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SMART-VECTORS OF POST-WAR RENOVATION OF THE REGIONAL ECONOMY OF UKRAINE: BUDGET DECENTRALIZATION, «INDUSTRY 4.0», ENERGY SECURITY

Summary

The current internal situation in Ukraine as a result of hostilities, the destroyed industrial potential and social facilities, a significant number of evacuees, requires effective, fast, with a synergistic effect, tools for the post-war revival of the economy. The research of the article proves that The internal economic consequences of the war will be disruptions in supply chains, loss of labor due to participation in the country's defense and forced migration, and significant logistical problems. Given globalization, continued military aggression will change international food and energy markets, and may lead to higher prices for metallurgy, food and energy. It is noted that the situation in Ukraine is dualistic: on the one hand, there are destructive processes due to hostilities, and on the other – possible scenarios, the implementation of which before these events was considered as potential development horizons (integration of Ukrainian energy). in the European ENTSO-E, applications for full economic integration in the EU under the accelerated procedure). The uniqueness of the situation provokes non-standard approaches to identifying post-war development trends in order to obtain a synergistic effect given the large-scale economic, financial and human losses of the country. The main trends of post-war renewal of Ukraine's economy, which affect regional development on the basis of SMART-goals of budget decentralization, industry 4.0, regional energy management, eco-innovation, are proposed. This defines the purpose of the study in this article and is adapted in several European publications.

Introduction

According to FORBES, during the first three weeks of the war, the Ukrainian economy lost more than 50% of average annual GDP, about 30% of enterprises completely ceased operations, 45% – reduced production [1–4]. This course of events, from an economic point of view (probable acceleration of inflation, rising prices, etc.), requires the introduction of certain administrative restrictions at this stage – fixing the official hryvnia exchange rate, controlling costs, focusing on creating and replenishing strategic resource reserves. In general, the military economy must solve two main tasks – to help the army and provide the rear. That is, the principle of the current economic strategy –

healthy asceticism and the provision of saved aid to the front, or the social needs of the victims of the forcibly evacuated sections of the population – is absolutely acceptable and relevant.

The internal economic consequences of the war are currently extremely severe: declining business activity in areas where hostilities continue, destroyed housing and commercial stock in many major cities (Mariupol, Kharkiv, Chernihiv, Sumy), supply chain disruptions, labor losses due to participation in defense of the country and forced migration, significant problems with logistics.

But given globalization, the impact of military aggression will have a significant impact on external economic challenges and the world. The war in Ukraine will change international food and energy markets. And with the prolongation of hostilities, the situation will only get worse and may lead to higher prices for metallurgy, food and energy.

Currently, the situation in Ukraine is dualistic: on the one hand, there are destructive processes as a result of hostilities, and on the other hand, scenarios are becoming possible, the implementation of which before these events was seen as only potential development horizons. The exclusivity of the situation provokes non-standard approaches to determining the trends of post-war development in order to obtain a synergistic effect given the large-scale economic, financial and human losses of the country.

According to forecasts, the external environment will be determined by the speed and quality of change in Ukraine. Scenario plans for the development of Ukraine's post-war economy must be prepared now.

For example, according to the Essay on Reconstruction of Ukraine, developed by a number of scholars and presented on April 8, 2022, the principles of international assistance are: reconstruction programs, coordination and management of EU-funded assistance, international assistance to Ukraine in the form of grants, not loans. capital. But in general, these development scenarios strongly correlate with the well-known Washington Consensus; representation of realities is sufficiently concentrated around corruption; not so many socio-economic accents that arise during the conflict and significantly affect the situation in the country; in terms of growth, only foreign aid is a significant advantage. In addition, only the achievement of a low-carbon level of the economy has been declared a factor in the reconstruction.

We consider it necessary to propose the main trends of post-war renewal of Ukraine's economy, their impact on regional development based on the principles of budget decentralization, Industry 4.0, regional energy management, eco-innovation.

Part 1. Analysis of current sectoral trends in Ukraine's economy

The current course of events demonstrates the existing capabilities and capacity of the European Council to assist Ukraine in rebuilding its economy in new and Euro-oriented areas of development. In particular, the EU is unanimous in supporting Ukraine, while supporting several initiatives to

provide assistance to the energy sector through the establishment of the Energy Support Fund of Ukraine.According to analysts at the KSE Institute, Ukraine's losses from Russian aggression amounted to $ 88 billion as of April 26 USA [5]. Transport and industrial infrastructure suffered the most. The damage from the destruction of housing amounted to about 29 billion dollars USA.

