

Energy independence and energy efficiency of populated areas in the system of management

Ilona YASNOLOB,
Poltava State Agrarian Academy, Ukraine
ilona.yasnob@pdaa.edu.ua
Oleg GORB,
Poltava State Agrarian Academy, Ukraine
oleg.gorb@pdaa.edu.ua
Yuliia KOZACHENKO,
Poltava State Agrarian Academy, Ukraine
yuliia.kozachenko@pdaa.edu.ua
Oleksandr KALIAN,
Poltava State Agrarian Academy, Ukraine
oleksandr.kaliyan@pdaa.edu.ua
Tetyana BOROVIK,
Poltava State Agrarian Academy, Ukraine
tatiana.borovyk@pdaa.edu.ua
Iryna ZAHREBELNA,
Poltava State Agrarian Academy, Ukraine
iryna.zagrebelna@pdaa.edu.ua

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Abstract:

The idea of the essence of notions “energy independence” and “energy efficiency” was extended in the article taking into account the promising directions of developing energy saving, ensuring the harmonious system development. The energy policy in the populated localities of European countries was analyzed in the article and also their practical experience concerning the questions of energy independence and energy efficiency was studied. Special attention was paid to the Polish experience, because the country has the greatest number of energy independent populated localities among other European countries. The European experience of energy policy enabled to reveal economic, ecological, and social levers of forming and developing energy independence and energy efficiency of populated localities, forming the system of their management. The necessity of introducing consolidated state policy as to raising energy independence and energy efficiency of populated localities was proven, their priority directions and assistance in introducing the corresponding projects in the populated localities of Ukraine were determined. The necessity and peculiarities of energy management system for the need of project management in energy independence and energy efficiency of populated localities were investigated. Practical recommendations as to optimizing the management system of energy independence and energy efficiency of populated localities in Ukraine were developed.

Keywords: energy efficiency, energy saving, fuel-power resources, alternative sources of energy, system of energy management, energy policy.

JEL Classification: Q01, Q56, Q57.

Introduction

At the present period power consumption of Ukraine considerably exceeds the corresponding level of other industrially developed countries, which leads to high power inputs and makes it one of the largest energy inefficient countries in the world. For example, nearly all energy consumption in Ukraine is ensured owing to the

extracted fuel, the major part of which is imported. As a result of constant price changes (as a rule, the growth) of energy sources together with huge energy wastes and excessive dependence on the import of extracted fuel the economy of the country is very vulnerable, which leads to lowering the level of its competitiveness.

Thus, decreasing the consumption of traditional kinds of fuel (particularly, natural gas), stimulating energy saving, diversifying the sources of power supply, introducing energy efficient techniques and technologies, developing the using of local alternative sources of energy, and also solving important ecological problems are important tasks for Ukraine at present (Yasnolob, 2018).

Under such conditions, in our opinion, the Ukrainian way to success will begin with the social realization, that energy efficiency is not simply the condition of the country's economic development. This is the indicator of the state's self-sufficiency, and also the marker of its readiness to lead in innovation development, to attract the technologies of the future and benefit from them.

Today energy independence is one of the cornerstones of Ukraine's foundation. It is known, that Ukraine consumes 11 times more energy, than Japan, and 7 times more, than Germany in any branch. This also concerns private houses and companies. The same is true about the cost of any national product, which increases the share of energy materials decreasing the share of wages. That is why energy efficiency is a considerably important source of saving money (Energy, 2018).

1. Research Background

According to statistical data, energy efficiency in Ukraine is on the average 11 times lower, than in other developed countries (EEA Report No 4/2016), and our country is among 30 the largest producers of greenhouse gases (BP Statistical Review of World Energy 2016). At present, more and more countries of the world are intending to use 50% and more of renewable energy sources in the power sector (The Analytical note of PEA No 17/2016 (Analyzing, 2016)).

The question concerning energy efficiency and energy independence of populated localities is becoming topical for scholars in connection with the necessity of global changes in energy policy of every country, energy saving at the local level, developing alternative sources of energy. The existing international and national experience enables to introduce the projects of energy independent rural territories in Ukraine (Yasnolob, 2018).

Ukraine has a great potential of bio-mass, accessible for producing alternative energy, favorable natural-climatic conditions for developing and producing alternative kinds of fuel and renewable energy (Heletukha, 2016). Being the agrarian-developed country, Ukraine has enough opportunities for ensuring energy independence and raising the competitiveness of the economy by using the biomass potential of crops and fast-growing energy crops (Tytko, 2010). At the same time, the development of bio-power engineering in Ukraine must not be injurious to the natural environment, and be oriented only at sustainability and economic advantages (Melnyk, 2011).

In articles by A.V. Kalinichenko (2014) the opportunities of optimal using renewable sources of energy on the example of Poland are considered, which makes it possible to ensure complex power supply of farms by using the excess heat energy from technological processes in agrarian production, and also bio-mass, biogas, and so on. Eco-social advantages of the projects in introducing alternative energy sources are presented; these projects enable to obtain economic advantages.

