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Developing Capacities in the Area of VET for Green Energy Transition in Sub-Saharan Africa

Skills needed for working in the automated green energy sector

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1. Introduction

The essence of the competencies necessary to work in the automated Green Energy Sector will be described, and an example of its practical application and the path that must be followed to acquire a given competency will be presented.

In recent years, the Green Energy Sector has become one of the most popular topics undertaken by representatives of the world of business and science. Thanks to the development of renewable energy technologies and the growing demand for electricity not only among highly developed countries but also in the so-called Third World, the issue of Green Energy has become an essential element of broadly understood teaching activities (training, fields of study, social campaigns promoting renewable energy sources). Implementing technological solutions in the automated Green Energy Sector requires having the necessary competencies to understand its essence and impact on the natural environment or the economics of producing energy in an alternative way. In the literature on sustainable development, there is also the so-called concept of Green Jobs, i.e., positions in sectors related to environmental protection (Sulich et al., 2020), which include employees of the green energy sector.

Automation in the Green Energy sector is becoming increasingly common, so employees must be prepared to work in a robotic environment. This study aims to present the most critical competencies that employees who want to work or are working in the green energy sector should have. In the manual, you will find a description of the ten most essential competencies necessary to perform work properly in the industry discussed, as well as examples of their practical application in market conditions. The textbook is intended primarily for pupils, students, employees, and entrepreneurs in African countries, but its universality and utilitarian nature allow for its global use.

The competencies necessary to work in the automated green energy sector are crucial in the context of the growing importance of renewable energy. The dynamics of this sector require not only technical skills from employees but also the flexibility of thinking and readiness to improve constantly. Combining knowledge with practice technical and social skills is the foundation of success in this dynamically developing field. Progressing digitalization, automation, and new technologies require employees to adapt and update their knowledge and skills frequently (Zaphiris & Ioannou, 2018). Using new devices, computer programs, or mobile applications supports work efficiency and makes it easier to perform (Oberländer et al., 2020).

Competencies should be understood as knowledge, skills, potential, and attitudes that enhance effectiveness at the individual and organizational levels. Knowledge is acquired through education and observation, while skills result from the regular use of expertise or abilities. Abilities are the potential to perform specialized activities, while behavior is an employee's reaction to specific situations (Armstrong, 2006). Boyatzis (2006) defines competencies as the employee's abilities, manifested in workplace actions and measured by the actual effects achieved in this position (the effects are the basis for assessing the employee and making decisions about employment/dismissal or promotion).

The manual will describe competencies closely related to the automated green energy sector, divided into technical, business, and ecological awareness and sustainable development.

2. Technical competencies

Technical competencies in the renewable energy sector are the skills and knowledge necessary to design, build, operate, and maintain renewable energy generation and distribution systems. They mainly concern areas such as:

2.1. Knowledge about technologies for producing renewable energy sources

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The first and most crucial competence a candidate for an employee or an employee of the automated renewable energy sector should have. The most popular technologies for producing renewable energy sources are photovoltaics, wind turbines, water turbines, biogas plants, geotherms, and solutions based on hydrogen. It is worth emphasizing that in addition to specialist knowledge regarding technology, installation, maintenance, and repairs, the employee must first acquire knowledge in the field of occupational health and safety because each of the technologies mentioned above involves numerous risks and threats that may affect the health and life of employees in a given sector.

Popular photovoltaics requires, first of all, knowledge of the principles of operation of photovoltaic cells, the materials from which they are produced, and their technical parameters. Then, the employee must know how to install individual system elements at a point and convert the energy produced in the panels into "usable energy." The aspects of the photovoltaic system are cells, often called panels. This inverter changes direct current into alternating current, overvoltage protection, a cell assembly system, electric cables, and a bidirectional counter. In practice, an employee working on photovoltaic installations should select individual system elements tailored to the user's needs, design and implement the installation, check the operation, and assess the efficiency of the installation.

In the case of wind turbines, the employee must know and understand the units' operation principles, as well as their types (propeller, drum, carousel, rotor, vertical, etc.) and characteristics. An essential competence in the case of wind systems should be knowledge about optimal locations for installing a wind turbine - related to meteorology, anemology, and geomorphology.

Similarly to the types of renewable energy technologies described above, in water technologies, employees should have specialist knowledge of water installation diagrams and types of water turbines (Francis, Kaplan, Pelton, Tesla, or Shintake turbines). Additionally, knowledge of hydropower, hydrology, and oceanology is necessary.
Biogas and biomethane plants are also frequently used electricity production systems that allow the management of organic waste and biomass. This alternative energy production requires knowledge of different biofuels and technologies for converting them into energy, from biogas to liquid biofuels. Most often, in practice, these competencies are used to manage the process of converting biomass into energy and maintaining the efficiency of the process in the long term. Knowledge of biotechnology, agronomy, and chemistry is valid here.

Geothermal systems, in which energy extraction and use are based on various types of heat pumps (vertical and horizontal collectors), are among the most effective energy sources. The locations of geothermal power plants depend primarily on their place on the world map. African countries, in particular, have favorable conditions for installing geothermal energy.

In this case, in addition to specialist geo-energy knowledge, knowledge of geology and hydrology is essential.