Industrial infrastructure lost almost $ 10 billion dollars USA. The top 20 completely or partially destroyed industrial facilities, the vast majority in the old industrial regions, look like this (Table 1):

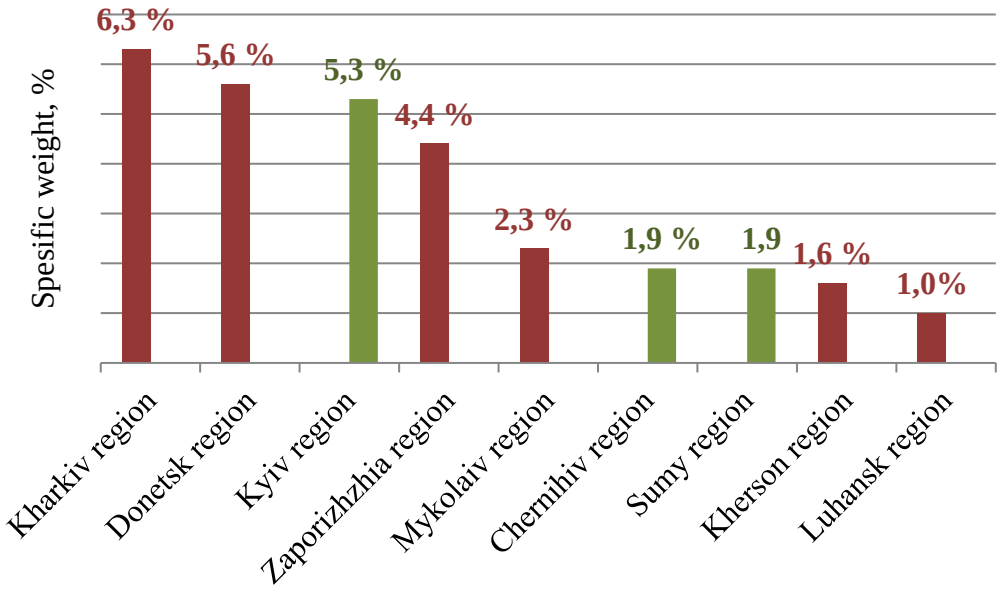
Table 1

Industrial facilities of Ukraine destroyed (in whole or in part) as a result of hostilities

Industrial facility	**Location**	**Assets, million dollars USA***
Metallurgy		
MMK them. Ilyich	Donetsk region, Mariupol	1 893
PJSC «MK Azovstal»	Donetsk region, Mariupol	1 444
Aircraft construction		
SE «Antonov»	m. Kyiv	385
Heavy industry		
JSC «Ukrainian Power Machines»	Kharkiv region, Kharkiv	417
DP NVKG Zorya – Mashproekt	Mykolaiv region, the city of Mykolaiv	137
Oil refining industry		
Kremenchug Refinery	Poltava region, Kremenchuk	374
Odessa refinery	Odesa region, Odesa	171
Linik	Luhansk region, Lysychansk	116
Coke industry		
Avdiivka Coke Plant	Donetsk region, Avdiivka	343
Defense industry		
SE «Plant them. Malisheva «	Kharkiv region, Kharkiv	101
Zhytomyr Armored Plant	Zhytomyr region, Zhytomyr	72
Chemical and insulation industry		
PJSC «Sumykhimprom»	Sumy region, Sumy	73
PE «Obio»	Zhytomyr region, Zhytomyr	28
Glass and paper industry		
Gostomel glass factory «Vetropak»	Kyiv region, Gostomel	92
Rubizhne Cardboard Plant	Luhansk region, Rubizhne	82
Vehicles		
Kharkiv Tractor Plant	Kharkiv region, Kharkiv	41
Popasnyansky car repair plant	Luhansk region, Popasna	40
Food Industry		
PJSC «Mondelis Ukraine»	Sumy region, Trostyanets	104
Kharkivyanka Confectionery	Kharkiv	22
Coca Cola Beverages	Kyiv region, Velyka Dymerka	150