The initial research of project management in introducing alternative energy sources has shown that in order to start manufacturing heat energy from bio-mass, it is necessary to develop technical-economic substantiation and make the business-plan (Chaika, Yasnolob, 2017). Thus, taking into account all the above mentioned and the priority directions of rural territories' development (ecology, energy saving, alternative power engineering, and social efficiency) the project of creating energy efficient and energy independent village in Poltava region was created (Gorb, 2017).

2. Methodology

The aim of the article consists in the following: using the foreign and Ukrainian practical experience of introducing and functioning of the energy independence and energy efficiency of populated areas. Dialectical cognitive method and system approach has been applied in studying scientific works by Ukrainian and foreign scholars devoted to energy supply and energy saving in agriculture, especially in the rural districts of Ukraine. Using the practical experience of investigated questions helps to form the theoretical and methodological foundations of the research.

The following methods were used in the process of writing the article: abstract-logical (to adapt the energy independence and energy efficiency of populated areas the principles of efficient management); systemic analysis (to determine general principles of forming the system of ecological management and efficiency); normative (to determine enterprise strategy in the system of ecological management); grouping (to define the characteristics of general principles and those of efficiency of ecological management system); modeling (the formation of the efficient system of enterprise ecological management).

3. Results and Discussion

Today the efficient using of fuel-power resources is the most important economic, ecological, and socially expedient factor, but at the same time it is the least used and understood way of raising both the level of profitability, the life of everybody and the life in the conditions of environmental preservation. So, the necessity of determining the essence of such categories as “energy efficiency” and “energy independence” arises, taking into account the promising directions of energy saving development.

Energy efficiency as a field of knowledge is on the verge of engineering, economics, science of law, and sociology. In its general definition, it envisages the efficient (sensible) using of power stock on the basis of using less amount of energy for supporting the primary level of power supply of buildings or technological production processes.

There are a lot of definitions of the term “energy efficiency”. For example, Zhovtianskyi V. considers it to be a field of knowledge on the verge of engineering, economics, science of law, and sociology, which means the rational using of power resources, achieving economically expedient efficiency of using the available fuel-power resources at the existing level of machinery and technology development, following the requirements to the environment. Energy efficiency is useful, effective power consumption (Zhovtianskyi, 2008), but its correlation with the final results of functioning is not taken into account in this definition.

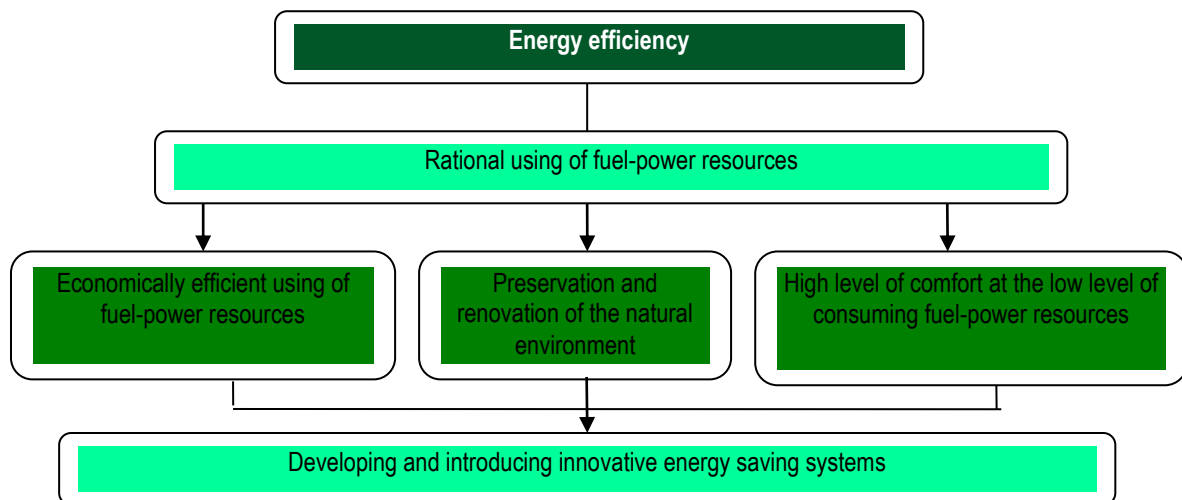
Sukhodolia O. considers that the term “energy efficiency” has to reflect the activities of the state (enterprise, human) directed at ensuring the determined (guaranteed) level of manufacturing products (providing services) at minimizing the amount of using energy and suggests the following definition: “energy efficiency is the system position, at which the achieving of goals and performing of its functions are ensured by minimal power inputs” (Sukhodolia, 2009).

Ginzburg M. (2008) states, that energy efficiency is the totality of indicators, which enables to compare different products for the same purpose from the viewpoint of power consumption.

In the Law of Ukraine “About energy saving” only energy efficient products, technology, equipment are considered as products or method, way of their manufacturing, which ensure rational using of fuel-power resources as compared to other variants of using or manufacturing the products of the same consumer level or similar technical-economic indices (The Law, 2017).

In our opinion, energy efficiency can be defined by its essence as: rational using of fuel-power resources, achieving economically expedient efficiency of using the available fuel-power resources at the existing level of machinery and technology development together with simultaneous stimulating the developing and introducing of energy saving systems, following the requirements as to the preservation and renovation of the natural environment, ensuring a high level of comfort at the low level of consuming fuel-power resources (Figure 1).