The last renewable energy technology described in the textbook is a hydrogen power plant, which, after many years of research, has been used in practical applications worldwide. The ability to produce hydrogen from various materials makes it possible to use this technology in almost every corner of the world. Even waste and plastics have been heavily polluting the natural environment for years can produce hydrogen (so-called turquoise hydrogen). Knowledge of the construction of hydrogen power plant systems is very specialized. Still, in the coming years, it may be very desirable, as the development dynamics of the hydrogen industry are incredibly high. Practical skills will be mainly used in operating devices in a hydrogen power plant and monitoring their parameters. Engineering and chemical knowledge are necessary here as well.

Citizens and entrepreneurs in African countries can use the renewable energy technologies described. Their successive emergence in this region of the world will pose a significant challenge to the education sector at all levels. Building awareness of pro-ecological production and energy use from green sources should occur at the beginning of the educational journey of young citizens of African countries. The following stages of learning should provide the opportunity to acquire specialist knowledge that can be implemented in professional work - from secondary school to higher education, as well as supplementary courses and training.

2.2. Automation in the renewable energy sector

Automation enables continuous monitoring and effective management of the energy network. Thanks to advanced systems and technologies, it is possible to collect data from various points in the network, analyze parameters, and identify irregularities or failures.

Competencies related to automation and control systems for renewable energy installations consist of understanding the automation of processes used in renewable energy, such as the SCADA system or monitoring and control systems.

The SCADA system is one of the most popular computer systems used to monitor, collect, and analyze data from various electricity production installations, which allows you to control production processes in real time. It consists of three elements that together allow for the automation of the manufacturing process, including:

- field devices that collect data from installations or power plants using many sensors placed at individual production stages. These devices transmit information to the central system;

- industrial computers, so-called programmable logic controllers (PLC) that allow you to control devices creating power plants, and additionally, using machine learning algorithms, will enable you to automate processes through machine learning based on measurements and data from field devices;

- an interface that allows the user (an employee employed in the green energy sector) to read information about the state of production processes and changes in power plant parameters expected by this user. Most often, interfaces take the form of mobile applications or information screens. The interfaces have data visualization systems, control parameters, and alarm information about deviations from production standards.

Many tools allow remote access to automated systems for supervising and managing power plants producing energy from renewable sources and take the form of web and mobile applications where the user has a current view of the operating parameters of the production system.

2.3.Competencies related to programming and data analysis

Programming and data analysis are other skills that, in addition to the technical side of creating energy production systems from renewable sources, allow for practical work in the industry. IT/ICT technologies are increasingly used in renewable energy power plants and play a vital role in managing and controlling devices in green power plants, such as solar panels, wind turbines, and energy storage systems. Moreover, through data analysis, the programs optimize the operation of individual devices to obtain the highest possible efficiency of the entire system.

In programming systems and applications, dedicated programming languages are used, such as:

1. Python is a high-level programming language appreciated for readability, clarity, and flexibility. It offers many features that make it easy to write complex codes quickly. Python has an extensive library of modules, making it easy to develop applications without writing code from scratch. This allows you to integrate ready-made solutions rapidly. Additionally, Python is portable and runs on multiple system platforms so that code can be easily transferred between different operating systems. Thanks to open source codes, Python is constantly being improved thanks to a community of programmers who, thanks to their skills, expand the possibilities of using the language. In the renewable energy sector, Python is used in data analysis, management, and creating control and optimization algorithms in renewable energy sources.

2. LabVIEW utilizes graphical programming, where programs are created by connecting function blocks in the form of graphical icons, known as "virtual instruments," representing operations, functions, or measurement devices. In the renewable energy industry, this language is used for controlling and communicating with various measurement devices, robots, or PLC controllers, creating transparent and easily interpretable information for users about the operational parameters of individual elements within power plants.

3. C/C++ are languages used for embedded programming in controllers and devices that control processes in renewable energy plants. C/C++ is also used to create mathematical models for alternative energy production systems, which enable forecasting the efficiency of installations or conducting advanced simulations enabling research, testing, and analysis of new solutions in renewable energy (similar to the MatLAB programming language).

4. JavaScript, traditionally used in web browsers to create interactive websites, can also be used in the renewable energy sector for various purposes. JavaScript is often used to create user interfaces that allow operators to monitor and control renewable energy installations. You can visualize data, charts, alarms, and control systems via a web browser. It can be used to create interactive charts, graphics, or maps that present data on the efficiency and effectiveness of renewable energy installations thanks to communication and interaction with Internet of Things (IoT) devices. Mobile applications for individual users of photovoltaic or wind installations are often created thanks to JavaScript.

5. SQL (Structured Query Language) is used to create and manage databases where information about energy production from power plants is stored. This language allows you to perform advanced database queries to analyze data regarding the efficiency, trends, forecasting, and reporting of the performance of renewable energy installations. SQL is also used to implement database security, such as authorization, authentication, and data access rights management.

What is to be done to acquire a given competence?

The path of learning programming languages that can be used in the green energy sector depends on what a person wants to do. If the goal is to create interactive websites, then it is necessary to learn JavaScript, while if someone wants to make software that processes large amounts of data from power plant equipment, they should focus on PYTHON.

Learning programming begins with familiarizing yourself with basic programming concepts and structures, such as data types, operators, control instructions, functions, loops, and conditions. In the next step, the student learns more complex programming patterns, e.g., objects, polymorphism, design patterns, unit testing, and object-oriented programming. After getting acquainted with them, the student chooses specializations and further learns the programming techniques and languages of his choice. You can prepare for the profession of a programmer at secondary school, university, and postgraduate studies, as well as training and courses organized by specialized units. It is also worth using alternative learning sources, such as the Internet or social networking sites, where experienced programmers often provide support in individual learning.