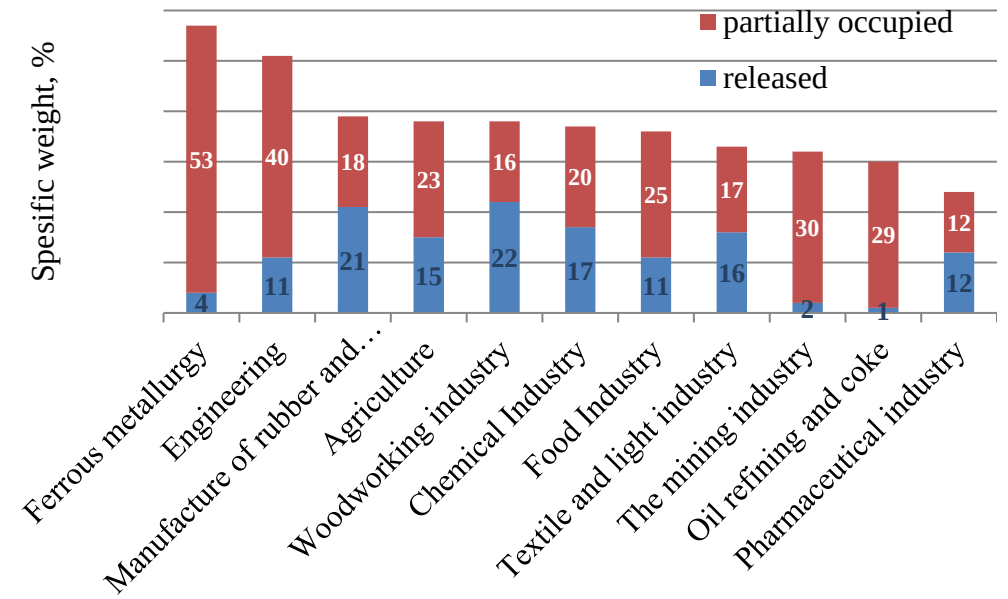
Sourse: compiled by the author based on [6]

The affected regions are, firstly, industrial or agro-industrial, and secondly, they play a significant role in the country's GDP, namely about a third of the national GDP. If we assume that the affected areas in terms of their industrial potential to some extent removed from the national value chains, the corresponding picture will look like (Figure 1, Figure 2):



Fig**ure** 1. The share of affected regions in the GDP of Ukraine, %

Sourse: [6]



Fig**ure** 2. The share of affected areas in national industrial and agricultural production, %

Sourse: [6]

Thus, the metallurgical industry of Ukraine lost about 30% of assets. Thus, the value chain, consisting of the largest plants in Mariupol PJSC MMK. Ilyich, PJSC MK Azovstal and Avdiivka Coke Plant were destroyed or critically damaged. The only oil refinery in Kremenchug was deliberately destroyed, provoking 100% of fuel imports from other countries (coming from sources in Russia and Belarus). At the same time, Ukraine joined the European energy system ENTSO-E in late February [7].

For the European Union, the main objectives of energy policy can be formulated as follows (Table 2):

Table 2

The main objectives of EU energy policy

Target	The essence of the goal
Security of supply	Reliability of energy supplies
Competitiveness	Availability of energy resources at a competitive price
Sustainability	Minimum harmful impact of energy resources (production and consumption) on the environment

Source: compiled by the author on the basis of data [8

According to DTEK's analysts, electricity consumption has fallen by 36% this year (Figure 3), almost catching up with the country's overall projected GDP decline:

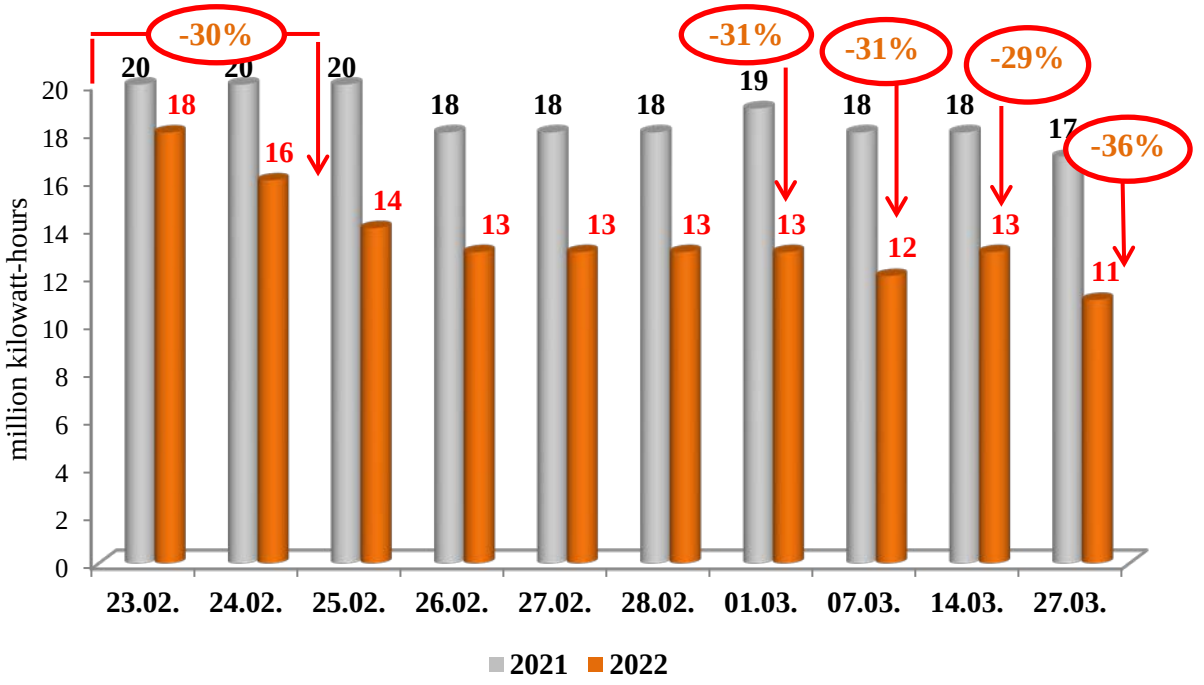


Figure 3. Dynamics of electricity consumption from February 2022 (compared to the same period in 2021)

Source: [9]

It should be noted, however, that these trends can be used in constructive aspects. Thus, to increase exports, the European Commission has proposed to suspend for one year all import quotas and duties of Ukrainian goods [10]. And the decline in imports allowed the Ministry of Finance to state the relative stabilization of the hryvnia exchange rate and avoid sharp amplitude fluctuations in the national currency and price level.

In addition, price increases are currently being curbed by administrative measures such as regulated prices for fuel, gas, heating and electricity, as well as a fixed exchange rate.

According to the Institute of Industrial Economics of the National Academy of Sciences of Ukraine, neo-industrial modernization should be carried out on the basis of increasing the share of knowledge-intensive production, development of smart industry and widespread use in all areas of new information and communication technologies [11].

The main structural elements of Industry 4.0 are:

– exponential (non-linear) growth of innovation;

– unprecedented growth of new technologies and opportunities for their use;

– cheapening of management decisions and maintenance of management systems;

– innovative ecosystems.

These principles are basic for the reconstruction of Ukraine's economy in the postwar period, as the most effective way to develop the destroyed economy will be the development of innovation-active regions and industries, which in turn will be drivers of related territories and industries.

According to experts, the signs of post-war Ukraine will be: the functioning of institutions, including state, the availability of skilled labor, because 80% of evacuees will return to the country after the «hot» phase of the war, fiscal deficit is mainly financed by international aid and NBU, Ukraine is moving to membership in the EU, part of the territory (mostly western, has not suffered significant damage. That is, infrastructurally and economically, post-war Ukraine will correlate with post-war Europe.

Therefore, there is an urgent need for the Ministry of Economic Development and Trade, the Ministry of Infrastructure of Ukraine, the Ministry of Social Policy in coordination with the relevant committees of the Verkhovna Rada and foreign donors to step-by-step program of postwar economic transformation of Ukraine on the principles of Industry 4.0.:

– technical and technological re-equipment of enterprises in the direction of high-tech production and digitalization;

– technical measures for modernization of logistics systems and renewal of the transport network;

– support for «digital mobility» of industry and business, including displaced;

– organization of additional transport corridors for the import of humanitarian aid and export;

– measures to organize the employment of displaced persons, including retraining programs for high-tech enterprises.