Figure 1. The essence of energy efficiency taking into account the development of energy saving systems

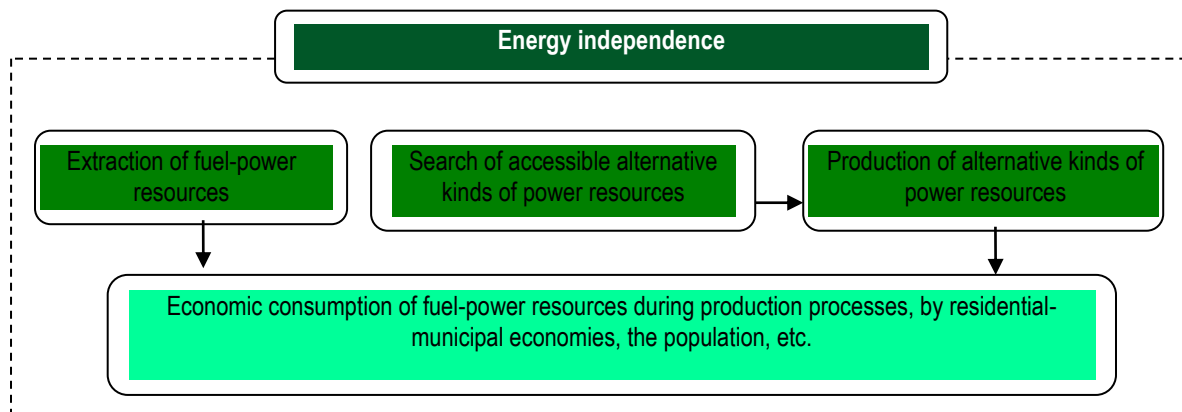


Source: the author's development.

Thus, energy efficiency is characterized by constant changes, causing the raising of its level at the expense economic, ecological, and social components, ensuring a harmonious development at micro-, meso-, and macro-levels of any system.

Raising energy efficiency ensures the achieving of energy independence, which is defined as using fuel-power resources in the complex with energy saving technologies aimed at ensuring energy requirements without outside interference. Moreover, the cooperation at all levels – state, private, public – is expedient (Figure 2).

Figure 2. The essence of energy independence, taking into account the search of promising directions of developing accessible alternative kinds of power resources



The source: the author's development

As it is seen from Figure 2, energy independence is also based on searching and using new accessible alternative kinds of power resources, which stipulates the growing of its level. In such a way raising energy efficiency is ensured, and it testifies about the mutual connection of these two categories.

Nevertheless, till the programs of energy efficiency in Ukraine are not connected with the general economic strategy of the country's development, the development of extracting industry and using alternative power sources are restrained.

State and regional programs of energy saving, raising energy efficiency and energy independence in any sphere of production cannot be considered separately from the general strategy of the country's economic development, without singling out the moments of break-through growth.

At present, the model of power-consuming economy is continuing to be implemented in Ukraine, when power consumption per the GDP unit is 3-5 times higher, than the similar indices in economically developed countries. The reason is rent orientation of the national economy, the absence of modernizing the production

processes by the big business, and as the state is supporting the interests of the former, the state reforms are not of high quality, and they do not ensure energy efficiency and energy independence of the processes at micro-, meso-, and macro-levels.

At the same time, the modernization of any production processes begins only when the source of profit formation is transferred from the sphere of rent formation to the sphere of added value creation. That is why the necessity arises to implement state and regional programs of energy efficiency at all levels. It is particularly urgent for rural territories, which today are in complicated conditions: growing unemployment and poverty; improper state of physical and social infrastructure (the systems of social security, health protection, recreation centers, kindergartens, schools, etc.); improper development of personnel resources (the level of education, etc.); the situation connected with natural resources and the natural environment is aggravating.

That is why, in our opinion, the formation of the effective system of energy independence and energy efficiency management of populated localities is necessary, taking into account the successful European (Poland, Federative Republic of Germany, France, and others) and national experience (the village of Severynivka in Vinnytsia region, the village of Vesele in Kharkiv region, the towns of Zhytomyr, Voznesensk).

As it was substantiated above, at present, under the insufficiency of the traditional sources of fuel-power resources (natural gas, petroleum), raising energy efficiency and energy independence of populated localities (especially the most economically unstable – villages, townships, etc.) is topical. These localities have enough potential for using local alternative energy sources (bio-fuel, wind power engineering, solar power engineering, and so on) in connection with their accessibility and small areas of infrastructural objects, liable to the transfer to such power sources.

There is the practice of creating and effective functioning of such energy efficient and energy independent populated localities in Poland, Germany, and France, where there are many localities using the energy of the Sun and wind (Figure 3). The above mentioned projects are a long-term target program, consisting of a number of micro-projects, aimed at ensuring energy sustainability of rural communities and decreasing the expenditures of local budgets on energy sources. Moreover, innovative technologies are introduced by investors, advertising their activities (Chaika, 2016).

