

## MUNICIPAL ENERGY PLANNING UNDER CONDITIONS OF GLOBALIZATION: IMPERATIVES AND OBJECTIVES

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UDC 338.2:620.9

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### Municipal Energy Planning under Conditions of Globalization: Imperatives and Objectives

The article reveals the importance of energy planning for local authorities in the path of achieving the goals of sustainable development. The quintessence of energy planning in territorial communities of Ukraine and Europe has been outlined from the perspective of analyzing the infrastructure sectors of the municipal economy. The article is based on observing certain international methodologies related to local energy and climate planning. The evolution of Covenant of Mayors initiative is briefly described with a focus on its intensive expanding in terms of energy and climate issues. The experience in the development of municipal sustainable energy and climate action plans in European countries and Ukraine is studied. A survey of empirical data on the consumption of fuel and energy resources and greenhouse gas emissions in territorial communities of Ukraine and European countries is conducted. The European methodological guidelines on the subject under study are highlighted based on the key policy documents. A few practical examples of Ukrainian and European cities are presented in order to illustrate possible actions corresponding to the defined problem. A systematic framework is proposed to describe the various and complex aspects of energy planning in cities with regard to rational implementation of energy efficient measures. The innovative mechanisms, main barriers and opportunities for the effective implementation of energy efficient projects in territorial communities of Ukraine and European countries are revealed. It is substantiated that under the current conditions of globalization, using project-oriented paradigm, municipal energy planning instruments become key motivational factors for development sustainable energy policy.

**Keywords:** energy planning, sustainable energy and climate action plan, globalization, local authorities, energy consumption, energy efficiency, greenhouse gas emissions, sustainable development.

**Fig.:** 8. **Tbl.:** 3. **Bibl.:** 10.

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УДК 338.2:620.9

#### Горбань В. Б. Муниципальне енергетичне планування в умовах глобалізації: імперативи та цілі

Розкрито важливість енергетичного планування для органів місцевого самоврядування на шляху досягнення цілей сталого розвитку. Окреслено сутність енергетичного планування в територіальних громадах України та Європи з позиції аналізування інфраструктурних секторів міського господарства. Стаття базується на дослідженні відповідних міжнародних методологій, пов'язаних із енергетичним і кліматичним плануванням на місцевому рівні. Наведено опис процесу трансформації європейської ініціативи «Угода мерів» з акцентом на її інтенсивну глобалізацію щодо енергетичних і кліматичних питань. Досліджено досвід формування муніципальних планів дій зі сталого енергетичного розвитку та клімату в європейських країнах та в Україні. Наведено огляд емпіричних даних споживання паливно-енергетичних ресурсів і викидів вуглекислого газу в територіальних громадах України та країн Європейського Союзу. Європейські методологічні директиви з досліджуваної тематики висвітлено на основі ключових політично-розпорядчих документів. Кілька практичних прикладів із українських і європейських міст наведені для ілюстрації можливих дій відповідно до визначеної проблематики. Запропоновано системні методологічні рекомендації щодо опису комплексних аспектів енергетичного планування у містах, беручи до уваги раціональне впровадження енергоефективних заходів. Виявлено інноваційні механізми, основні перешкоди та можливості раціонального впровадження енергоефективних проектів в Україні та країнах Європи. Обґрунтовано, що в сучасних умовах глобалізації, використовуючи проектно-орієнтовану парадигму, інструменти муніципального енергетичного планування стають ключовими мотиваційними факторами для розвитку політики сталого енергетичного розвитку.

**Ключові слова:** енергетичне планування, план дій зі сталого енергетичного розвитку та клімату, глобалізація, органи місцевого самоврядування, енергоспоживання, енергоефективність, викиди парникових газів, сталий розвиток.