In general, the concept of «Industry 4.0» provides for the transfer of technology, which is extremely important for renovations in the economy of Ukraine. First of all, it should be a transfer of military and armed technology to create a powerful military-industrial complex. However, the formed powerful military-industrial complex is the basis for the future development of aerospace technologies,

Thus, the example of Israel convincingly proves that innovative military-tech can be the basis for the development of the civilian economy.

In order to implement the above measures, Ukraine needs to increase energy (including export) opportunities.

Along with this, it is important to achieve Ukraine's energy independence, including through «green» technologies. The reserve of «blue fuel» in the bowels of Ukraine puts it in second place in Europe. At the same time, the energy-consuming component of production should be reduced with the help of thermal modernization programs.

Climate modernization programs are another important and innovative step for renovating and reviving the economy after the war. Thus, the construction of destroyed industrial facilities should be carried out on the principles of decarbonisation, minimization of carbon consumption and emissions, as well as dependence on fossil fuels. Moreover, funds for such a transformation are already available.

Niarshoring concept for Ukraine. Niarshoring, as a concept of transferring business technologies to a country that is relatively close to the main country of outsourcing, can turn Ukraine into the closest industrial zone for Europe, such an industrial park of gigantic proportions.

The conditions for using this format of relations are mutually beneficial both for Ukraine (with the attraction of foreign investment and rapid renewal of industrial capacity) and for Western partners (because European governments can provide state guarantees to companies investing in Ukraine).

Ukraine's advantages for European partners in the context of niarshoring in the energy sector:

1. Ukraine is a highly educated country, there is a sufficient personnel reserve of qualified technical specialists. The quality of Ukrainian higher education is recognized worldwide. Quite a large percentage of specialized specialists are engineers.

2. Reasonable combination of price and quality. The price of domestic electricity is absolutely acceptable for European consumers, at the same time, synchronization with the European energy system has made it possible to ensure European standards, including quality standards.

3. Synchronization of accounting due to the proximity of time zones of Ukraine and the EU. Given the almost minimal time gaps between Ukraine and Europe, such a business model will satisfy both producers and consumers. Ukraine, being in the center of Europe, conveniently crosses time zones with European countries with minimal deviations.

Part 2. SMART-chain of decentralization in Ukraine: administrative-budgetary-energy. Their interaction and development

Administrative decentralization. Empirical work and new research in the field of behavioral economics show that well-conducted financial decentralization naturally directs the national economy towards reducing corruption and stable economic growth. The example of some European countries helps to understand what a clever SMART model of decentralization should look like. Varieties of decentralization mutually influence each other and it is their complex organization and is a SMART-model of decentralization, adapted to the conditions of the country.

We consider it expedient to consider the chain of administrative-budgetary-energy decentralization as one that will in the shortest possible time protect the development of Ukraine's economy from the challenges of the postwar period. In addition, the first two stages, namely administrative and budgetary decentralization in Ukraine, are already under way. The standard of living in European countries directly correlates with the level of budget decentralization.

From a fiscal and administrative point of view, Greece is an extremely centralized country. Only 0.7% of all tax revenues go to local budgets, while the European average is 10.6%. Due to the overly centralized budgetary and administrative structure, local governments lack incentives for effective business development.

In contrast to Greece, the Baltic countries, as well as Slovenia, Finland and Sweden – with a high degree of decentralization, including budgetary – demonstrate broad financial powers of local administrations, including the disposal of local economic revenues (income tax, income tax enterprises), which significantly improves the overall standard of living.

Research on this issue underlies the behavioral approach to management in economics. The dependence of local government powers and the redistribution of tax revenues is direct to ensure stable economic growth and innovation at the state level.

The issues of the optimal institutional model define the general institutional features:

A. Local communities enjoy broad administrative and budgetary autonomy.

B. In this case, territorial communities (districts) and cities receive part of the tax revenues from economic activities within the community (district) or city, for example, part of the income tax, profit. tax or local business.

C. There is a fixed formula (with zero or minimum discretion) with objective criteria for the distribution of grants and equalization of revenues between central, regional and local governments.

Thus, fairly simple organizational changes in the institutional model can improve the quality of institutions from the bottom up, which is a necessary condition for the development of an innovative economy, and it, in turn, is the basis of postwar renewal.

