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ENERGY STRATEGY OF UKRAINE FOR THE PERIOD UP TO 2035
“SECURITY, ENERGY EFFICIENCY, COMPETITIVENESS”

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LIST OF ABBREVIATIONS, ACRONYMS AND TERMS

NPP – nuclear power plant

GDP – gross domestic product

RES – renewable energy sources

HAPP – hydro-accumulating power plant

HPP – hydropower plant

GDS – gas dispensing station

GPP – gas processing plant

GDS – gas distribution systems

GTS – gas transmission system

ESU – Energy Strategy of Ukraine for the period up to 2035 “Security, Energy Efficiency, Competitiveness”

EU – European Union

ZNPP – Zaporizhzhia Nuclear Power Plant

GPES – general primary energy supply calculated as the amount of production (extraction), import, export, international ship bunkering and changes in the reserves of energy resources in the country

ECUF – installed capacity use factor

EF – efficiency factor

CNG – compressed natural gas

IAEA – International Atomic Energy Agency

IEA – International Energy Agency

MROO – minimum reserves of oil and oil products

MECI – Ministry of Energy and Coal Industry of Ukraine

NATO – North Atlantic Treaty Organization

NEURC – National Commission for State Energy and Public Utilities Regulation (national regulator)

UCT – uncontrolled territories: separate raions of Donetsk and Luhansk oblasts that are temporary occupied

OPP – oil processing plant

OTS – oil transmission system of Ukraine

OECD – Organization for Economic Cooperation and Development

UES of Ukraine – Unified Energy System of Ukraine

UNO – United Nations Organization

Paris Agreement – Paris Agreement adopted in Paris on 12 December, 2015 at the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change and signed on behalf of Ukraine in New-York on 22 April, 2016

FEC – fuel and energy complex

PPP – purchasing power parity

UGS – underground gas storage facility

RF – Russian Federation

LHG, LPG – liquefied hydrogen gas, liquefied petroleum gas

TPP – thermal power plant

CHP – combined heat and power plant

toe – ton of oil equivalent

DH – district heating

DHS – district heat supply

EITI – Extractive Industries Transparency Initiative

ENTSO-E – European Network of Transmission System Operators for Electricity

ENTSO-G – European Network of Transmission System Operators for Gas

OPAL – 470 km long gas pipeline enabling gas transmission from the German part of the Baltic Sea coast to the border on Czech Republic. OPAL connects the “Nord Stream” gas pipelines with Russian gas consumers in the Central and Eastern Europe, bypassing Ukraine.

Price Cap Regulation – a method of incentive-based tariff setting for the services of energy network operators with features of natural monopolists. This method is used in order to set the upper cap of the tariff in accordance with indices reflecting changes in the overall inflation rate in the economy of the country over the reporting period (normally, one year) and with due account of the operator’s possibility to get higher profit as compared to the average statistical profitability of the country-average operator of a certain type of energy network. In case of excessive profitability, the NEURC reduces excessive profitability of the operator in question, thus re-distributing relevant excessive profit between the operator and its customers via reduction of tariffs.

SAIDI (System Average Interruption Duration Index) – index of average duration of interruptions in electricity supply in the system calculated as correlation of the aggregate duration of interruptions for consumers resulting from all long interruptions in electricity supply over the reporting period to the total number of consumers.

SAIFI (System Average Interruption Frequency Index) – index of average interruption frequency in the system characterizing the number of interruptions in electricity supply to consumers.

PREAMBLE

Global approaches to state energy policy development are changing: outdated energy sector models dominated by large producers, fossil fuels, inefficient networks, inadequate competition in natural gas, electricity and coal markets are changed with new ones featuring more competitive environment, more balanced development opportunities and minimized prevalence of any energy production type or source and/or way of fuel supply. At the same time, preference is given to increased energy efficiency and renewable energy sources. Prevention of climate change and adaptation thereto are also among the priorities of global energy development.