Technical competencies are the basis for operation in the automated renewable energy sector. Depending on the specific nature of the work performed, the competence structure should be adapted to it. People dealing with infrastructure and power plants should focus on strictly developing technical skills such as constructing machines and devices, energy, and automation. In turn, people who want to build power plant management systems should focus on acquiring IT/ICT competencies. In both cases, an inherent element is learning specialized English, which is required at a very high level in both hard and software.

3.Business competences in the automated green energy sector

These competencies are another category of skills that, apart from technical knowledge, constitute the foundation for the effective operation of employees in the green energy sector. The energy business is based on having several different types of competencies, allowing the creation of new solutions in the industry, practical cooperation and communication with internal and external stakeholders, and broadly understood management of energy industry enterprises by legal acts that strictly regulate the manner of running an enterprise and protect health and life of employees in this industry. Moreover, the energy industry is characterized by high innovation, requiring numerous research and development projects. This, in turn, forces the employment of project managers with knowledge and skills in project management.

3.1. Energy company management

Management is based on implementing four primary functions of the manager's daily activities. The first and most crucial function is planning, i.e. the stage at which goals and resources are defined to achieve these goals. During planning, employees of energy companies in the green sector are assigned responsibilities and explained the principles they should follow when carrying out their tasks. Management tools such as a Gantt chart, commonly called a work schedule, are often used at the planning stage. Tasks are assigned attributes such as contractor, duration, necessary resources, and implementation priority. The second management function is organizing the required resources identified at the planning stage. Here, the manager must collect organizational resources in the appropriate quantity and quality by the principle of rationality. When discussing corporate resources, we should understand the following resources: financial, material, human, and the most important ones, i.e. intellectual and information, which in the energy industry determine the company's innovativeness. The third management function is to motivate employees to work effectively. The appropriate selection of motivation techniques is an essential skill of a manager, which, combined with knowledge of other management techniques and industry knowledge, allows for achieving the goals intended at the planning stage. Motivation can take two forms: financial, where employees are influenced using material resources, and non-financial, where the incentive to work efficiently is primarily the possibility of professional development and recognition.

The last of the management functions, i.e., the control function, consists of the ability to properly check the results obtained by employees while performing the tasks entrusted to them. Control should be continuous, i.e., subordinates should be controlled during the entire process and not only at the end of work.

The competencies described below characterize a complete manager who can efficiently and effectively manage an enterprise.

Management of an energy company can be carried out at three levels:

1. Operational level, where the manager manages the work of executive employees. This level is characterized by short-term management, where the formulated goals are implemented quickly, i.e., a week or a month. An example of a position held by a manager is Team Leader or Foreman. Delegating tasks most often concern routine and repetitive work for executive positions.

2. At the tactical level, the manager defines tasks for line managers and independent positions. The goals are medium-term, which in practice usually translates into a quarter - up to one year. A tactical manager is often called a middle manager because he carries out tasks assigned by top management and is responsible for dividing these tasks among his subordinates. An example of a tactical level manager position is head of the energy network maintenance department or regional sales representative for renewable energy sales.

3. Strategic level, where experienced managers make long-term decisions regarding the direction of the company's development for the coming years. These decisions have a horizon ranging from 3 to even ten years. Strategic managers set goals that allow the organization to develop and gain competitive advantages. In the energy sector, these decisions often concern expanding transmission networks, increasing production capacity, or creating innovative solutions through research and development. Positions held at the strategic level include, for example, operational director, financial director, etc.

The structure of managerial competencies at individual levels is very well described by the model created by Robert L. Katz (2009), who distinguished three closely integrated types of skills: technical, social, and conceptual. Table 1 presents the structure of these competencies, considering the management hierarchy.

Table 1. Katz's competency model

Type of competency/ level in hierarchy	Technical	Social	Conceptual
Conceptual	60 %	30 %	10 %
Tactical	33 %	33 %	33 %
Strategic	10 %	30 %	60 %

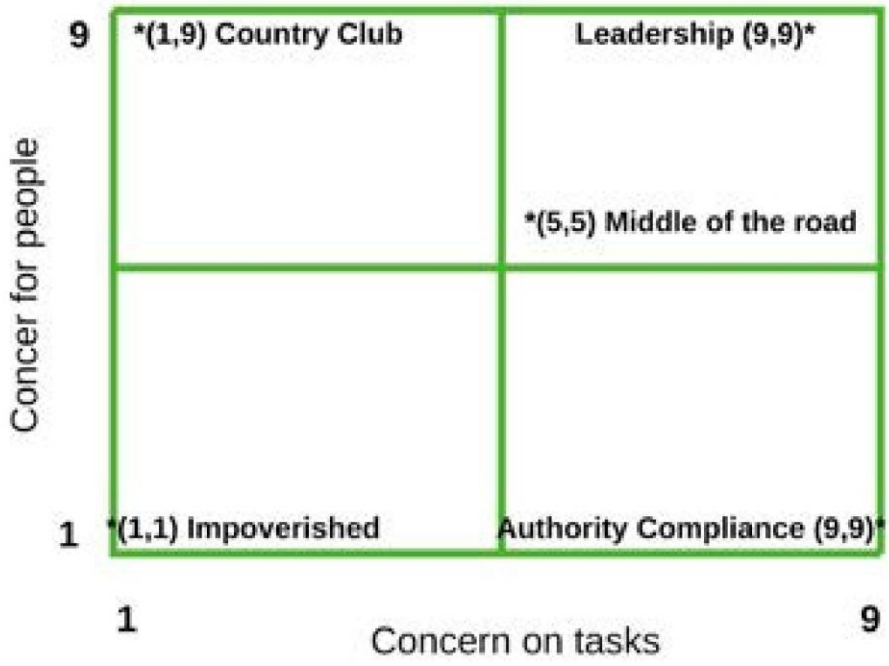
Source: Own elaboration.

