flexibility in connection**: Involvement of production plants/members of the energy community in such a way that they reflect the actual required reserve power of the network, so that oversizing does not occur and efficient energy distribution is ensured. **Quality Assurance:** Emphasis on the competence and quality of SW installation and consulting companies involved in the preparation and creation of energy communities in order to ensure reliable and efficient operation. The participation factor indicates the percentage of consumption or production of a member in the ES that it contributes to the community. It determines the maximum percentage of generated electricity that can be supplied to the energy community, or the maximum percentage of electricity consumption covered by the energy community. Participation in multiple energy communities allows for an increase in the share of surplus electricity sold or

	purchased from energy communities. This is a very suitable innovation factor for managing the energy economy not only of the given community, but also of the managed region or locality. Adjusting the participation factor within the energy community can help limit high consumption, making dynamic allocation more attractive. Participation in multiple energy communities allows members to better manage electricity supplies and promote the use of renewable energy. Aggregators of flexibility are a solution to reduce the costs of consumers for electricity and at the same time the carbon footprint. They can optimize and manage the operation of flexible devices of consumers and producers in real time. The task of the aggregator will be to aggregate unnecessary electricity from consumers and smaller providers and then provide it to the transmission system **Recommendation 1:** Finish and repeatedly assess the synergy of the results of activities A.T.1.1, A.T.1.2 and A.T.1.3 and connect with the currently resolved results from activities A.T.2.2, A.2.4, A.T.3.1 and especially activity A.T.3.5. At the same time, the implementation of activity A.T.3.4 in the next period of the NEGCOM project will also be crucial for the implementation and verification of the ETMEC SW tool. **Recommendation 2:** In the next step of the NRGCOM project, analyze in more detail the internal methodology for creating organizational structures and managing ECs and focus on a modern method of process and project management of these ECs in practice and, in particular, transfer this to the flow chart of the concept and the architecture of the SW tool for management. **Recommendation 3.** Inform all project partners LP, PP to PP13 in detail about the content of this activity and its results and ensure awareness, a User

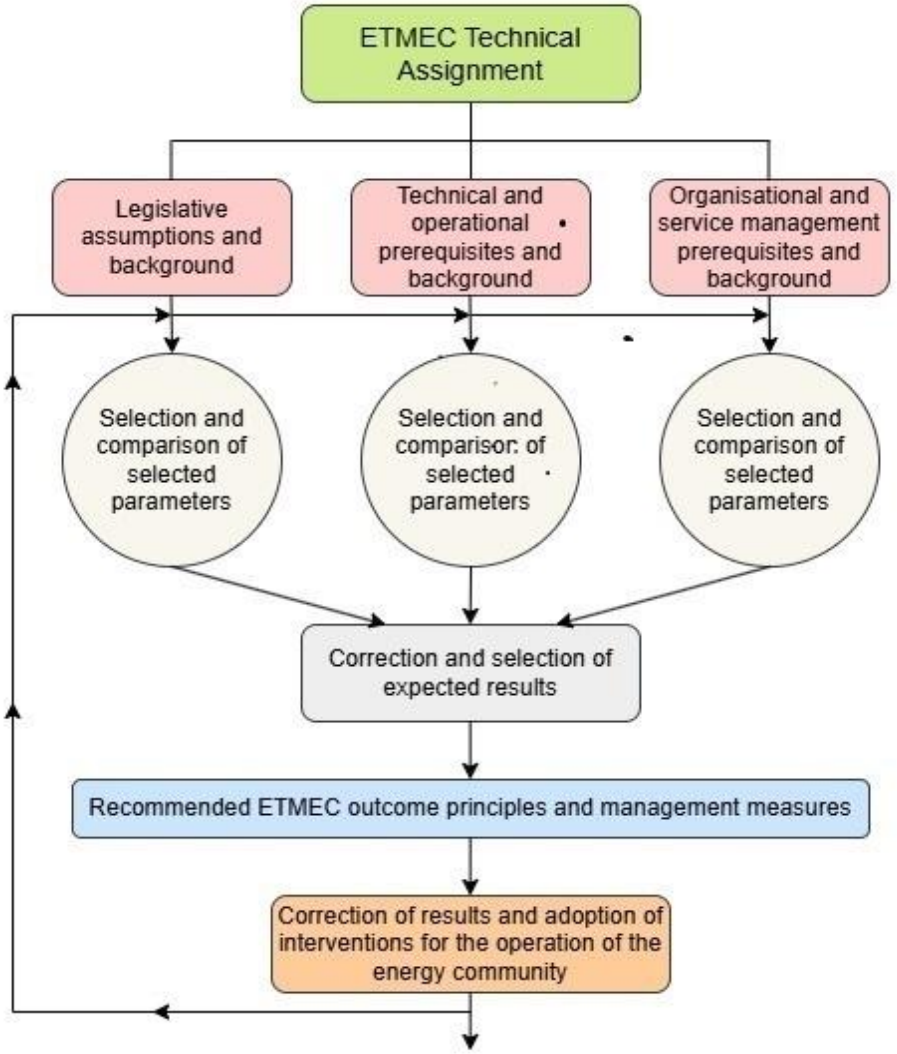
	Manual and, especially, instructions for testing in practice. A suitable form for awareness and education of project members - an international NRGCOM conference under the guarantee of NEK and subsequent promotion on social networks, etc. In doing so, it is essential to comply with the rules of authorship and protection of the ETMEC product exclusively for the needs of NEGCOM project members.
Contribution to the sustainability of project results	The recommended overall procedure for the creation of an EC at the local or regional level can be determined from the overall documentation of activity A.T.3.3, in particular as: - Mapping of legislative, self-governing, economic and operational aspects and financial possibilities in the catchment region of the establishment and functioning of the given energy community - Mapping of local energy potential and energy consumption at a defined location. - Starting preparations for the construction of new own energy sources around the location with an emphasis on RES in order to best and most advantageously cover the consumption of the entire defined area. - Maximizing the use of subsidy programs and possible financial resources for construction solutions and the necessary infrastructure. - Creating a suitable environment and ensuring personnel and managerial professional capacities for the energy community. - Preparing for the creation and establishment of an energy community in a given location. - Creation of an internal organizational system and sales techniques in the energy community - Methodology of community customer care and crisis and problem resolution - Audit of the internal energy economy of individual energy suppliers - community members in the production and distribution