Due to the aforesaid Ukraine faces new economic and technological challenges, at the same time getting new opportunities for the search and implementation of innovative developments in the field of extraction, processing of fossil fuels, production, transformation, supply and consumption of energy. Therefore, the need to develop a new state energy policy arises.

Energy Strategy of Ukraine for the period up to 2035 “Security, Energy Efficiency, Competitiveness” is a document that outlines strategic goals for development of energy complex in Ukraine over the period till 2035.

Targeted values contained herein show the way for development of energy and adjacent industries. Further on, within, ESU Tasks and values set out herein will be further elaborated in the framework of development and approval of the ESU Implementation Action Plan by the Cabinet of Ministers of Ukraine and reflected in respective subsectoral development programs. To implement the ESU it will also be necessary to develop new and change current laws, regulations and numbers of industry-specific rules regulating activity in the energy sector.

Ukraine is and wants to remain one of the biggest producers of hydrocarbons in the continental Europe and reliable energy resources transit partner (first of all natural gas and oil) ensuring secure and reliable supply of energy resources both to domestic consumers and to those in neighbouring markets. These energy resources have to be produced and supplied with high level of environmental and social responsibility, making efforts towards implementation of obligations on reduction of greenhouse gases emissions.

Considerable resource base and priorities set at national level regarding extension thereof with the aim to increase production of hydrocarbons to ensure energy independence of the country, as well as hydrocarbons' transmission, storage and processing overcapacities, including integration into the European market and possibilities to arrange supplies from world markets for further supply to EU together create foundation for development of relevant industries and the economy of Ukraine in general.

Ukraine uses different energy sources for its own needs. They are oil, natural gas, coal, nuclear and hydropower, wind and solar power, etc. Traditionally, as of today fossil fuels are in the biggest demand. Namely, natural gas and coal jointly amount for 60% of the domestic energy balance. At the same time, over the recent years the share of other energies in consumption has been gradually increasing due to changes in the price situation, technologies and global trends. What is more, there are all grounds to expect their further growth and respective reduction of the share of fossil fuels in the country's energy balance.

Availability of all of the above-mentioned resources in Ukraine, creation of a competitive market environment and conditions for consistent development of resource base for nuclear energy, modernization of generating capacities and substitution of current raw materials base with alternative fuels, further exploration and extraction of hydrocarbons, including unconventional ones, as well as increased efficiency of use of renewable energy potential together will promote strengthening Ukraine's position in sustainable energy production and its economical consumption.

SUMMARY

Energy Strategy of Ukraine for the period up to 2035 “Security, Energy Efficiency, Competitiveness” envisages that the reform of the energy sector of Ukraine will largely be completed by 2025, in particular priority security and energy efficiency targets will be achieved, innovative upgrading and integration of the Ukrainian energy sector into the EU energy sector will be ensured.

Performance of the ESU tasks after 2025 will require somewhat different approaches to energy regulation, based on fundamental principles accepted by the EU countries, as well as to development of strategic planning documents and practical actions relating to the implementation of the state policy in the energy sector.

The ESU was developed against the background of high uncertainty and complications due to the military aggression of the RF against Ukraine, which arose from the attempts of the RF to keep its significant political influence on Ukraine and resulted in temporary occupation of a part of the Ukrainian territory, namely annexation of the Crimea and a long-lasting armed conflict in some areas of Donetsk and Luhansk oblasts.

The dynamics of economic development will mainly depend on the implementation of economic reforms, by virtue which the “rules of the game” in the energy market will become transparent and non-discriminatory, as well as on the implementation of the EU legislation, including energy legislation and terms of integration into the European energy market.

The ESU is a document designed to establish cross-sector cooperation aimed at efficient and reliable coverage of the needs of the national economy and citizens for the relevant types of energy. The energy complex of Ukraine must go through a period of transformation. This is necessary not only due to industry-specific factors, but also due to social and economic transformations in the country, taking into account security issues in the conditions of external aggression.