Figure 3. The European experience of functioning energy independent populated localities



The source: the data (Ignatiev 2014)

Each European country has a unique experience in this field, which may be used by Ukraine. Modern world energy market quickly develops every year, which is stipulated by the global striving to energy independence, ecology, decreasing the dependence on the global price fluctuations. As a result, renewable energy sources are being used more actively, increasing the share in the general electric power supply. For example, 13,5% of electric power requirements in Poland are ensured by renewable sources (according to the

data of Eurostat in 2016), 32% – in Germany, and 22,5% – in Slovakia. Norway is leading in Europe, ensuring 100% of electric power for its own needs from renewable sources; the country even produces 4% more, than it requires. The similar indicators in Ukraine are insignificant – only 4% of electric power is obtained from renewable sources (Martyniuk, 2018).

Large cities and small towns all over Europe invest more and more in local power generation either from renewable source or wastes. Depending on the local resources, they can invest in town wind turbines, as in Amsterdam (the Netherlands), solar photo-electric and heat systems, as, for example in Ljubljana (Slovenia), or enterprises, functioning on biomass as in the town of Gateshead (Great Britain). As large municipal investments in renewable energy sources, as a rule, require considerable financing, these projects can be implemented in cooperation with the private sector or by leasing or concluding energy contracts on beneficial conditions. One of such examples is the island of Certoza in Venice (Italy), which, owing to the state- private partnership, was transformed in the center of renewable energy sources (Decreasing Energy, 2018).

Thus, it is expedient to consider the peculiarities of energy policy in some European countries, which ensure the sufficient level of their energy efficiency and energy independence (Table 1).

Table 1. The peculiarities of energy policy of European countries

European country	Peculiarities of energy policy and its directions	Advantages
Federal Republic of Germany	Using the concept of “energy turning” (Energiewende), which envisages gradual refusal from hydrocarbon and atomic power engineering and its transition to renewable sources, more economic and careful energy using. The main aims of the concept implementation: 1) fighting the climate changing; 2) decreasing the dependence on the import of energy sources (the country has no petroleum and natural gas, but it has large deposits of coal); 3) stimulating the development of technological innovations and “green economy”; 4) decreasing the risks of using atomic energy (especially after the accident on “Fukushima”); 5) fighting monopolies in power generating sector, and so on.	1. The developed and for the first time tested balanced, long-term system of “green tariffs” made the country the leader in investment volumes in renewable energy sources and the number of installations operating on wind, solar energy, or bio-fuel. 2. Considerable amount of investments in renewable power engineering. 3. Decreasing the volumes of imported extracted fuel and economic savings. 4. Creating additional working places owing to the development of renewable energy sources. 5. New buildings are constructed on the principle of energy saving buildings. 6. Providing subsidies for buying electric motor cars.
France	1. The transition to renewable energy sources and lowering the share of atomic power engineering from 75 to 50%. 2. Decreasing the production of electric power at atomic electric power stations by 25% by 2025 3. Developing the branch of electric power production according to kinds (atomic, natural gas, renewable energy sources, etc.).	1. The level of investments in French power engineering will be 400 billion Euros during the nearest 20 years. 2. By 2020, the share of wind power engineering will have been 23% of the general volume of generated electric power.
Belgium	1. Power engineering branch is private and functions exclusively according to the tendencies and laws of free, transparent market. 2. High tariffs for public utility services and their obligatory payment by consumers.	1. Each homestead, community of citizens, separate community or township can choose the final supplier of energy sources. 2. The culture of consuming public utility services is distinguished by the high level of saving.

	3. At present, the margin from selling electric power or natural gas to consumers is insignificant.	3. Operators engaged in power supply offer their clients the so called "clever" or smart decisions as to the most effective equipment concerning energy efficiency in their houses.
The Netherlands	1. The market of power services is very liberal. 2. The Netherlands Authority for Consumers and Markets, engaged in the control of competition and protection of consumers' interests, is functioning.	1. The users can independently choose the supplier of power services, and change him any time, if it is necessary. 2. The consumer can choose power supply source independently, for example, prefer renewable energy resources, such as wind power engineering or bio-mass.
Poland	1. The diversification of power supply sources became one of the main elements of the country's national security. 2. For the next decades it is planned to construct two atomic electric power stations with the aim of fulfilling the requirement of the European Commission to decrease the emission of carbon dioxide in the atmosphere (till the present time the needs in electric power were satisfied by electric power stations operating on coal, extracted in Poland). 3. According to the adopted strategy of energy policy till 2030, the share of the renewable energy sources in Poland is to grow to 20%. 4. Power generating companies are considered strategically important for the country's security, that is why the majority of them are state owned, or the state has the control block of shares in them.	1. Decreasing the prices for the natural gas from Russia by 15%, the share of which is 1/3 of the general natural gas supply of the country. 2. The majority of Polish power generating companies are successful and they actively invest and develop their opportunities abroad, but within the country's power security.