	of energy based on RES. A significant contribution to the sustainability of energy systems based on RES in the application of ES and ES activities is the knowledge and summary of operating models and the management and control system of energy communities and the application of relatively universal business models for managing these communities.
Concept of the proposed expert SW tool ETMEC	It is important to know the specification and specific content of the created SW tool itself for expert management and decision-making of energy community management in the creation and building of energy communities and at the same time in the real operation and production of energy economy. The ETMEC concept is built on three separate groups of SW architecture and activities and assessment of individual steps and questions for successful assessment and determination of the real state of a given energy community. The following overview briefly describes the main attributes of the architecture of the solved SW tool and details are contained in the document D3.3.1 Software solution with instructions for installing REC in the form of a separate Expert tool for management of energy communities ETMEC.
Working model for designing an expert tool for managing energy communities ETMEC	The author collective of the solvers of the activity A.T.3.3 - ambassadors, experts and stakeholders, built for the needs of designing ETMEC this clear working model describing the individual components and the architecture of the created SW tool for energy community management. This consists of three separate levels, namely: **Level I**: Determination of the technical task, needs and expectations of managements and future users from ETMEC and subsequent specification of the available information in individual countries and

	regions of the energy community's scope on legislative assumptions and starting points, but also technical and operational requirements and limitations and own organizational and service management and personnel assumptions. **Level II:** It consists of the selection and comparison of selected parameters based on a gradually created and updated database of information, individually for each area of the SW tool in connection with the previous level I. The result is the correction and selection of expected results and their professional formulation, preferably in the form of specific statements and values / data. **Level III:** It is the so-called decision-making expert level and provides recommended resulting interventions and measures for the management of the energy community. This is followed by the correction of these results and the adoption of evaluation interventions and measures for the management and subsequent monitoring of the operation of the energy community.

Figure 3: ETMEC design model

Source: created by the team of autors PP12-NEK



Defining the needs and expectations of EMTEC software users

An essential requirement of the solved expert SW tool for management and decision-making of energy community managements ETMEC is knowledge of the needs and expectations of future users, namely:

1. Is there a need to create an energy community in a given region?

2. Is there sufficient technical, energy and professional

	management background for establishing an energy community? 3. Are the basic prerequisites for the effective functioning of an energy community given? 4. Are the energy potentials of the members of the energy community given for the production and distribution of energy in a given region? 5. Does the management of the energy community have the ability and knowledge to successfully manage and monitor activities? 6. Is there sufficient legislative and financial background in the given country of jurisdiction for the functioning of the energy community?
Defining the expected outputs and recommen-dations of EMTEC software	The decisive value of the solved expert SW tool for management and decision-making of energy communities ETMEC is the knowledge of possible potential results and setting parameters for expert advice on specific steps carried out through the resulting recommendations of the software to energy community managers, especially future users, namely: 1. Does the energy community meet the conditions and parameters for the establishment and launch of activities in a given region and country of operation? 2. Do the economic parameters and energy potential opportunities in the area of operation enable the effective functioning of the energy community? 3. Do the operational and organizational factors of the energy community enable its functioning and successful operation in a given state, environment and under given circumstances? ETMEC should in all circumstances be able to determine at least an approximate measure of whether the answer to the given expected

	outputs is YES or NO, or UNDER WHAT CONDITIONS (proposed measures or return to repeated self-assessment in the SW by the given management. **Final note:** The details will be specified by the ETMEC management expert tool itself and the related manual for implementation within the substantive output D3.3.1 Software solution with REC installation instructions.