The ESU has been developed in the context of the Sustainable Development Strategy “Ukraine–2020” approved by Decree of the President of Ukraine of 12 January, 2015 No. 5, which, in particular, envisages the reform of the energy sector and implementation of the energy efficiency program within the determined vector of further development.

The ESU sets the **objectives, tasks and mechanisms** for taking the energy sector to a brand new level. The ESU aims primarily at solving problems of energy security against the background of the urgent need for ensuring state sovereignty in the conditions of external aggression involving both advanced types of weapons (information and hybrid war methods), and non-military influences. The document suggests transformation mechanisms for the period up to 2020 and determines strategic development guidelines till 2035.

Reduced energy intensity of economy, as well as **diversification of energy sources and ways of supply, domestic production growth** will contribute to improved economic, energy and environmental security, which, in turn, will lead to optimization of energy balance and enable development of solid foundation for sustainable energy future of the country. The use of domestic sci-tech and technology achievements with the maximum involvement of local stakeholders will promote innovative development of economy, research and educational capacity building, increase of employment rates, reduction of dependence on import of resources, etc.

The key quantitative and qualitative feature of the ESU is the **structure of general primary energy supply (GPES)**. To develop the GPES structure economic and mathematical models, generalized expert opinions, as well as target values Ukraine has to achieve under its international commitments in the fields of RES development and climate change were used.

Instead, due to the absence of a long-term forecast for the state social and economic development and high level of political and economic uncertainty in the country at the moment of the ESU development, it will be necessary further adjust estimated GPES figures in course of the ESU implementation based on current practice and predictive modelling methods used in the EU countries. The estimated GPES figures and electricity generation figures are provided in *Annex 2*.

As a result of gradual economic recovery, minor growth of the GPES indicator is expected in long-term period. Over the period of 2017–2020 Ukraine shall fulfil an ambitious task, namely **to achieve stability in the GPES level and sustainable GDP growth**. As the result of implementation of the ESU tasks it is planned to **achieve reduction of GDP energy intensity more than twice** by 2035. This will require advances technological decisions, considerable investments, updated legislation and structural changes in the economy.

Flexibility of energy sector development may be ensured through using opportunities provided by energy efficient technologies and investment. Sustainable development of the energy sector shall become the first step towards the recovery and growth of the country’s economy in general.

Reforms, demonopolization, transparency and improvement of legal and regulatory mechanisms shall create the foundation for investment. While making minimum investment the state shall ensure maximum incentives for development of good investment environment.

The main **pre-conditions for attraction of investment** are the following: rule of law, approximation of the European energy legislation, deoffshorization of economy, introduction of incentive-based regulatory legislation, economically sound tariffs, and communication policy aimed at attracting new strategic and financial investors to the market.

The share of direct investment from the state budget of Ukraine into the energy infrastructure development should account for no more than 5–10%, while direct investment from a country should not reach the critical level. This requires investment diversification.

Based on the ESU provisions, the Government of Ukraine shall prepare **decisions on the functions of executive authorities** and their responsibilities in course of preparation and development of activities aimed at efficient energy production, transformation, transmission, processing and consumption, as well as in the process of development of competitive and transparent electricity, natural gas, oil, thermal power and coal markets.

For the purposes of the ESU development **program-and-goal-oriented approach** was applied. Unlike previous energy strategies, the method of forecasting the future condition of the energy system was replaced by development of algorithms to be used to achieve the desirable results. In particular, it involves development of key “goalposts” of energy policy development, energy development at each of the three main phases of the strategy implementation specified below. Estimated target values will be further adjusted considering factual social and economic development of Ukraine.

Leading Ukrainian non-governmental organizations and state bodies supported by the European institutions and experts participated in development hereof. At the final stage of public discussion of the draft ESU expert discussions involving representatives of research institutions, energy sector economic operators, international and civil society organizations, domestic and foreign experts. Based on results of the discussions final version of the ESU was developed.

Thus, the ESU may be considered a result of joint effort of the Ukrainian expert community, domestic companies, state bodies and representatives of competent international institutions.