3.2. Leadership in the energy industry

Leadership is another essential element related to a company's management in the renewable energy industry. Leadership should 1be understood as the ability to inspire employees to work by building authority and creating a vision that directs action. A good manager who can achieve goals by effectively motivating and inspiring others to act, releasing positive energy, and being willing to work effectively with his subordinates is an effective leader (Nawaz et al., 2016).

Managers can use different leadership styles depending on the organization's needs and the manager's predispositions. Leadership styles were very well described by Todăriţă (2021), who, based on the achievements of Blake and Mouton, presented a grid of styles (Figure 1).

Figure 1. Blake and Mouton's leadership style grid



Source: Own elaboration based on Todăriță (2021).

The structure of the grid is based on two dimensions that characterize the direction of the manager's attention. He may focus on the goals he has set or on his subordinates, i.e., the human factor. The strength of orientation to a given dimension, described on a scale of 1-9, allows you to identify a specific leadership style, which may be:

1. focused solely on people, i.e., the so-called democratic or country club style characterizes a manager who pays his attention primarily to the needs of his employees. He tries to provide them with comfortable working conditions, taking into account his employees' opinions in the decision-making process, often forgetting about their work efficiency. In the company, a manager is liked among employees and has informal authority (resulting from the employees' acceptance of a given manager as a superior) but does not always have formal authority (i.e., resulting from his position in the company).

2. focused solely on tasks, i.e., autocratic style. In this case, the manager focuses exclusively on the tasks performed by subordinates and their work efficiency. He forgets about his employees' needs and the team's good atmosphere. He makes all decisions himself, disregarding the suggestions and opinions of his subordinates. He often has only formal authority and needs to be recognized by employees (lack of informal authority).

3. not oriented towards people or tasks, i.e., a passive style (often called impoverished). In this case, the manager is not interested in employees and the results of their work. He minimizes his efforts and commitment to work - he only wants to maintain his position in the organization. He blames the team itself for the failure of the team's work, as he claims that the employees made the decisions themselves. Such a manager has no formal or informal authority.

4. highly people-oriented while taking care of the implementation of tasks, i.e., leadership style. The manager tries to build a great work atmosphere and inspire people to do it effectively. He believes that understanding the purpose of work by employees and the sense of fulfilling the organizational mission among them is the best way to achieve high work effects. The most desirable style on the labor market, representing a manager who has formal and informal authority/

5. both people- and task-oriented, but without the element that characterizes a good leader - a balanced style. It is an intermediate variant between democratic and autocratic. It is characterized by the manager's moderate involvement in caring for working conditions, employee morale, and the results of their work. Such a manager achieves his intended goals, which could be more ambitious and satisfying for the organization but allow him to maintain his position safely. He has formal and informal authority, but his employees will not "follow him into the fire," as in the case of a leader

The greatest skill for a manager is the ability to adapt their style to the organizational conditions and the nature of the work being performed. Leadership is termed as situational leadership, which is variable. This requires significant experience and knowledge on the manager's part. This knowledge can be gained as early as in vocational school with an economic profile, then further developed in business studies or specialized postgraduate studies. Participation in managerial training sessions and workshops conducted by experienced business practitioners is also immensely valuable.

To check your approach to people management, Appendix 1 presents a leadership style test developed by Blake & Burton, along with the interpretation of its results.

3.3. Ability to cooperate, communicate with internal and external stakeholders, and analyze the external environment.

Functioning in the rapidly changing environment of the energy industry requires managers to be able to analyze behavior and communicate with market entities with which the company cooperates or influences its operations.

The way we communicate reflects on the company as a whole. It talks about its values, culture, traditions, employees, and their affiliation to the organization or the ambitions the company strives for. It builds the image among the employees it employs and those who want to join the company, as well as the contractors it cooperates with or could potentially cooperate with.

Building a communication system that will quickly and reliably share information inside and outside the organization is challenging. A well-transmitted message gives the sender a sense of certainty that it arrived at the right time and has not been distorted along the way. In contrast, the recipient gives a sense of understanding and the opportunity to provide feedback.

In communication within the organization, the most crucial goal is to inform employees about their tasks and issues related to the organization's policy and build a community within the organization. More and more often, this communication is digitalized (e.g., using an internal messenger). Communicating well allows managers to build positive relationships with employees, help resolve conflicts, effectively identify employees' needs, and support their professional development. Through appropriate communication, the manager becomes a leader of positive changes.

In external communication, the company tries to present its organization in the best possible light for customers, suppliers, the labor market, and the local community. To do this, it must use various communication tools adapted to the specific market segment it wants to reach. Marketing departments or external marketing companies are responsible for external communication. The selection of external units to conduct activities for the parent company is called outsourcing.

In recent years, marketing has moved from traditional channels to the virtual world, where society spends more and more time. Instead of leaflets and newspaper articles, companies advertise on the Internet. The primary and most effective online channels are auction portals, social media (Facebook, Instagram, TikTok, etc.), and industry portals and communities like LinkedIn.