УДК 338.2:620.9

#### Горбань В. Б. Муниципальное энергетическое планирование в условиях глобализации: императивы и цели

Раскрыта важность энергетического планирования для органов местного самоуправления на пути достижения целей устойчивого развития. Определена сущность энергетического планирования в территориальных общинах Украины и Европы с позиции анализа инфраструктурных секторов городского хозяйства. Статья базируется на исследовании соответствующих международных методологий, связанных с энергетическим и климатическим планированием на местном уровне. Приведено описание процесса трансформации европейской инициативы «Соглашение мэров» с акцентом на ее интенсивную глобализацию по энергетическим и климатическим вопросам. Исследован опыт формирования муниципальных планов действий по устойчивому энергетическому развитию и климату в европейских странах и в Украине. Приведен обзор эмпирических данных потребления топливно-энергетических ресурсов и выбросов углекислого газа в территориальных общинах Украины и стран Европейского Союза. Европейские методологические директивы по исследуемой тематике освещены на основе ключевых политико-распорядительных документов. Несколько практических примеров из украинских и европейских городов представлены для иллюстрации возможных действий в соответствии с определенной проблематикой. Предложены системные методологические рекомендации по описанию комплексных аспектов энергетического планирования в городах, учитывая рациональное внедрение энергоэффективных мероприятий. Выявлены инновационные механизмы, основные препятствия и возможности рационального внедрения энергоэффективных проектов в Украине и странах Европы. Обосновано, что в современных условиях глобализации, используя проектно-ориентированную парадигму, инструменты муниципального энергетического планирования становятся ключевыми мотивационными факторами для развития политики устойчивого энергетического развития.

Рис.: 8. Табл.: 3. Бібл.: 10.

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**Ключевые слова:** энергетическое планирование, план действий по устойчивому энергетическому развитию и климату, глобализация, органы местного самоуправления, энергопотребление, энергоэффективность, выбросы парниковых газов, устойчивое развитие.

Рис.: 8. Табл.: 3. Библ.: 10.

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**Problem statement.** The rapid growth of the modern world requires a well-balanced critical energy infrastructure. Nowadays challenges lie in searching innovative directions how to interlink the supply of and demand for energy services with their effect on the ecological environment aiming to realize sustainable development goals.

Presently the most important global issue is the role of energy in climate change process. Taking into consideration that almost all of world's countries depend on fossil fuels, reduction of CO<sub>2</sub> emissions has very direct economic and environmental impacts. For example, the Kyoto Protocol sets binding targets for developed countries to limit or reduce greenhouse gas emissions and costs of their mitigation. Hence, it is important to rethink how and why fuel and energy resources are used, as well as to identify and develop new sustainable energy options. By taking such steps towards the development of clean and efficient integrated energy infrastructure, it is possible instantaneously reduce emissions related to climate change.

Cities are responsible for approximately two-thirds of the global primary energy consumption, and consequently are expected to play fundamental role in reaching the European climate change targets. One of efficacious and useful methods to encourage more sustainable way of energy usage is energy planning. Innovative energy planning methods are in particular needed to benefit from energy efficient measures in anticipation of globalization impact and climate change. Thus, the energy action plan is considered to be a helpful instrument which gives an opportunity to engage different groups of stakeholders and more effectively address the full range of energy issues.

**Analysis of recent research and publications.** Until 2008 municipal energy planning was not commonly practiced. Local authorities were mostly unfamiliar with development of energy concepts and municipal energy action plans and usually elaborated municipal programs of urban and social development, where they tried to address several specific energy issues. Within profile diversification of international organizations working in the field of energy efficiency (in particular USAID, NEFCO, EBRD, GTZ, UNDP etc.), the necessity of appropriate energy planning at national, regional and local levels was actualized.

Previous studies on municipal energy planning in Ukrainian cities [1, p. 56–58; 2, p. 596–602] have shown its high importance for effective functioning of the municipal energy management system. Still it has been observed that many Ukrainian municipalities in recent years are not eager to update their existing energy plans and programs. There is a lack of know-how and methodologies on transforming the existing municipal energy plans into long-term strategic energy efficient programs and bringing them in line with other adopted municipal programs and budget planning issues.

The study of recent scientific publications, which analyze the specific issues of energy planning process [3] – [7], shows that suitable forms of energy planning mechanism can positively affect the trend of implementing energy efficiency measures. However, conceptual aspects of energy planning still lack a proper framework and clearly defined methodologies.

**The aim of the research** is to provide an extensive, systematic review of the ways to set into motion a long-term energy planning with a clear focus on the practical implementation of energy efficient measures and activities at local level. The main objective is to explain an approach to effective municipal energy planning and provide a framework for increasing the capacity of managing and developing the community energy system in a more sustainable manner.

**Presentation of basic material of the research.** Energy planning is well known as a tool for setting up effective energy policies ranging from national to local level. Under current conditions, energy planning clearly shows how strategic decisions taken today might influence the level of energy consumption and CO<sub>2</sub> emissions in future in terms of various options. It also enables the evaluation of the decisions made in relation to its long-term results (e.g. economic, environmental, social etc.). Eventually, energy planning provides support for making wise and efficient investment decisions.