The ESU is a document which outlines strategic guidance for development of Ukraine’s energy sector until 2035. At the next stage the high quality energy balance forecasting model will be developed with assistance of leading experts (including from EU). This will allow getting reliable data to be used for implementation of Energy Strategy or adjustment thereof, if necessary.

The ESU is expected to be implemented in three main phases:

- **PHASE 1. Energy sector reform (till 2020)**

Over the next three years the emphasis will be made on implementation of reforms and development of competitive environment attractive for investment.

Within the aforesaid period implementation of the Third Energy Package **is expected** to be completed. This will enable creation of full-fledged natural gas and electricity markets in accordance with the EU energy legislation. Also, the institutional integration of Ukraine in ENTSO-G is planned to be finished during this phase and the major share of activities aimed at integration of the UES of Ukraine into the ENTSO-E energy system is to be implemented.

Reform of energy companies in accordance with Ukraine’s commitments under the Treaty establishing the Energy Community, increased gas extraction, reduced energy intensity of GDP and further development of ESU are the key **tasks** of the ESU at this phase.

The coal market will be established. Restructuring of coal industry will be accompanied by a complex of measures for mitigation of social and environmental consequences of mines closure/conservation and social reconversion of the regions, where mines will be closed in accordance with best EU practice.

As regards environmental protection, compliance with best environmental standards of energy production, transmission, transformation and consumption, as well as funding of investment projects within the National Large Combustion Plants Emission Reduction Plan in line with the Ukrainian legislation and commitments in the framework of the Energy Community shall be ensured.

At the first phase **it is expected** to achieve revolutionary progress in the field of RES increasing their share in final consumption up to 11% (8% of GPES) as a result of stable and predictable RES development and investment policy.

● PHASE 2. Optimization and innovative development of energy infrastructure (till 2025)

The second phase of the energy strategy implementation will **focus** on the activities in the new market conditions and practical integration of the UES of Ukraine into the European energy system that will considerably influence the choice of energy facilities for reconstruction or new construction and improvement of energy efficiency.

The tasks at this phase are as follows: to introduce mechanisms for involvement of investment in program for replacement of capacities to be taken out of operation with new facilities; to increase the level of corporate governance of economic operators and their capacity to use available tools of internal and external capital markets and resources of the energy market of Ukraine.

The following shall be done during this phase:

- Integration of the Ukrainian energy system into the ENTSO-E's Continental Europe zone in the operation regime;
- Full integration into the European gas transmission system ENTSO-G, further enhancement of cooperation with the Central European countries for the sake of raising reliability of energy supplies;
- Implementation of investment projects envisaged by the National Large Combustion Plants Emission Reduction Plan;
- Development of local heat supply systems taking into account economically justified potential of local fuels, supply logistics, regional and national energy infrastructure;
- Increase of efficiency of operating district heating systems;
- Involvement of private investment.

Besides, the systems of accounting and consumers' involvement in management of their own demand for energy resources are **expected** to be modernized and improved. As regards the gas sector, internal demand for natural gas is expected to be fully covered with domestic resources via increased production, while the functioning of gas transmission system shall be enhanced considering expected scenarios of use of its capacity.

At this phase intensive investment attraction to the RES sector, development of distributed generation, in particular, development and commencement of implementation "smart" energy grids plan and development of an extensive infrastructure for electric transport development **are expected** as well.

● PHASE 3. Ensuring sustainable development (till 2035)

The third ESU phase **aims** at innovative development of energy sector and construction of new generation capacities. It involves investment into new generation capacities to replace the capacities that shall be taken out of operation. The choice of the generation type will depend on the fuel price forecasts and intensity of development of each generation type promoting increased competition between them; from integration of smart technology for balancing consumption peaks.

As regards energy efficiency and environmental protection, introduction of "passive house" construction standards, achievement of SO₂, NO_x and dust emission targets under the National Large Combustion Plants Emission Reduction Plan and introduction of greenhouse emission credit trading **are expected**.