It is also worth emphasizing the role of marketing innovations, such as the activities of Influencers, who, thanks to their popularity and extensive media reach, can quickly reach many potential customers with information about a given company's offer.

Another competent employee of the automated green energy sector responsible for the management or supporting the management process should be able to conduct market analyses. In a world of intense competition, the behavior of one energy producer triggers a quick reaction from another. Competitive advantages are built by better adapting the offer to customer requirements, lower prices, better quality of customer service, and introducing innovations. One of the tools supporting analysis, primarily of the external environment, was created by R.W. Griffin, who presented the essential elements of the organization's internal and external environment - see Figure 2.

The model divides the organizational environment into internal (describing the essential components of the organization, i.e., employment structure, most important assets, prevailing culture or ownership structure, or management staff) and external. The external environment is divided into closer ones, the so-called task-related and, further, so-called general. The task environment describes the essential entities the organization cooperates with daily: customers, suppliers, competitors, regulators, and strategic allies. In turn, the general environment is defined by the dimensions of the environment that apply to all entities operating on the market, including:

- technical dimension, which describes the latest technologies that can be used in the industry,

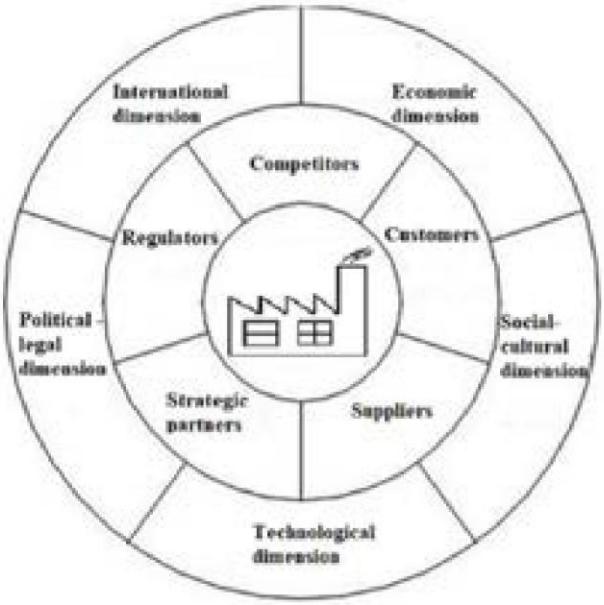
- economic dimension describing the financial situation in the sector and the entire economy (usually through macroeconomic indicators such as inflation, interest rate, GDP, unemployment, etc.),

- socio-cultural dimension, which includes, among others, trends in consumer behavior or changes in demographic structure,

- political and legal dimension, where information is presented on the stability and transparency of the law, trends in their changes, and the policy approach to the issue of renewable energy sources,

- international dimension, where countries' membership in economic unions, possibilities of goods and services flow, mobility of labor between countries, and opportunities resulting from membership in a union or associations (e.g., the possibility of obtaining subsidies or duty-free export/import) are described.

Figure 2. Griffin's organizational environment model



Source: Own elaboration based on Griffin (2021).

Analysis of the organizational environment helps in the decision-making process, especially those of a strategic nature. Knowledge of analysis tools is beneficial in the organization management process, especially in situations of high variability, where it is necessary to quickly and appropriately adapt to market conditions.

3.4. Competence related to the management of innovative projects and related entrepreneurship in the renewable energy production and distribution sector.

A high level of innovation characterizes the renewable energy sector. This is primarily due to the growing requirement for energy from environmentally friendly sources not based on fossil fuels, i.e., hard coal, gas, and oil. In addition to being limited, fossil fuels emit carbon dioxide into the atmosphere, thus generating a carbon footprint. Support for developing green energy technologies by international organizations and governments of most countries causes enterprises and small market innovators - startups to attempt to implement risky but very innovative research and development projects.

Implementing these projects requires the employment of a manager who has knowledge of project management tools, techniques, and methods and can use them in practice. Therefore, the role of the project manager, who is responsible for building the team, the course, and the partial and final results of the energy innovation project, becomes crucial. In addition to creating innovations, the energy industry implements many infrastructure projects that involve the construction of green energy production facilities or infrastructure for its transmission or storage.