The European Union has contributed to guiding and harmonizing the process of energy planning towards applying a more holistic and integrated approach. In Europe there is a clear demand for action by the public authorities at all levels, in order to promote measures on the efficient use of energy resources and mitigation and adaptation to climate change. Many European cities have already demonstrated their commitment to reducing the amount of CO<sub>2</sub> emissions by joining the Covenant of Mayors, a European Commission initiative launched in January 2008 that unites regional and local authorities for the implementation of measures on energy and climate issues on their territory, which imply reducing carbon emissions at least by 20 % by 2020 [8]. It is important to note that the above mentioned initiative during 2008 – 2015 was rapidly evolving and passed three phases (Tbl. 1).

Now it is the world's biggest urban climate and energy initiative named as Covenant of Mayors for Climate & Energy, which commits new signatories to reduce CO<sub>2</sub> emissions by at least 40 % by 2030 and adopt a multifaceted approach in order to promote the idea of mitigation and adaptation to climate change [8].

It is important to note, that Covenant participants share a common goal: to provide an environmentally, socially and economically stable environment for their citizens and contribute to resolving global issues related to resource depletion and climate change.

Table 1

Evolution of Covenant of Mayors goals and activities from 2008 till 2015

Phase	Period	Main focus of activities	Types of activities
1	2008–2011	promoting ideas of the Covenant of Mayors	<ul style="list-style-type: none"> <li>explaining the Covenant of Mayors objectives and benefits;</li> <li>supporting the efforts deployed by local authorities in the implementation of sustainable energy policies</li> </ul>
2	2011–2013	Encouraging to sign and to join the Covenant of Mayors	<ul style="list-style-type: none"> <li>raising the awareness of and knowledge on the climate and energy policies among the relevant decision-makers;</li> <li>increasing the overall project visibility</li> </ul>
3	2013–2015	Highlighting the specific results of the initiative of the Covenant of Mayors	<ul style="list-style-type: none"> <li>promoting best practices from Covenant signatories and stakeholders (e.g. replicable energy-efficient measures or policy approaches);</li> <li>highlighting local authorities' leadership skills in carrying out sustainable energy policies;</li> <li>stimulating the networking between the Covenant stakeholders</li> </ul>

Source: developed by the author based on [8]

Signatories of the above mentioned EU initiative represent urban areas of different sizes from small villages to large cities that have committed to implement the sustainable energy policies and increase energy efficiency through development of renewable energy sources.

Local authorities are considered to act as key players. The reason is that cities, towns and other metropolitan areas play an essential role in mitigating climate change, as they are responsible for over 70 % of the current global CO<sub>2</sub> emissions. According to the results of research carried out by World Bank staff (2015), cities represent three quarters of the world total energy consumption [9]. That's why they are exercising a great influence on the environmental policy challenge. Urbanization is only increasing importance of cities, as until 2050 they will

cover three quarters of the terraqueous globe. To cope with the tendencies of urban growth it is important to invent new directions to administrate cities more effectively and make them smart [10]. It is important to create new services, which will enable higher quality of life, reduce energy consumption and CO<sub>2</sub> emissions. Covenant of Mayors initiative promotes the development of such objectives.

Today the number of Covenant signatories totals 7709 local and regional authorities all over the world [8]. In Ukraine, this process was intensified in 2010, when the first city of Ukraine signed the Covenant of Mayors commitment document. According to the official web-site of the Covenant of Mayors [8], the number of Ukrainian cities that joined the EU initiative as of 01.01.2017, amounted to 99 (Fig. 1).