The gas sector will face the following tasks:

- Increase in the national gas extraction, in particular unconventional gas and extraction at continental shelf and exclusive (marine) economic zone of Ukraine;
- Adjustment of the gas transmission system capacity to developments in European natural gas market.

The coal sector shall become competitive and transparent during this phase.

RES development will be the fastest among all the types of generation. This will enable increase the share of RES in the GPES structure up to 25%.

The phased tasks shall be coordinated against each other to ensure concentration of efforts on the ESU implementation. The program implementation will result in achievement of the goals as well as quantitative and qualitative indicators set out in the ESU (*Annex A*). Achievement of parameters provided in the GPES Forecast Balance for the period till 2035, the share of RES in GPES and the energy efficiency of the national economy shall become a summary result for quantitative indicators of the ESU implementation.

It should be underlined that achievement of the aforesaid indicators will be possible only in case of successful performance of the ESU tasks and implementation of comprehensive social and economic reform in the country.

A detailed composition and description of the above ESU phases is provided in Section 3 hereof.

1. ENERGY SECTOR OF UKRAINE: TRENDS, CHALLENGES, PROSPECTS

1.1. Trends and threats in the Ukrainian energy sector development

Global energy development trends

Decarbonisation of the energy sector is becoming more and more important from the point of view of climate change prevention. This influences energy-generating capacity balance. The Paris Agreement requires the international community to undertake definite consolidated action against global warming.

Nuclear energy, hydropower, wind energy and other RES producing the lowest amount of greenhouse gas emissions will have an important role in achievement of the aforesaid task. Sustainable position of Ukraine in relation to expediency of using nuclear power will, among others, contribute to solving the problem of energy sector decarbonization.

Ukraine considers nuclear power one of the most economically effective low-carbon sources of energy. It is estimated that nuclear power industry will develop further up to 2035 as the share of nuclear generation in the overall electricity production will increase.

Revolutionary technological innovations are expected in transport sector. Progressive shift from internal combustion engines and replacement of a considerable share of ICE vehicles with those using non-emission electric engines and green hydrogen engines are expected in the nearest decades.

Hence, increasing competition in the world energy markets, rapid sci-tech progress in RES and alternative fuels development expand possibilities for selection of primary energy sources and ways of their supply, optimization of energy mix and, in future, reduction of greenhouse gases emissions.

1.2. New challenges and opportunities

Geographic location of Ukraine between the EU and the RF and external aggression of the latter against Ukraine create both challenges and opportunities. A challenge here is the risk to lose a part of the energy system and transit status; while the opportunities are to use favourable geographic location and trends in the energy transmission markets, become independent of gas import and reduce dependence on the oil transit from the RF.

The Memorandum of Understanding on cooperation in the field of energy of November 24, 2016 between Ukraine and the EU sets the strategic role of Ukraine as a transiting country. However in general the EU strategy is not focused on Ukraine's capacity of the most important eastern energy transmission partner, since the interests of some more influential Member States prevail over mutually agreed priorities.

Integration of European energy standards into the Ukrainian legislation will considerably increase Ukraine's resistibility to the attempts to politicize international relations in the field of energy, while joining the general European market will help liberalize and demonopolize internal energy markets, make them more transparent and competitive. Transformation and integration of markets are possible only if a consumer becomes one of the key players as required under Goal 7 of the United Nations Resolution "The 2030 Agenda for Sustainable Development".

A strategic objective is to maximise energy independence of the country. Therewith energy saving, keeping achieved levels of hydrocarbon extraction and maximum diversification of primary energy resources supply will be the key focus till 2025.

Up to 2035 the top priorities will be successful implementation of natural gas deposits development projects, including unconventional gas. As the result of comprehensive transformation the energy infrastructure shall become a flexible tool of the energy security system of Ukraine, the basis for reliable supply of energy to consumers and an element of the security of supplies to the EU from the eastern direction.