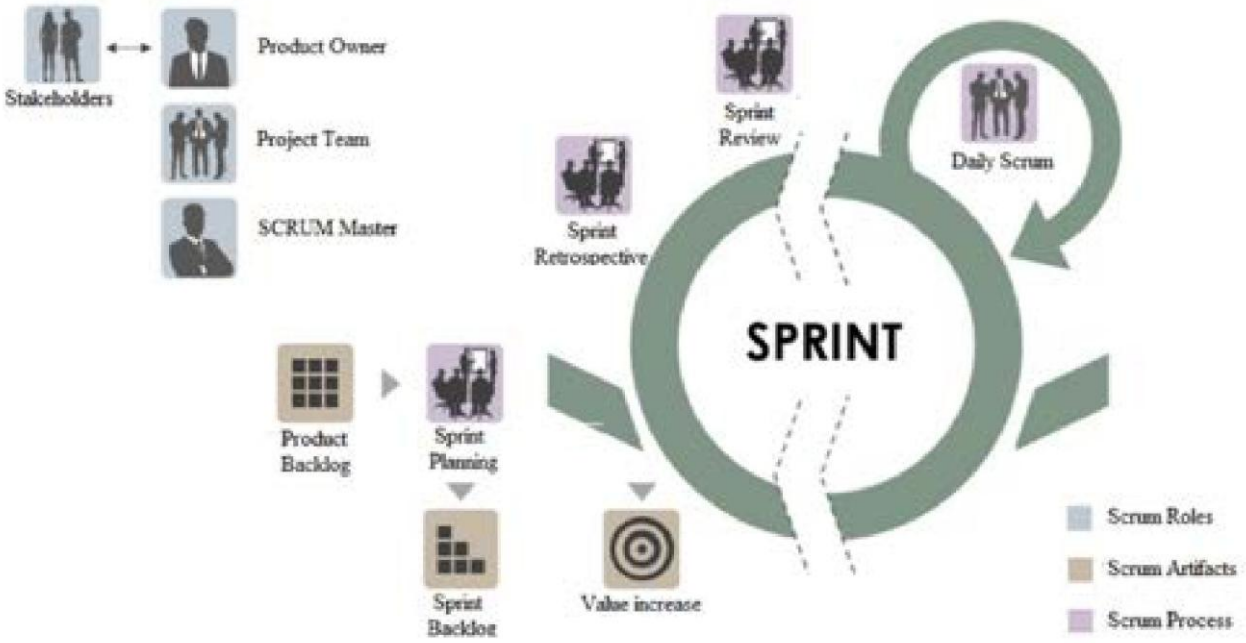
A project is a unique, temporary, multidisciplinary, and organized undertaking to prepare value within predefined requirements and constraints. The condition for achieving the project goal is compliance with the requirements, including many constraints such as time, cost, resources, and standard quality (IPMA, 2006). In turn, project management is the application of knowledge, skills, tools, and techniques to project activities to meet their requirements (PMI, 2017).

When managing innovation projects, adopting appropriate tools, techniques, and methods that correspond to the specific nature of creating innovations is essential. Then, using agile management methodologies, i.e., SCRUM or, in the case of IT/ICT projects, Extreme Programming (XP), is compelling.

Schwaber and Sutherland (2017), the creators of the SCRUM methodology, define it as "a framework in which people can solve complex problems while delivering products of the highest possible value productively and creatively." By defining Scrum in this way, the creators want to emphasize the possibility of using various techniques and tools together with SCRUM processes, which is a massive advantage of this methodology over traditional ones, which are linear and inflexible. It works exceptionally well when, at the beginning of the project, the user's requirements are not fully specified and frequently modified, which is typical of innovative projects.

SCRUM is an iterative and incremental model that delivers the current version of the created value in a short time (Akif and Majeed, 2012). Incremental design means the organic development of the product being developed (Nerur et al. 2005), which is based on iterations of tasks until the product of a given task is considered final (Ozkan and Kocuk, 2016). This is extremely valuable from the user's point of view, who receives tangible results of the design team's work and the opportunity to make suggestions for further improvements, which helps avoid errors in the final product. The Scrum methodology is built on three main components: roles, processes, and artifacts. It is shown in Figure 3.

Figure 3. SCRUM process



Source: Own elaboration using the Visual Paradigm published drawing program.

Extreme programming is an approach to software development that is based on creating frequent releases (versions) of software in very short time intervals (timeboxing) (Cobb, 2012). The "light methodology," as the creators call it, is dedicated to small teams (of a maximum of several people) that need to quickly create software in an environment with unclear or rapidly changing customer/user requirements (Beck, 2004). XP is distinguished from other agile software development methodologies by one fundamental difference, namely a strong emphasis on the technical side of the project. The method diagram is described in Figure 4.

Figure 4. Product development process by XP

Source: Own elaboration based on Beck (1999)

In turn, infrastructure projects in the green renewable energy production sector are implemented using classic management methods and techniques, which include:

a) PMBoK (Project Management Body of Knowledge) is not strictly a management methodology but a standard covering best practices and experiences that can be applied in the project management process. Project managers should conduct projects according to the principles described in Table 2.

Table 2. Characteristics of the principles addressed to project managers of their teams included in PMBOK 7

Name	Characterstics
Stewardship	Conscientious action that is full of respect and care for the organizational environment
Team	Building a team that will be able to cooperate with each other and maintain good relationships with the external environment
Stakeholders	Effective involvement of stakeholders in the project implementation process
Value	Taking the team's actions to create value as a guide
Systems thinkig	A holistic view of the project implementation as a system combining various aspects
Leadership	Presenting the attitudes of a leader - a leader leading the team to success.

Tailoring	Continuous adaptation of activities to the changing conditions of project implementation
Quality	Focus on quality as an element included in processes and created products
Complexity	Adapting project activities and work to respond to challenges related to its complexity
Risk	Adjustment of actions aimed at eliminating/neutralizing risky situations
Adaptability and resilience	Building the ability to return to a state quickly enables effective project implementation due to quick adjustments to disturbances occurring in the project implementation process.
Change	Building the ability to return to a state quickly enables effective project implementation due to quick adjustments to disturbances occurring in the project implementation process.