The number of SEAP's

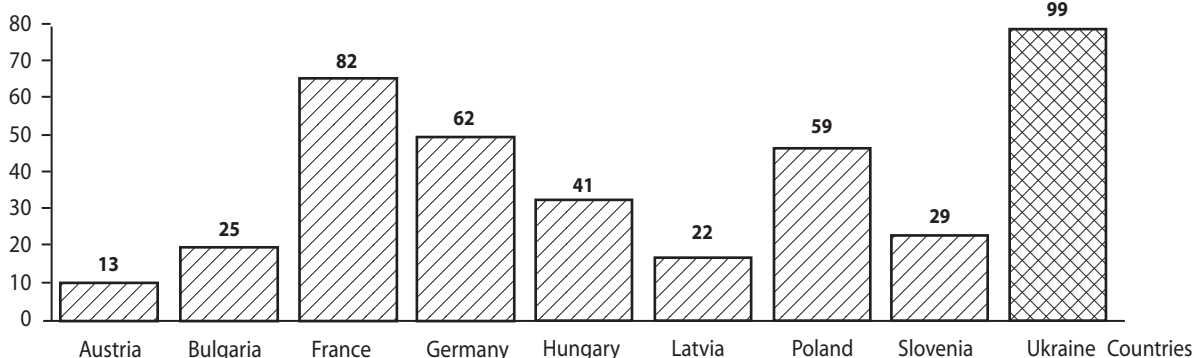


Fig. 1. The number of Covenant signatories in Ukraine and some European countries as of 01.01.2017

Source: developed by the author based on [8]

One of the main challenges for the efficient implementation of local energy planning process within the framework of the Covenant of Mayors initiative is a successful development of a Sustainable Energy Action Plan (SEAP) – a strategic document, which shows how cities can perform reducing their carbon impact and what instruments are primarily needed.

It is important to note that under the initiative of the Covenant of Mayors for Climate & Energy new signatories have an obligation to prepare a Sustainable Energy and Climate Action Plan (SECAP) outlining the key activities that should be undertaken in order to track mitigation actions, climate risks

and vulnerability assessment. The core differences between SEAP and SECAP are shown in Table 2.

SEAP/SECAP acts as a key document outlining how the Covenant signatory intends to fulfil its commitments. SEAP/SECAP serves as a roadmap towards achieving the energy and climate ambitions at local level. It uses the results of the baseline emission inventory in order to identify the key sectors of action and funding opportunities for reaching the local authority's CO<sub>2</sub> reduction target. SEAP/SECAP delineates concrete reduction measures reconciled with time frames and assigns responsibilities, which actually translate the long-term strategy into action.

Table 2

## Differences between SEAP and SECAP

Criteria	SEAP	SECAP
EU initiative	Covenant of Mayors	Covenant of Mayors for Climate & Energy
Time duration	By 2020	By 2030
Overarching objective	At least 20 % CO <sub>2</sub> emissions reduction by 2020	At least 40 % CO <sub>2</sub> emissions reduction of by 2030 and climate adaptation
Fields of action (key sectors)	<ul style="list-style-type: none"> <li>▪ Buildings (municipal, tertiary, residential)</li> <li>▪ Transport</li> <li>▪ Public lighting</li> <li>▪ Green public procurement</li> <li>▪ Local electricity production</li> <li>▪ Local heat/cold production</li> <li>▪ Others (e.g. industry, agriculture, forestry, fisheries)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Buildings (municipal, tertiary, residential)</li> <li>▪ Transport</li> <li>▪ Public lighting</li> <li>▪ Green public procurement</li> <li>▪ Local electricity production</li> <li>▪ Local heat/cold production</li> <li>▪ Others (e.g. industry, agriculture, forestry, fisheries)</li> <li>▪ Land Use Planning</li> <li>▪ Environment &amp; Biodiversity</li> </ul>
Definition of baseline	Comprehensive overview of energy generation and consumption in the municipality	<ul style="list-style-type: none"> <li>▪ Comprehensive overview of energy generation and consumption</li> <li>▪ Risk and vulnerability assessment</li> </ul>
Mandatory indicators	<ul style="list-style-type: none"> <li>▪ Reduction of CO<sub>2</sub> emissions [%]</li> <li>▪ Energy use, generation from renewable energy systems and savings indicators for each action [MWh]</li> <li>▪ Activity indicators for monitoring each action</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduction of CO<sub>2</sub> emissions [%]</li> <li>▪ Energy use, generation from renewable energy systems and savings indicators for each action [MWh]</li> <li>▪ Activity indicators for monitoring each action</li> <li>▪ Vulnerability-related indicators</li> <li>▪ Impact-related indicators</li> <li>▪ Outcome-related indicators</li> </ul>

Source: developed by the author based on [8]

Sustainable energy action plans have become a powerful toolkit for regional and local authorities in planning, implementing, monitoring and evaluating climate and energy poli-

cies, global mitigation and adaptation achievements. The state of development of SEAPs in Ukraine and some countries of the European Union is shown in Figure 2.