Several weeks of war proved that the reform of administrative decentralization was the most important of those carried out in Ukraine. For some time, necessary for the reform of the central government to the military, the life of the country is largely supported by the self-organization of communities.

Budget decentralization. Significant transformations caused by hostilities, as well as the potential threat of temporary loss of communication and control of territories, require the synchronization of fiscal policies at different levels of government.

The main advantage of communities – the fullest possible knowledge of the real needs for their proper functioning, as well as the available and potentially available resources at their level – should be strengthened by coordinating their actions to ensure the sustainability and viability of the country. Such functions are the competence of the Ministry of Regional Development, and currently there are problems in their implementation. At the same time, high-quality self-organization of communities should grow into national cohesion and the stability of communities should become the basis for the stability of the state.

Budget decentralization will have a significant social impact on IDPs and evacuees, as it will improve care for such families in the communities where they find themselves. With the positive advantage of budget decentralization in the form of minimizing corruption, preventing financial distribution from the center, and in conditions of extreme lack of funds in the war-torn infrastructure, this argument is quite strong. The systematized list of problematic issues of budget decentralization and ways to solve them in the modern and postwar period is as follows (Table 3).

Economic recovery should be as adaptable as possible to new geopolitical and geocultural realities.

Given the unprecedented financial assistance from our foreign partners, it is highly probable that the filling of extra-budgetary funds for the Ukrainian economy is quite possible.

Measures for liberalization and budget decentralization show that the direct relationship between the degree of economic freedom and the pace of economic development is unconditional.

SMART vectors of Ukraine's post-war economic development, focused on its maximum deregulation and demonopolization, should be formed today. And given the realities of wartime, when the destruction of large stocks of fuel and food, as well as powerful logistics hubs, it is advisable to talk about laying the foundations of a kind of «mosquito economy» (by analogy with «mosquito« military strategies, when the main goals in the battlefields are achieved primarily through the use of small, maneuverable and highly mobile innovative tools and resources).

Table 3

List of database problems and ways to overcome in wartime and postwar transformation of Ukraine's economy

Problem	Ways to solve
The need for communities to provide methodological support from the CEB, as the official website of the Ministry of Regional Development is virtually inaccessible due to hacker attacks	Provide open assistance – providing the official website of the Ministry of Regional Development with anti-hacker protection, as well as specific assistance through network communication – to determine the needs of the community, including food, communal, social, household spheres, transport logistics, security and order, application of optimal management models.
Building adequate differentiated recommendations for communities, financial assistance policy, and in the long run – post-war reconstruction	On the basis of the Ministry of Regional Development, together with the Ministry of Finance to classify communities (low-risk communities with a large number of internally displaced persons, communities with increased potential risks, communities in areas close to hostilities, etc.).
Lack of systematic management approaches to ensuring the sustainability of communities depending on the level and typology of risks.	To recommend to the Associations of Local Self-Government Bodies and the Ministry of Regional Development to involve specialists in the working bodies of the Government, which will coordinate humanitarian aid, to address the issues of sustainability of economic sectors. At the level of the Ministry of Finance and the VCA to provide financial support to communities in which the population has grown significantly at the expense of evacuees. Develop means of operative compensation of expenses of agribusiness enterprises and farmers, aimed at supporting communities and displaced persons, terrorist defense, the Armed Forces of Ukraine to guarantee their ability to start seasonal field work in time.
A real and urgent problem, even before the war, at the district level, but one that will be exacerbated by the destruction of infrastructure and industrial production, is the extreme lack of funds, even for the exercise of their powers.	Solutions – 1) one-time subventions from the state budget (which will be extremely burdensome for the postwar economy) or transfers to the district council from the regional council. 2) to achieve a positive effect of the positive effect of external externalities. The experience of foreign countries is significant, where local governments have the right to create extra-budgetary financial funds that are targeted and are created to address specific economic and social problems. By its status, a regional non-budgetary fund is usually a trust, which also includes an investment corporation. The trust nature of the funds allows to increase the capital concentrated in them.