Source: Own elaboration based on PMI (2021) and J.R. San Cristobal 2017.

b) The PRINCE 2 methodology, similar to PMBoK, is a project management standard that divides each project into managed and controlled stages. Thus, controlling and estimating costs and implementation time of complex projects are much more accessible. This is also influenced by the hierarchical organizational structure of the project team, which favors a clear division of duties and responsibilities for individual areas of the project. This approach is so flexible that it can be used in almost any case. PRINCE 2 is also based on its principles that are intended to support project management, including:

- Continuous business viability – the project should be checked on an ongoing basis in terms of the viability of its further implementation;

- Using experience - which should accompany the project team throughout the project;
- Defining roles and responsibilities within the organizational structure, taking into account the interests of all project stakeholders, i.e., sponsors, users, and suppliers should be effectively represented in the project management team;

- Stage management, which, about essential management functions, should consist of planning, ongoing monitoring, and control at each stage of the project;

- Management using tolerances that are included in the deviations from specific project implementation parameters manifested in its intermediate and final goals;

- Focus on products that are clearly defined in the project in terms of quality and quantity;

- Adapting the project to external conditions, often unidentified and disturbing its progress during project implementation.

c) IPMA (International Project Management Association) has as its essence the assumption that the leading and irreplaceable resources in implementing all types of projects are people, and attention should be focused on them. Regardless of existing methodologies, such as PRINCE2 or good project management practices (PMBOK), people and their competencies determine the value of organizational resources that determine the success of project implementation. The most important Project Manager competencies have been assigned to 3 project, program, and portfolio management areas: perspective, people, and practice - see Table 3.

Table 3. IPMA ICB 4.0 Individual Competence Guidelines

Competencies		
Perspective	**People**	**Practice**
1. Strategy 2. Management governance, structure and processes 3. Compliance, standards and regulations 4. System of forces and interests 5. Culture and values	1. Self-reflection and self-management 2. Internal consistency and reliability 3. Interpersonal communication 4. Relationships and commitment 5. Leadership 6. Teamwork 7. Conflict and crisis 8. Entrepreneurship and creativity 9. Negotiations 10. Results orientation	1. Defining the project/program/portfolio 2. Requirements, goals and benefits 3. Scope 4. Time management in the project 5. Project organization and communication 6. Quality 7. Finance 8. Resources 9. Orders, contracts and cooperation 10. Planning and control 11. Risk 12. Stakeholders 13. Change and transformation 14. Selection and optimization

Source: Own elaboration based on IPMA (2015).

Depending on the specific nature of the project in the green energy sector, the project manager's role is crucial in achieving the project's success or failure. Knowledge of project management techniques and methods is an inherent attribute of an efficient and effective manager.

In addition to project management techniques and methods, the manager must have the knowledge and ability to build project teams effectively. A complete team means employing people with appropriate technical qualifications and, equally important, predispositions to work in a group. While it is easy to verify technical competencies (graduated school and other forms of education, certificates, recommendations, etc.), it is much more challenging to check the personality predispositions that predispose people to work in a group or not. A specialized tool developed by a famous psychologist, Dr. Taylor Hartman, comes to the rescue here. Thanks to the extended test, he helps managers in the process of selecting appropriate employees for teams. This test and its discussion can be found in Appendix 2.

4.Competences related to ecological awareness and sustainable development.

Environmental awareness includes several competencies and attitudes that allow people to make conscious and responsible decisions related to environmental protection and sustainable development. In the modern production and distribution of the green energy industry, they are the basis for the activities of all employees employed there. The awareness that one is doing work that affects the ecological safety of the region, country, or world motivates conscious employees of the sector to work effectively. Environmental awareness is represented in the attitudes and behaviors of people who actively participate in counteracting the degradation of the natural environment. Ecologically conscious people are convinced that the state of the natural environment depends on human activity. It is also essential to understand the relationships occurring in nature and to respect its laws, which enables adequate environmental protection, preventing potential ecological disasters. Ecological knowledge is the key to maintaining the balance of nature and ensuring its sustainable preservation for future generations.

An environmentally conscious employee will:

- knew local and global problems and threats occurring in the natural environment;

- skillfully made choices in private and professional life, taking into account long-term environmental consequences;

- reduced to a minimum the consumption of raw materials and other materials necessary for the operation of the company in which he works, and will segregate and recycle post-production residues;

- educated less ecologically conscious employees in their work and outside of work; they will be active informers of good practices protecting the natural environment;
- actively participated in social initiatives organized for environmental protection, such as cleaning the city or company premises;

- searching for new solutions to the problem of environmental degradation by acquiring knowledge and implementing it in his professional work.

In 2015, the leaders of 193 UN countries prepared the document "Transforming Our World: Agenda 2030 for Sustainable Development", which is the foundation of the principle of sustainable development. The 17 UN Sustainable Development Goals identify the critical challenges of today regarding people, the planet, prosperity, peace, and partnership. The main goal of the principle of sustainable development is to build a better world that is beneficial for all inhabitants of the planet.

Sustainable development is a set of actions to achieve simultaneous growth in its three dimensions: economic, social, and environmental. In the economic dimension, we can talk about promoting business through ecological protection and caring for local communities. Such a business generates not only an economic effect but also influences environmental indicators and improves the social situation of the local and regional community. Good practices include, for example, purchasing green energy, installing pollen filters on factory chimneys, closed-circuit waste management, and employing the local community or socially excluded people. In addition, it supports the population's quality of life by facilitating access to education, health care, and other services needed for life.