The source: made according to (Planet Power...2016)

Let us consider the energy policy of Poland in more detail, as it has more energy independent populated localities than any other European country (see Fig. 3). The Polish energy policy till 2030 contains six main directions of actions, including (Yaskula, 2018):

1. Raising the country's energy efficiency:
 - striving to ensure zero energy growth and consistent decrease of power consumption of the Polish economy to the level of the EU-15;
 - increasing the share of renewable energy to 15% in the total volume of consumption in Poland in 2020.
2. Since 2014, the national plan of actions in energy efficiency has had the description of adopted and planned measures in raising energy efficiency of separate branches of the economy, necessary to achieve the national goal of energy efficiency.
3. The national plan of actions in the sphere of power engineering from renewable energy sources:
 - sets the goals as to the share of energy obtained from renewable energy sources in transport sector, and also in electric power, heating, and cooling;
 - the general aim is to achieve the share of 15,5% of renewable energy sources in the ultimate gross energy consumption in 2020.
4. The Law about power engineering – municipal duties:
 - planning and organizing the supply of heat, electric power, and natural gas to the commune's districts;
 - planning the lighting of public places and roads, located on the territory of the commune;

-financing the lighting of streets, squares, and public roads in the commune's district.

5. The Law about energy efficiency determines the tasks of the public sector subjects in the sphere of energy efficiency and measures as to raising energy efficiency in the sector.

6. The Law about renewable sources of energy includes the regulations about supporting renewable energy sources by conducting auctions of renewable sources of energy and the system of guaranteed tariffs for small buildings.

The national plan of actions is functioning in Poland as to increasing the number of buildings with low power inputs, raising energy efficiency in construction sector corresponding to the regulations of the Instruction 2010/31/ EC. It is envisaged, that by December 31, 2020 all new buildings will have had almost zero energy consumption. Today Poland is characterized by exceptionally high share of coal in the ultimate power consumption in residential (30%) and non-residential (10%) buildings in comparison with the European Union. More than half of coal, used in European buildings, is burnt in Poland. Individual heating based on coal burning in small installations, creates the problem of emissions, which are harmful for health and environment. Besides, old buildings have power ineffective stoves, operating on coal and consuming considerably more fuel, than new ones.

Summing up the research of energy policy in different European countries, it is possible to determine their economic, ecological, and social components (Table 2), which assist in developing energy independent and energy efficient populated localities, forming the system of their management.

Table 2. Economic, ecological, and social preconditions for creating and functioning energy independent and energy efficient populated localities

Categories	Preconditions
Economic	<ol style="list-style-type: none"> 1. Decreasing consumers' spending on energy materials. 2. Stimulating the development of energy saving systems and searching new kinds of alternative energy. 3. Attracting investments for developing and implementing projects. 4. Raising the incomes of the local population. 5. Increasing the profit sources of the local budget and population by selling the surplus energy. 6. Differentiating the kinds of fuel-power resources on the territory. 7. Forming the platform and establishing partner relations during project implementation. 8. Advertising energy saving systems in their action.
Ecological	<ol style="list-style-type: none"> 1. Decreasing the natural environmental pollution. 2. Limitation or complete termination of using non-renewable sources of energy. 3. Using wastes and by-products of manufacturing. 4. Using local renewable sources of energy.
Social	<ol style="list-style-type: none"> 1. Uniting the community around the common goal. 2. Raising the living standards of the local population. 3. Increasing the level of the population employment. 4. Raising the image of the rural territory and country. 5. Popularizing energy saving in rural territories. 6. Exchanging the experience of using energy saving systems and available local kinds of alternative energy.

The source: the author's development

According to our research, the following recommendations should be followed to ensure the efficient implementing of the projects in creating and managing energy efficiency and energy independence of populated localities (is adapted (Yasnolob, Chaika, 2018)):

1. Ensuring the maximal concentration of social sphere objects.
2. Preparing the public to changes by organizing: thematic trainings, seminars, conferences, study trips, days of energy, local forums.
3. Providing reliable and sufficient sources of financing (investments, credits, subsidies, grants, etc.).
4. Conducting energy registration of populated localities aimed at determining the most problematic objects.

5. Using the maximal number of accessible local sources of alternative energy.
6. Organizing events for sharing the experience concerning projects, spreading the information by media.
7. Adopting the strategy of populated localities' development for further objects' energy modernization, establishing cooperation with neighboring populated localities.

Thus, the higher the level of energy efficiency and energy independence of populated localities is, the more economically developed they are, the more comfortable their kindergartens, hospitals, schools, and other social establishments are, the better the ecological situation around them is. So, energy efficiency and energy independence is the way to transfer the reforms from political to practical direction.

It is expedient to pay attention to a certain lack of understanding and underestimating the changes, which are taking place in Ukraine concerning the approaches to solving the problems of energy saving; in many cases these problems are completely ignored or extremely simplified, and they are restricted to formal fulfilling several general requirements. This leads to inevitable losses, including economic opportunities both for separate objects and for Ukraine on the whole.

So, the necessity arises in developing and implementing projects on energy efficiency and energy independence of populated localities; these projects are based on creating and functioning the system of energy management (SEnM), which envisages the solving of several problems:

1. Ensuring the unity of the SEnM with the general system of object functioning management, because the most efficient directions of introducing energy saving measures require financing.
2. Substantiating the tasks, which are solved in the SEnM, defining the algorithms of solving, software, and organizational structure of energy services.
3. The corresponding staff provision of the object energy services and motivation of energy saving on the object.
4. Realizing the necessity of implementing the concept of energy management at a higher level of the economy management.