The structure of general primary energy supply

According to the data of the State Statistics Service of Ukraine, in 2015 the share of natural gas in the **GPES structure** was pretty large, namely 28.9% (26.1 Mtoe). The share of nuclear energy made up 25.5% (23.0 Mtoe); coal – 30.4% (27.3 Mtoe); crude oil and oil products – 11.6% (10,5 Mtoe); biomass (biomass, fuel and waste) – 2.3% (2.1 Mtoe); hydropower – 0.5% (0.5 Mtoe); thermal power (thermal power of the environment and technogenic waste) – 0.5% (0,5 Mtoe) and WPS and SPS together – 0.1% (0.1 Mtoe). The aggregate share of all RES amounted to 3.6 Mtoe, which is only 4%.

Due to the scarcity of Ukraine's natural resources, the import dependence rate, with due account of nuclear fuel supplies, was amounted to 51.6% in 2015, which is risky for energy security. Reduction of import dependence is one of the key priorities of the ESU. It is estimated that the share of import components in GPES will go down to <50% already in 2020 and to <33% in 2025-2035, in particular as a result of RES development, increased domestic natural gas extraction, energy saving and improving of energy efficiency in compliance with the best environmental standards.

2. OBJECTIVES AND PRIORITIES OF THE ESU

The goal of the ESU is to address the needs of the society and economy for the fuel and energy in a technically reliable, safe, economically efficient and environmentally friendly way in order to guarantee the improvement of social well-being.

Relevant strategic vision is the following: the energy sector of Ukraine is one of the economic guarantees of the state sovereignty, an element of good governance, a reliable basis for sustainable development of competitive economy and an integral part of the European energy space.

2.1. Conscious and energy-efficient society

- Introduction of energy management systems at national and municipal levels, as well as in companies, continuous enhancement thereof, in particular, in accordance with standards and international agreements;
- Incentivizing energy saving at the level of consumers, development of energy efficiency mentality;
- Promoting energy efficiency through targeted monetization of subsidies for end users with further minimisation of the scope of subsidies;
- Improving energy efficiency at the stage of electricity and heat power generation, reduction of energy losses during its transmission and distribution;
- Ensuring completeness and transparency of accounting of all the types of energy and energy resources (electricity and heat energy carriers, natural gas, etc.);
- Development and regular monitoring of Ukraine's energy balance, its assessment by efficiency criteria;
- Reduction of GDP's energy intensity till 2035:
 - As compared to GDP (PPP): from current 0.28 toe/thousand US dollars to 0.13 (according to PPP);
 - Development of energy infrastructure necessary for further sustainable development of the country on the competitive basis.

2.2. Energy independence, reliability and sustainability of the FEC (fuel and energy complex)

- Ensuring energy independence, including active development of resource base and extraction of primary energy resources, domestic capacities for their processing, development of reserves and resources, diversification of supply sources and ways, technical and technological refurbishment of the key companies in the sector;
- Ukraine shall get no more than 30% of primary energy resources from every single source of supply (the target value for nuclear fuel is determined separately);
- Minimization of import via:
 - Intensive growth in hydrocarbon extraction in the Ukrainian territory and beyond its boundaries;
 - Efficient use of resources;
 - Active development of domestic resource base;
 - Active RES development;
 - Energy balance optimization;

- Renewal of offshore exploration, development and extraction of hydrocarbon resources at continental shelf and within exclusive (marine) economic zone of Ukraine, creating favourable conditions for domestic companies and foreign investors;
- Reduction of dependence on supplies of anthracite coal;
- Improvement of critical infrastructure protection system based on the best practices of the NATO and EU countries, creation of a crisis-management system in energy sector;
- Using best practices on protection of environment;
- Performance of environmental commitments of the country to the world community and its own residents;
- Ensuring reliable operation of the energy infrastructure, taking the necessary steps for modernization, mitigation of accident risk, extension of operation under normal conditions;
- Ensuring guaranteed correspondence of the generating capacities to electricity consumption volumes and regimes in the UES of Ukraine, in particular, as regards availability of regulatory capacities;
- Integration of the UES of Ukraine into the energy system of the ENTSO-E synchronous Continental Europe zone and development of relevant legal and regulatory framework.