The fundamental principles of sustainable development include:

- sustainable economics: promoting an economy that takes into account the long-term consequences of economic activities while minimizing negative impacts on the environment,

- social justice: ensuring social equality, dignity, and development opportunities for all people, eliminating social inequalities and access to basic needs,
- environmental protection: preservation of natural resources, minimization of pollution and damage to ecosystems care for biodiversity,

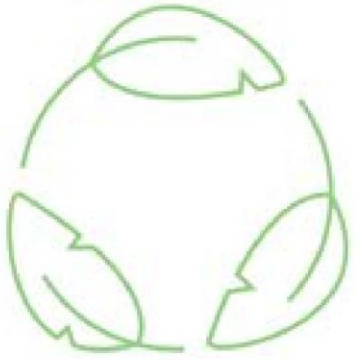
- sustainable lifestyle: cultivating behaviors and habits that reduce the consumption of natural resources, minimize the negative impact on the environment, and promote health,
- participation and cooperation: enabling public participation in decision-making regarding development, collaboration of various sectors and communities in activities for sustainable development,

- long-term perspective: Focusing on the long-term effects of our actions, rather than short-term profits, while maintaining a balance between current and future needs,

- sustainable use of resources: Rational and practical use of natural resources, minimization of waste and their optimal use,

- education and awareness: increasing public awareness about environmental issues and the necessity to initiate measures for sustainable progress, education is the key to changing attitudes and habits.

To check the level of knowledge about environmental protection and sustainable development, Annex 3 includes a knowledge test to determine the level of awareness on these topics.



5.Summary

Functioning in the automated green energy sector requires its employees to have a set of competencies that contribute to efficient and practical work. Efficiency, in turn, translates into achieving high results and the development of the industry. Employees can be divided into two categories that complement each other in the sector's activities. Technical workers are needed to create innovative solutions, provide ongoing operation of power plants, service the micro-installations they install, and maintain energy transmission or storage lines. People involved in the energy business administration are responsible for preparing contracts with customers, administrative services, and marketing promoting the sector's products and services. In turn, employees managing enterprises or teams involved in the implementation of energy industry projects try to ensure the continuity of the activities of other people employed in the industry. They set goals, plan activities, organize the resources necessary to achieve these goals, motivate their subordinates, and control the results of their work.

Each of these professional groups requires employees to have a set of different tools that are necessary to work in their profession. In African countries, the renewable energy sector is just developing, which creates employment opportunities for their inhabitants. Just like the innovative energy industry, the related education system is also growing. This manual contains basic information about selected competencies and how to acquire them. What is important here is, above all, creating ecological awareness among the youngest generations of Africa, who may find employment in the rapidly developing sector. Building pro-ecological awareness and knowledge of the effects of pro-ecological activities will translate not only into the professional life of the African population but also into everyday life. The additional materials included in the textbook in the form of tests, exercises, and tools are intended to support the teaching process among pupils, students, and employees of the energy sector in Africa.

Attachments

1. Blake Mouton test to identify leadership style
2. Hartmann personality test
3. A knowledge test will determine ecological awareness and knowledge about sustainable development.
4. Case Study
5. Competency matrix of employees in the automated renewable energy sector

References

- Akif R. i Majeed H. (2012), Issues and Challenges in Scrum Implementation, International Journal of Scientific & Engineering Research, vol. 3(8).
- Armstrong, M. (2006), A handbook of human resoruje management practice, Kogan Page Publishers.
- Beck K. (1999), Embracing change with extreme programming, Computer, vol. 32(10).
- Boyatzis, R. E. (2006), Leadership competencies (in:) Inspiring leaders, Routledge.
- Griffin, R. W. (2022), Fundamentals of management, Cengage Learning, Inc..
- International Project Management Association (2006), ICB - IPMA Competence Baseline 3rd edition, International Project Management Association Press, Nijkerk, Netherland.
- International Project Mamagement Association (2015),Individual Competence Baseline for projects, programme&portfolio management, http://products.ipma.world/wp-content/uploads/2016/03/IPMA_ICB_4_0_WEB.pdf (access 27.12.2023)
- Katz, R. L. (2009), Skills of an effective administrator, Harvard Business Review Press.
- Nawaz, Z. A. K. D. A., & Khan, I. (2016), Leadership theories and styles: A literature review. Leadership, vol. 16(1).
- Oberländer, M., Beinicke, A., & Bipp, T. (2020), Digital competencies: A review of the literature and applications in the workplace, Computers & Education,vol. 146.
- Ozkan N. i Kocuk C.(2016), A Systematic Approach to Project Related Concepts of Scrum, Review of International Comparative Management, vol. 17(4).
- Pawlowski S. (2021), Revolution in Project Management? What brings PMBOK® Guide – Seventh Edition, Project Management Institute Poland, vol. 34.
- PMI (2017), A guide to the project management body of knowledge: (PMBOK® guide) Newtown Square, ed. 6, Project Management Institute Press.
- San Cristobal J.R.(2017), Complexity in Project Management, Procedia Computer Science, vol.121.

- Schwaber, K., & Sutherland, J. (2017), The Scrum Guide. USA: Creative Commons, https://scrumguides.org/docs/scrumguide/v2017/2017-Scrum-Guide-US.pdf (access 28/12/2023)
- Sulich, A., Rutkowska, M., & Popławski, Ł. (2020). Green Jobs, Definitional Issues, and the Employment of Young People: an analysis of three European Union Countries. Journal of Environmental Management, vol. 262.
- Todăriţă, E. T. (2021), Leadership Style Determination according to Robert Blake and Jane Mouton's Managerial Grid (in:) International conference KNOWLEDGE-BASED ORGANIZATION, Vol. 27(1).
- Zaphiris P., Ioannou a. (eds.) (2018), Learning and Collaboration Technologies. Design, Development and Technological Innovation: 5th International Conference, LCT 2018, Held as Part of HCI International 2018, Las Vegas, NV, USA, July 15-20, 2018, Proceedings, Part I. Vol. 10924, Springer.

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