The generalizing of the available practical experience (Manual in...2018) enables to distinguish several principal differences between the traditional energy management and that one, which is characterized by novelty and its own peculiarities (Table 3).

Table 3. The comparison of the notions "traditional energy management" and "energy management"

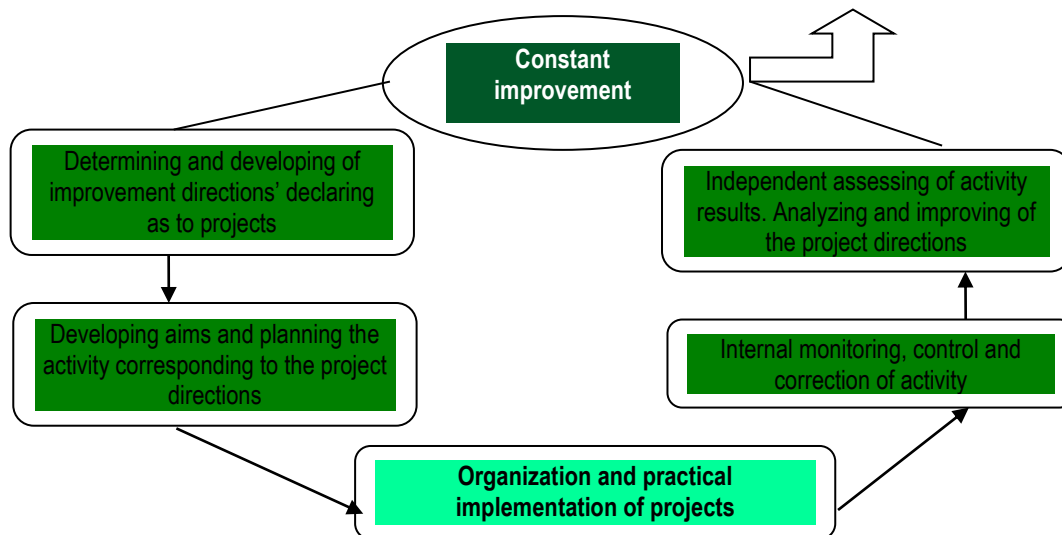
Traditional energy management	Energy management
Obligatory activity, stipulated by legislative requirements (Government energy control)	Initiative and voluntary activity, stipulated by the decision of the administration and usually is additional to the legislative requirements
The absence of clearly formulated, interdependent and documented aims and tasks of energy saving policy on the object. Practical absence of aims, connected with the processes of successive improvement	Clearly formulated, interdependent, and documented policy, aims, and tasks are the base of management
The priority of the external power consumption standards	The priority of internal, independently established power consumption standards
Planning the saving of energy resources for a separate subdivision is usually economically inefficient for the object on the whole	Management is directly mutually connected with the opportunity of getting considerable direct and mainly indirect economic effects (for example, while investing in production)
As a rule, responsible specialists are engaged in management. The administration and personnel, on the whole, do not take an active part	Sufficient result can be received only by active and conscious participation of the administration and personnel on the whole
Is conducted within strict position duties and instructions	Is mainly determined by the initiative and personal interest of energy manager and the personnel in the results of activity
The organization of activity is neither practically changed nor improved with the time	The activity is systematically corrected, supplemented and improved from year to year
The priority of separate highly consuming measures and operations	The priority of numerous costless and low-cost measures and actions

Practical inaccessibility of plans and results of activity for the majority of external interested persons and parties	Constant active demonstration of plans and results of activity to all interested persons and parties
Ignoring the negative results of activity. Fear and keeping silent about negative results	The value of negative results. Open demonstration of separate negative results of activity together with positive results
The absence of any external independent assessment (energy audit) of organizing the activity and achieved results	Energy audit (the assessment of organizing the activity and achieved results by the third party) is an indispensable part of any system of energy management
Comparative simplicity of imitation and falsification of the effective activity in the field of formal energy management	Practical inexpediency of imitation and falsification of the effective activity in the field of energy management

The source: is adapted (Manual in...2018)

The general principle of the SEnM is based on the quality loop (Figure 4). Constant improving the processes of ecologically oriented development by introducing modern techniques and technologies in bio-power engineering branch is the obligatory condition for the management system functioning of projects in energy efficiency and energy independence of populated localities.

Figure 4. The model of SEnM projects in energy efficiency and energy independence of populated localities



The source: the author's development

Efficient conducting the complex of work in developing and introducing the SEnM is impossible without the available organizational, technical, software, information, linguistic, mathematical, resource, and legal provision. Moreover, the process of the SEnM implementation should not be considered as single action, which is finished by solving a definite number of tasks. It is a successive, constantly functioning process of optimizing all the sides of activities, of both guided and guiding system in the sphere of power using efficiency (Table 4).

Table 4. The order of making the system of energy management and its functioning

Stages	Components
1. Making decisions about introducing the SEnM	1. Making decisions as to introducing the SEnM by the administration. 2. Allocating money for creating and functioning of the SEnM. 3. Determining the persons, responsible for creating and functioning of the SEnM. 4. Attracting the consulting company of the corresponding profile.
2. Attracting professional consultants	1. Organizing tender or conducting market research of the corresponding services for choosing the consultant. 2. Assessing the consultant according the selected criteria.