The number of SEAPs

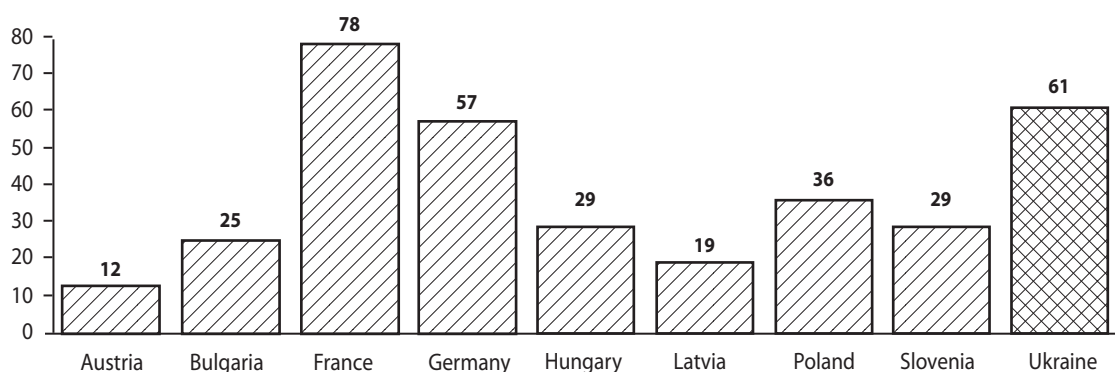


Fig. 2. The number of SEAPs in Ukraine and some European countries as of 01.01.2017

Source: developed by the author based on [8]

The number of SECAPs in Ukraine is shown in Table 3.

It is important to state that energy action plans provide systematic ground for municipal sustainable development. As by delivering the energy efficient projects, there is a clear expectation that the territorial community will benefit from better energy services, lower energy bills, more energy efficient investments, additional income to municipal budget, and ecologically friendly environment.

The present economic situation in Europe and in Ukraine produces concerns for and barriers to the deployment of

local sustainable energy services. Therefore, it much attention should be paid to developing and introducing innovative financing models, as well as reassigning and improving the existing financing schemes. More incentives are needed to stimulate private investments and realize more comprehensive embodiment of the successful solutions for financing energy efficiency renovation in buildings. Currently investors act on energy efficiency measures in buildings with short or medium pay back periods of less than 10 years, leading to energy efficiency of less than 30 % savings. However, European targets for the period

Table 3

The number of SECAPs in Ukraine as of 01.12.2017

Signatories	Council deliberation of SECAP	Signatories	Council deliberation of SECAP
Muzykivska community	30 Jan 2016	Izmail	31 Mar 2017
Morshyn	21 Jul 2016	Bilhorod-Dnistrovskyy	20 Apr 2017
Bila Tserkva	22 Dec 2016	Chortkiv	09 Jun 2017
Khotyn	23 Dec 2016	Shchaslyvtseve	30 Jun 2017
Fastiv	02 Mar 2017	Zolochiv	28 Sep 2017

Source: developed by the author based on [8]

until 2050 necessitate energy savings in buildings of up to 80 %, requiring investments with a much longer payback period, ranging from 20 to 40 years.

The energy action plan must have quantitative targets for energy efficiency improvement in relevant sectors, starting with public and residential buildings and installations; targets for power generation and reduction of greenhouse gas emissions.

In case of examining the energy consumption pattern of Ukrainian cities, it can be seen that the dominant consumable energy resource is gas. At the same time the highest percent of energy consumption is accounted for by the sector of residential buildings (Fig. 3).

All energy sources and energy-related activities are considered as entire system. In this regard, through using project-oriented approach there is a possibility to receive a significant

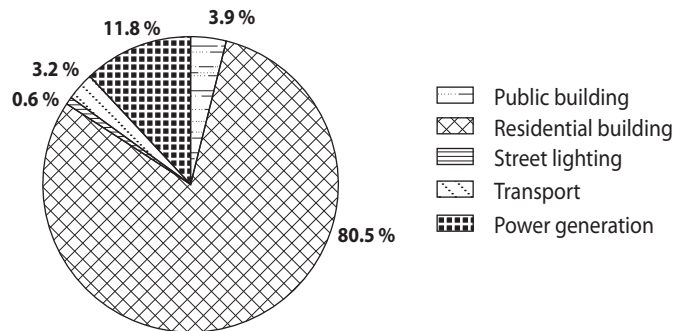


Fig. 3. Breakdown of energy consumption in Ukrainian cities\* by sectors

\* Remark to Figure 3: for investigative purposes there were chosen the Ukrainian cities that have adopted SEAP

Source: developed by the author based on [8]

reduction of energy consumption in municipal infrastructure sectors, and, therefore, the level of carbon emissions (Fig. 4).