4. Appendix – Manual

Manual for SW ***ETMEC***

Introductory Section

This software is designed to assess the basic conditions for the construction of an Energy Center (EC) and to evaluate the key factors that influence the success of the project. Based on the answers, further steps required for the realization of the project will be identified.

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1. Do you have a selected location for the construction of the EC?

a. Yes

- Description: If you have already selected a location, it means the project has a foundation to build upon. This step assumes the site is prepared for construction, and you have the necessary permits.
- Next Step: Proceed to the next questions regarding customer needs and grid connection.

b. No

- If you do not have a selected location, a detailed analysis and site selection are needed. Consider the availability of natural resources (solar, wind, water) and infrastructure. Additionally, check for necessary permits and environmental factors. The selection of a suitable location is the key to the success of the project.
- Next Step: Start searching for suitable locations and secure the necessary permits.

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2. How many potential partners/customers do you plan to sell the energy you produce to?

a. 0 – 5

- If you have only a small number of customers, it may be necessary to expand the demand. Try to identify additional energy sales opportunities, such as to larger industrial or commercial entities. You might also consider extending the market outside your area.
- Next Step: Conduct a market research study and consider diversification opportunities for energy sales.

b. 5 – 10

- Description: This range suggests a smaller but stable customer base. You can focus on long-term contracts with these partners to ensure a steady income stream.
- Next Step: Assess the demand and align production capacity accordingly.

c. 10 – 15

- Description: This number indicates that there is potential for growth and a stable market. You can focus on optimizing production to meet the needs of these customers.
- Next Step: Check the specific needs of these partners and optimize your distribution channels.

d. More than 15

- Description: More than 15 customers suggest the project has potential for large-scale operations and can support greater energy production. You can begin to scale up production capacity and consider expanding your distribution network.

- Next Step: Consider increasing production capacity and expanding infrastructure to meet this growing demand.

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3. Are there potential buyers of your energy resources or products in your area?

a. No

- If there are no potential buyers in the area, market research will be needed to find other regions or alternative sales channels. Without customers or distribution channels, the project will face significant challenges.
- Next Step: Consider seeking new market opportunities or partnerships with other entities.

b. Yes

- Description: If there are potential buyers in your area, the project is on the right track. Customers could include industrial plants, municipalities, or commercial properties.
- Next Step: Continue analyzing distribution possibilities and negotiating with potential customers.

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4. Is there available capacity in your area to connect to the distribution network (access point, grid connection, feed-in tariff possibility)?

a. No

- If no capacity is available for grid connection, alternative solutions must be sought, such as negotiating with the distributor to increase capacity or building your own connection infrastructure. This could be time-consuming and costly.
- Next Step: Consider negotiating with distribution companies or investing in your own infrastructure.

b. Yes

- Description: Available capacity for connection means that your energy can be immediately connected and distributed. This significantly accelerates the implementation process.
- Next Step: Proceed with the next phases of construction and grid connection.

5. Is there financial support available for the construction of the EC through subsidies, grants, or EU programs in your country?

a. No

- Without available financial support, the project will be more financially demanding. You will need to explore other funding options such as loans, private investments, or partnerships.
- Next Step: Investigate available alternative funding sources.

b. Yes

- Description: Financial support in the form of subsidies or grants can significantly reduce the construction costs. Proceed to the next planning phase with this financial framework in place.
- Next Step: Apply for grants or subsidies, or explore EU funding programs.

6. How much energy do you plan to produce within your EC?

a. 20 – 50 KWh

- This range may be suitable for smaller projects or local energy needs. Consider increasing capacity in the future to meet potential growing demand.
- Next Step: Monitor demand and analyze potential for capacity expansion.

b. 50 – 300 KWh

- Description: This range suggests a medium-sized project. It could supply energy to local communities or smaller industrial entities.
- Next Step: Move on to the next phases of project design and planning.

c. 300 – 700 KWh

- Description: A larger project that could serve larger areas or businesses. This requires more detailed planning and financing.
- Next Step: Develop a detailed project plan based on the anticipated capacity.

d. 700 – 900 KWh

- For this scale, consider significant investment in infrastructure and additional production capacity. Ensure you have a steady customer demand and access to distribution networks.
- Next Step: Begin planning and explore suitable partnerships for scaling up.

e. More than 1 MW

- For projects above 1 MW, you will need an extensive construction plan, significant financing, and collaboration with experts. This could be a large-scale commercial project with considerable impact.
- Next Step: Start detailed project planning and seek financing options.

Conclusion:

This expanded manual for ETMEC helps to better understand the answers to each question and determines the next steps required for the successful construction and operation of an Energy Comunity. Based on these steps, the project can be further developed and optimized according to market needs and available resources.

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