	3. Choosing the consultant and making the contract with him (her).
3. Developing the components of energy management system	1. The personnel of energy management service: - training own specialists at specialized extension courses of higher educational establishments of Ukraine and adapting the acquired knowledge to the local conditions by attracting consultants; - or attracting specialized consulting company to perform the functions of energy management service (outsourcing). 2. Estimating and improving the available system of power resources accounting, introducing automatized system of controlling and accounting power resources. 3. Plan of actions as to developing and introducing the SEnM and the algorithm of making managerial decisions.
4. Starting the functioning of energy management cycle corresponding to ISO 50001 standard on the object	Corresponding to Deming Cycle (PDCA – Plan – Do – Check – Act): 1) measuring power consumption indicators; 2) analyzing power consumption indicators; 3) developing energy saving measures; 4) introducing energy saving
5. The certification of the system of energy management corresponding to the ISO 50001 standard	Attestation by the independent accredited body of the International System of Standardization ISO 50001, the availability of which increases the amount of attracted investments.
6. Ensuring the continuous functioning of energy management cycle	1. The continuity of the SEnM functioning cycles is fixed in documents. 2. Yearly report of the chief and yearly report of energy audit company about the state of energy management system. 3. Material stimulation for energy saving by employees according to the corresponding provision. 4. Developing plans as to the SEnM improvement.

The source: is made based on (Manual in...2018)

For wide introducing of energy management as a system, ensuring the efficient energy economic development of Ukraine, the organization and government support of the following main directions are necessary (is improved (Yasnolob, Chaika, 2018)):

- the preparation of recommendations and manuals concerning the system of energy management;
- the creation of the national structures, necessary for the attestation of specialists, accreditation and certification (registration) bodies, recognized by the corresponding international, and, first of all, European structures and bodies;
- using stimulating measures, providing the determined benefits as to the objects, which use the SEnM;
- instructing the interested organizations as to the requirements and recommendations concerning the creation of energy management system;
- familiarizing wide circles of energy consumers, the public, and other interested parties with the results of the efficient functioning of energy management systems, and also foreign and national achievements in the field of energy saving;
- training the specialists who introduce the system of energy management on objects, and also auditors, who check the correspondence of the given system to standard requirements, the efficiency of this system, and so on.

Conclusion

The main way owing to which populated localities can decrease the risk, connected with paying much for the imported energy, is developing and introducing the system of populated localities' energy efficiency and energy independence management, which will enable to implement the projects of raising energy saving and

using local alternative energy sources. It will make possible to get considerable advantages, the main of which are the following:

- decreasing the spending on energy by municipality and its inhabitants;
 - introducing modern technical and financial approaches, directed at raising energy saving, energy efficiency, and energy security;
 - the capability to influence the structure of energy consumption, increasing the share of renewable energy sources by strict and not strict measures;
 - building the organizational and managerial potential of local self-government bodies to solve the problems of the local energy sector based on ISO 50001:2011 International Standard "Systems of energy management";
 - better conditions for reacting on unstable power supply;
 - uniting efforts and mobilizing the available resources of all the interested parties for developing and implementing new energy policy;
 - forming the new attitude of the public and culture of behavior at home as to using traditional and renewable energy sources and environmental protection.
- Local bodies of power can decrease their dependence on external energy sources by reasonable using local resources and general lowering of energy consumption for the needs of municipal and dwelling buildings, town transport, and street lighting. Raising energy efficiency and decreasing emissions will enable to decrease the dependence on external energy sources and at the same time to improve the quality of the inhabitants' life. These measures are to help in decreasing the risk of switching-off electric power and decrease the spending of homesteads, municipalities, and the business. Energy is also important for business activity and its development: the availability of reliable energy sources, which are at the same time pure and efficient, will assist in success of the national production sector and economic growth. Having defined the origin of energy and looking for its local alternatives, populated localities will be able to improve their power base and assist in well-being of the local population.

As it is difficult to achieve complete energy independence, it is important to have a diversified structure of power consumption, which can make municipalities more flexible in the future. Despite the fact that energy strategies are generally in the competence of national governments, the parties that signed Mayors' Agreements and their Sustainable Energy Action Plans can contribute considerably to achieving this goal.