The situation in European cities concerning the distribution of energy efficient projects by thematic field is different (Fig. 5). For European cities public lighting is the most

popular investment field together with energy efficiency and renewable energy investment in municipal buildings: it represents 63 % of investment plans. Municipal buildings and public lighting account nearly for 2.2 % of a city's total CO<sub>2</sub> emissions.

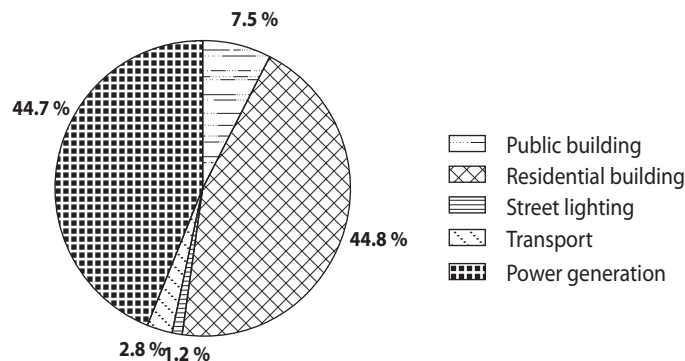


Fig. 4. Level of reducing the energy consumption in Ukrainian cities\* in case of using a project-oriented approach with a breakdown by sectors

\* Remark to Figure 4: for investigative purposes there were chosen the Ukrainian cities that have adopted SEAP

Source: developed by the author based on [8]

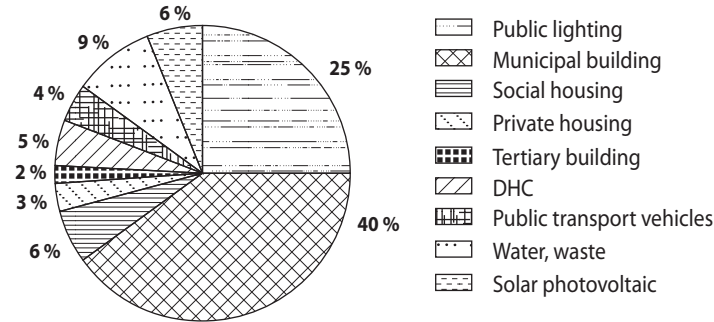


Fig. 5. Distribution of municipal projects in EU countries by thematic field

Source: developed by the author based on [8]

Energy action plan should also describe the municipalities' implementation capabilities. Basic financial resources that are mainly used in municipalities for implementing energy efficiency projects are internal. External financial resources are involved by cities with great difficulty (Fig. 6).

It is important to note that the main share of financial resources for implementing energy efficiency projects according to the developed sustainable energy action plans of Ukrainian cities, municipalities usually plan to direct into the sector of residential buildings, sector of power generation and transport sector. The expected financial resources for every municipal infrastructure sector are indicated in Figure 7.

In particular, small cities and villages do not have enough capacities to develop appropriate initial financial appraisals and run cash-flow calculations for their energy efficiency projects in order to attract grant or loan funds. Very often small territorial communities are not even aware of the existing financing opportunities.

In this regard it is possible to emphasize main barriers to financing energy efficient projects in Ukraine and EU countries, which are shown in Figure 8.

Every city should decide which financial sources are the most appropriate for financing energy efficient measures. Municipal budget or grants should be used for unprofitable (e.g. social) projects, preparatory studies (energy audits, environmental impact assessment, etc.), hiring of experts, which are not attractive for private investors and financing institutions. Profitable projects with quick return on investment can be financed by international financial institutions or commercial banks. A combination of several funding sources is the most common solution. Ideally, sustainable energy action plan needs to be transformed into a long-term multi-annual financial plan.