Sourse: compiled by the author

Decentralization of the energy sector. It is the liberalization and deregulation of Ukraine's energy sector that is the basis for its effective development. The transition to decentralized energy is a global energy trend. The central idea of energy decentralization is the tendency to promote new environmental technologies of energy production, while allowing individuals, households and small businesses to reduce the cost of meeting their own needs. For example, with regard to solar panels in households, the maximum allowable power of installations is 15 kW; even for a small business this will suffice. The current architecture of the energy market of Ukraine is presented in Figure 4.

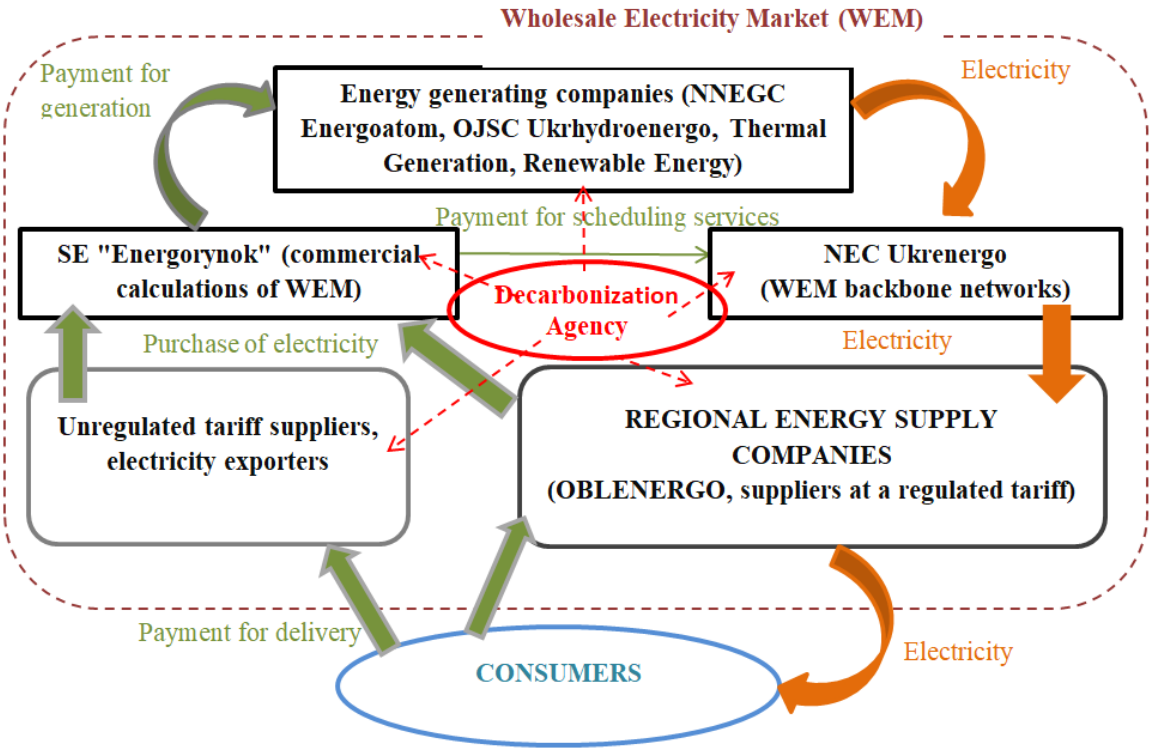


Figure 4. Current model of the energy market of Ukraine

Sourse: [11]

As can be seen from Figure 4, Ukraine’s energy market is a highly centralized system based on the Unified Energy System. Reforming such a system of liberalization and decentralization towards a significant increase in the share of microgeneration and an increase in green energy to 30% of total energy by 2035 is in line with both global trends and national economic benchmarks.Thus, microgeneration provides opportunities for direct electricity consumers to install compact energy sources for their own needs near the place of consumption. At the same time, energy producers can sell surpluses to the general grid. Administrative and fiscal decentralization in Ukraine opens wide opportunities on the ground for the development of decentralized low-capacity electricity, the sale of surplus to the wholesale market and its effective development.

The development of microgeneration at the community level in Ukraine is also encouraged by EU requirements for the production of goods from green energy, which come into force in 2023, which will be a powerful driver for the construction of solar power plants of all sizes – from industrial facilities to rural energy cooperatives. An important factor in the development of microgeneration is the trend and economic feasibility of using renewable energy sources. Today, they are widely used in facilities designed to produce and sell energy to the wholesale market: in wind farms or solar power plants. With regard to medium and large industrial enterprises, integration into the European energy system has provoked increased demands for non-alternative green generation from alternative energy sources.