References

- [1] Yasnolob, I., Chayka, T., Gorb, O., Demianenko, N., Protas, N., Halinska, T. (2018) The Innovative Model of Energy Efficient Village under the Conditions of Sustainable Development of Ecological Territories. *Journal of Environmental Management and Tourism*, 3(27): 648-658. doi: [http://dx.doi.org/10.14505/jemt.9.3\(27\).25](http://dx.doi.org/10.14505/jemt.9.3(27).25), available at: <https://journals.aserspublishing.eu/jemt/article/view/2272>
- [2] Energy Efficiency is an Important Source of Saving Money – Town Mayor (2018), available at: <http://www.chernigiv-rada.gov.ua/news/view/11830> (accessed 10 January 2019).
- [3] Renewable energy in Europe 2016 Recent growth and knock-on effects (2016): EEA Report No 4/2016, Luxembourg: Publications Office of the European Union. doi:10.2800/6803.
- [4] BP Statistical Review of World Energy (June 2016), available at: <http://oilproduction.net/files/especial-BP/bp-statistical-review-of-world-energy-2016-full-report.pdf> (accessed 10 January 2019).
- [5] Analyzing the Criteria of Sustainable Development of Bio Power Engineering – the 17th Analytical Note of the Bio Power Engineering Association of Ukraine (2016), available at: <http://www.uabio.org/activity/uabio-analytics/3065-uabio-position-paper-17>(accessed 10 January 2019).
- [6] Heletukha, H.H., Zhelezna, T.A., Tryboi, O.V., Bashtovyi, A.I. (2016), Analyzing the Criteria of Sustainable Development of Bio Power Engineering. Analytical Note of the Bio Power Engineering Association of Ukraine, 17.
- [7] Tytko, R., Kalinichenko, V. (2010), Renewable Sources of Energy (the Experience of Poland and Ukraine): Manual. Warsaw – Krakow – Poltava: Publishing House OWG.
- [8] Melnyk, N.V. Bio Power Engineering and Natural Environment (2011), *Economics of Agro-Industrial Complex*, 1: 70-73.
- [9] Kalinichenko, A., Tytko, R. (2014), Optimizing Power Supply of Farms in Poland Taking into Account Ecological Factors. *Actual Problems of Economics*, 7(151): 284–297.

- [10] Chaika, T.O., Yasnolob, I.O. (2017), Project Management of Introducing Alternative Energy Sources: Peculiarities and Prospects. The Development of Forms and Methods of Management under Globalization: The Materials of the 5th International Scientific-Practical Conference.
- [11] Gorb, O.O., Chaika, T.O., Yasnolob, I.O. (2017), The Development of Eco Settlements for Using the Potential of Renewable Energy Sources. Bulletin of Poltava State Agrarian Academy, 3: 52–55.
- [12] Zhovtianskyi, V.A. (2008), Strategy of Energy Saving in Ukraine: Analytical-Information Materials: in 2 vol.
- [13] Sukhodolia, O.V. (2009), Kinds and Targets of Managerial Impacts in the Sphere of Energy Efficiency. Bulletin of the National Academy of State Administration under the President of Ukraine, 2: 252–261.
- [14] Ginzburg, M.D. (2008), Terminologist's Notes. What is Energy Efficiency? The Market of Installations, 5: 54–56.
- [15] The Law of Ukraine No. 74/94 About Energy Saving, dated 01.07.1994 (with changes and supplements of 23.07.2017), available at: <http://zakon4.rada.gov.ua/laws/show/74/94-вр>.
- [16] Chaika, T.A. (2016), The Prerequisites of Creating and Efficient Functioning of Energy Independent Village. Modern Energy and Resource Saving Ecologically Sustainable Technologies and Systems of Agricultural Production: The Collection of Scientific Papers, Issue 12: 245–247.
- [17] Ignatiev, S. (2014) Project “Energy Efficient Village”, available at: https://www.slideshare.net/institute_SD/ss-30934879 (accessed 10 January 2019).
- [18] Martyniuk V. (2018) Green Power Engineering. Why is Ukraine Moving So Slowly to Energy Independence? Available at: <https://glavcom.ua/publications/vidnovlyvalna-energetika-chomu-ukrajina-tak-povilno-ruhajetsya-do-energonezalezhnosti-497787.html> (accessed 10 January 2019).
- [19] Yasnolob, I. and all (2018) The Formation of the Efficient System of Ecological Enterprise. Journal of Environmental Management and Tourism, [S.l.], v. 9, n. 5: 1052-1061. doi: [https://doi.org/10.14505/jemt.9.5\(29\).17.](https://doi.org/10.14505/jemt.9.5(29).17.), available at: <https://journals.aserspublishing.eu/jemt/article/view/2595>
- [20] Decreasing Energy Dependence in European Cities (2018), available at: http://see.org.ua/files/books/Зменшення_енергетичної_залежності_в_європейських_містах.pdf (accessed 10 January 2019).
- [21] Planet Power Engineering – Experience for Ukraine (2016), available at: <http://fbm-ua.com.ua/planetarna-energetika-dosvid/> (accessed 10 January 2019).
- [22] Yaskula, A. (2018), State Policy of Poland in the sphere of Energy Efficiency, available at: https://www.auc.org.ua/sites/default/files/anna_jaskula_kijow2.pdf (accessed 10 January 2019).
- [23] Yasnolob, I.O., Chaika, T.O., Gorb, O.O., Radionova, Ya.V. (2018), Theoretical-Practical Foundations of Creating Energy Independent Rural Territories. Economics of Agro-Industrial Complex, 11: 97–105. DOI: <https://doi.org/10.32317/2221-1055.201811097>, available at: <http://eapk.org.ua/contents/2018/11/97>.
- [24] Manual in Municipal Energy Management (2018), available at: http://see.org.ua/files/books/Посібник_з_муніципального_енергетичного_менеджменту.pdf (accessed 10 January 2019).