City councils have the possibility to finance their projects through loans or innovative financing schemes in cooperation with private partners. If they wish to benefit from grants, technical assistance, loans or guarantees provided by international

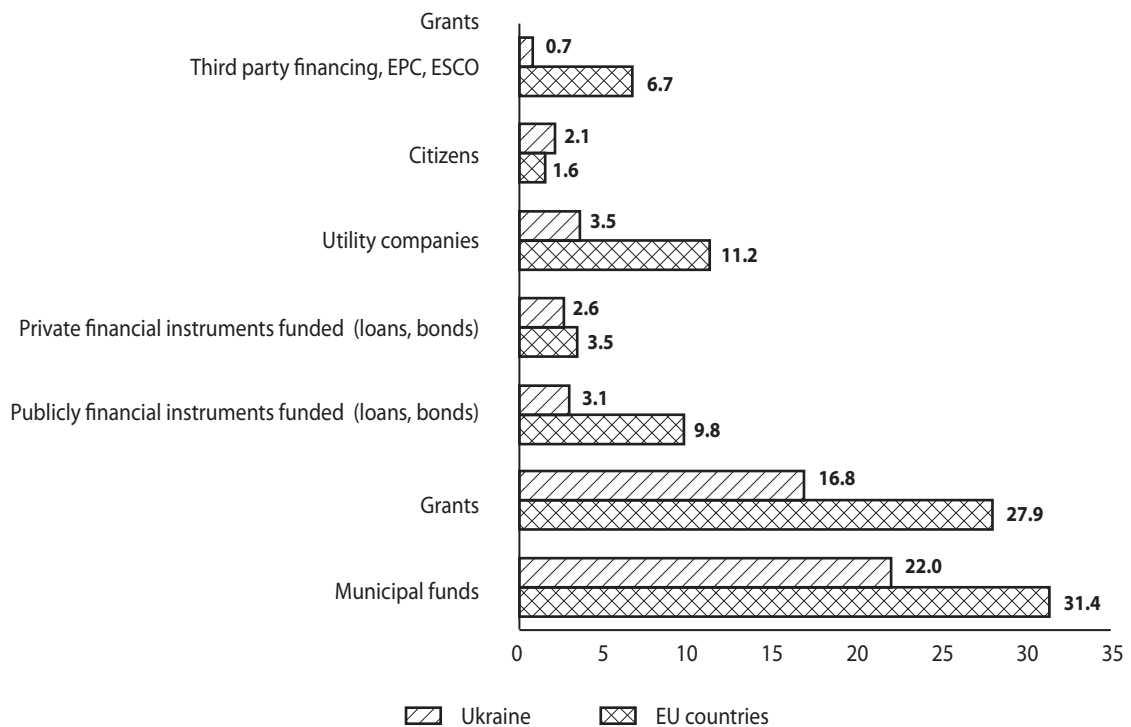


Fig. 6. Municipal experience in innovative financing of energy efficient projects in Ukraine and EU countries, %

Source: developed by the author based on [8]

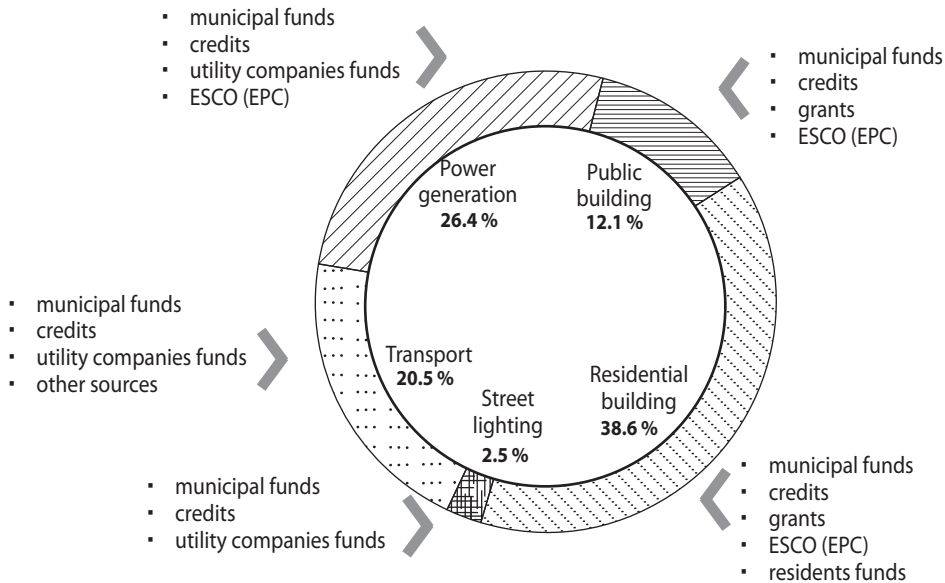


Fig. 7. Types of funding sources that are planned to be used by Ukrainian cities for implementing SEAPs with a sectoral breakdown