Effective decentralization is important for the effective integration of energy facilities into the energy markets of Ukraine presented in Figure 4. It will ensure the stabilization of network operating parameters, as well as allow saving and utilization of industrial waste at Ukrainian enterprises, stabilize tariffs for the entire range of energy consumption stakeholders. Table 4 lists the energy efficient and energy saving technologies that are potentially widely available in Ukraine.

It should be noted that a clear global trend today is the development of distributed generation at the level of local consumers, due primarily to its cheapness.

In recent years, the cost of equipment for solar power plants has become available even at the household level. In addition, solar energy has long been cheaper than electricity from any fossil fuel. This can solve the problem of providing electricity to vulnerable groups.

Thus, in order to stabilize and increase the energy efficiency of the Ukrainian energy market, the process of synchronization with the network should be replaced by the process of network formation, and this is an urgent task through storage systems. The interconnection of digital technologies, storage systems, solar power plants and power electronics can accelerate the energy revolution and achieve carbon neutrality.

Conclusions

Thus, summarizing the study, the following should be noted. The development of a strategy for the renovation of the economy of post-war Ukraine, as well as regional and sectoral development, should be based on a synergistic effect in the face of limited resources and large-scale losses.

Infrastructurally and economically, post-war Ukraine will correlate with post-war Europe, hence the need and expediency in ensuring the rapid development of high value added sectors and new industries in Ukraine, such as: renewable energy technologies; building materials and structures for energy efficient construction; production of batteries, electronics, electric vehicles, heat pumps; electrometallurgy and hydrogen steel production.

The following recommendations for Ukraine follow from the above arguments:

Table 4

Resource potential of Ukraine for the use of energy efficient and energy saving technologies

Energy efficient and energy saving technologies	Scope	The essence of use
Cogeneration in heat energy	Industrial enterprises	They serve for joint extraction of electric and thermal energy in cogeneration plants. They can use significant reserves of unconventional and non-fossil fuels (peat, sawdust, microalg, agricultural waste and food industry), have a high energy and resource-saving effect based on a high efficiency (efficiency) of fuel use (up to 90%)
Small hydropower and geothermal energy	Mostly western regions of Ukraine, wide application at the level of communities and energy cooperatives is possible	The potential for use in Ukraine reaches 8 million tons of standard fuel
Solar energy	Mostly eastern and southern regions of Ukraine, wide application at the level of communities and energy cooperatives is possible	The potential for use in Ukraine reaches 1 million tons of standard fuel

Source: compiled by the author

– maintain the pace and speed of reforms in the direction of greater budgetary and administrative autonomy of local self-government. At the same time, resources and responsibilities must be balanced;

– redistribute taxes so that more funds from the economic activities of not only small but also part of the taxes of medium and large businesses go to local budgets. Direct tax collection should remain the prerogative of the central tax administration;

– administrative powers and budgets at the regional level should be kept to a minimum and clearly justified;

– to minimize reckless spending, fiscal rules and clear bankruptcy procedures need to be put in place for communities and cities;

– conduct a clear information campaign on television and radio. Such awareness of entrepreneurs is the most important element of the «upward spiral» of improving the quality of institutions and public services;

– develop energy storage systems in Ukraine and provide support for energy storage projects at the state level;

– develop a strategy / action plan for the Ukrainian energy sector, which would take into account both global trends and Ukrainian realities of further development of the energy sector;

– to stimulate further development of the «green» generation. Based on Net Energy Metering, ie enabling producers in the energy market to build a new generation to consume energy for their own needs and transfer excess energy to the grid;

– focus on small projects that would meet the needs of improving energy efficiency, reducing the cost of electricity for specific industries;

– set up a decarbonisation agency with much broader intergovernmental powers, working not only in the public sector, housing and communal services, but also in all areas that can reduce CO_2 emissions;

– it is extremely necessary to create a legal basis in Ukraine for the construction of energy storage systems.

The Marshall Plan for post-war Ukraine must be special and balanced. The post-war economic boom in Ukraine is possible only if the state's economic policy measures are implemented in line with a clear and consistent strategy aimed at deregulating the economy and creating a favorable investment climate.

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