Source: developed by the author based on [8]

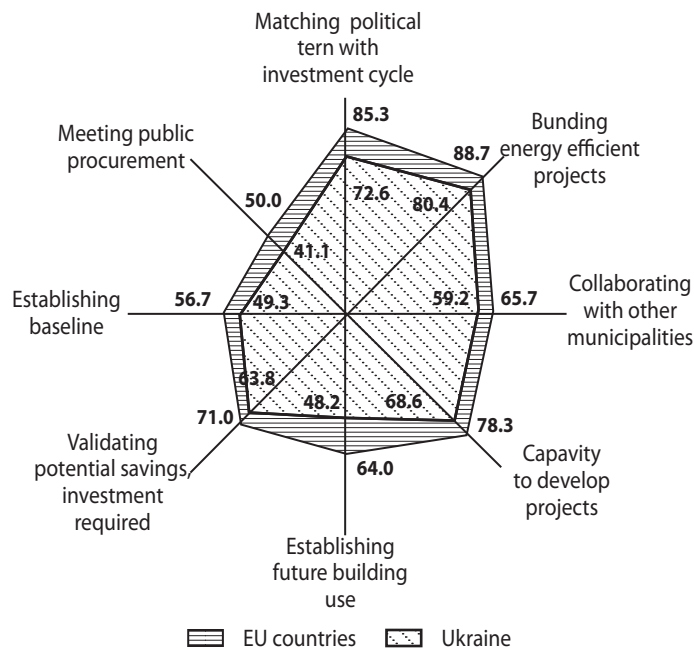


Fig. 8. Local authorities' barriers to financing energy efficient projects in Ukraine and EU countries, %

Source: developed by the author based on [8]

financial institutions, they have to keep themselves updated about the new opportunities and proactively promote their priority projects towards potential financiers. Municipalities should prepare initial financial appraisals for all projects which are planned to realize. It is extremely important to calculate main project indicators (e.g. total investment, energy savings, amount of CO<sub>2</sub> reduction, pay-back period, Net Present Value, etc.) and identify main social, economic and environmental benefits as well as effects for every SEAP/SECAP measure. This could help cities to rank the projects, prioritize their energy efficient measures and allocate the budget and external financial resources that are available.

Ranking of projects is a key stage as it is essential in terms of resource constraints to implement the most effective and strategically important projects. The criteria for the ranking of energy efficiency projects should be considered the following: amount of CO<sub>2</sub> reduction; amount of savings; amount of fuel and energy resources in physical terms; belonging of the project to the sphere of renewable energy sources; number of the stakeholders who can benefit from the project results; correspondence of the project subjects to the city strategic vector; availability of design specifications and estimates; availability of additional project documents (report on energy surveys, feasibility studies, expert opinion, etc.); social significance of the

project; need for additional funds for the following project examination; flexibility of the project; presence and significance of project nonfulfillment; availability of additional external funding; presence of synergistic effect; innovation aspects of the project; generation of effects for inflow of investments and budgetary receipts; profitability of the project; payback period, and others.

While preparing investment propositions, it is important to note that smaller projects should be bundled into bigger investment packages as large-sized investments are more attractive for international financial institutions and donors. This approach also allows the pooling of expertise and efficient use of human and financial resources related to project design and implementation.

**Conclusions.** Local authorities play an essential role in the international, national, regional and local efforts to reduce CO<sub>2</sub> emissions through improving energy efficiency and increasing the level of usage of renewable energy. Developing a sustainable energy and climate action plan is an effective and substantial step in this process.

Energy planning capacity ultimately supports self-sufficiency and sustainability in the energy sector. To realize its full potential, it must be pursued on a continual basis by a support of different groups of stakeholders. Financing energy efficiency projects in today's conditions with uncertain and often increasing energy prices is still a major challenge. It is extremely important to stimulate a more active uptake by successfully implementing of energy efficient projects both at municipal and national levels in order to overcome existing barriers, promote sustainable development and provide adequate level of energy security in the world.

## LITERATURE

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