2.3. Market development

- Creation of competitive gas, electricity, heat, coal, oil and oil products markets; competitive environment for their transmission through the Ukrainian territory, including ensuring market functioning with due account of the external aggression factor;
- Considering transition from use of the “cost-plus” principle when developing pricing and tariff policy to the incentive-based tariff regulation with further transition to market mechanisms;
- Promoting development of local energy initiatives, in particular small and medium business development in the energy sector and energy cooperatives, generation and supply of electricity and thermal power with due account of regional peculiarities, development of distributed generation;
- Transparent and non-discriminatory mechanism of tariff setting and cross-border capacity allocation for trade, simplification of transit procedures according to the principle of free access to transit capacities;
- Ensuring independence of the NEURC and Anti-Monopoly Committee of Ukraine from any influence, their financial and decision-making independence;
- Introduction of transparent mechanisms for extraction and use of own fuel resources according to the principles of the Extractive Industries Transparency Initiative (EITI);
- Introduction of principles and best practices of state oil and gas resources management;
- Improvement of legal framework, institutions and technical infrastructure for development of utilities services market.

2.4. Investment attractiveness

- Implementation of EU *acquis* requirements in the legislation regulating activities in energy sector and promoting development thereof;
- Transparent development of tactical decisions that, according to estimations, meet established long-term goals;
- Creation of conditions for development of technological innovative parks using modern scientifically justified energy solutions, technologies and equipment;
- Support of good competitive environment, uninterrupted access to markets and existing infrastructure (except for natural limitations, as well as based on rationalization of the factors of energy security of Ukraine);
- Stable and predictable investment attraction policy;
- Application of communication policy promoting entrance of new international strategic and financial investors to the market.

2.5. Network integration

Integration of the gas and electricity markets and respective transmission networks, as well as the OTS of Ukraine into the EU energy space is possible and expedient.

Electricity market integration. The goal of the integration in the electricity sector is to ensure synchronised operation of the UES of Ukraine with the energy system of ENTSO-E Continental Europe zone. Maximum electricity transmission capacity transfer to/from ENTSO-E in case of complete synchronization will amount to 4 GW. This will provide additional opportunities for balancing the energy system and creating conditions for better competition in the energy markets. In case of successful implementation of activities aimed at preparation of the aforesaid energy systems for integration, the UES of Ukraine can get united with the energy system of the Synchronous Zone of Continental Europe during the Second phase of implementation of the Strategy.

Gas market integration. It is necessary to transform the gas transmission infrastructure into a flexible European system of secure supply for Ukraine and Central European countries. Thus GTS will suit both for transit of

the Russian gas to the EU, and for reverse gas supplies from Europe to Ukraine, supply of gas from alternative directions and sources, as well as for gas storage, justified formation of its emergency reserve and for trade operations in the gas hub, which may further be created in the domestic market when the latter achieve sufficient liquidity. Public control over current strategically important infrastructural assets, including GTS and its components, shall be ensured.

It is necessary to enable European companies to buy gas at Eastern boarder of Ukraine. Also it is necessary to install the metering stations at the entrance points of the Eastern boarder of Ukraine, taking into account the gas quality parameters.

Oil infrastructure integration. Taking into account strategic importance of Ukraine as a transit country in oil supply to the EU, it is necessary to strengthen international cooperation in full-scale use of the capacity of oil transportation infrastructure, implementation of projects related to diversification of sources and routes of oil supply to Ukraine and transit to EU from alternative sources, as well as development and maintenance of the necessary level of oil and oil product reserves in Ukraine. Implementation of projects aimed at improving efficiency of use of infrastructure and development of new oil infrastructure, which is of common interest for improvement of energy security of the region, are also strategically important.

2.6. Modern Management System

- Introduction of strategic management system with due account of the market modelling scenario;
- Introduction of principles of resource management in mining industry;
- Training staff to work with new models of energy market functioning, preparation of staff and modern of R&D support;
- Introduction of public-private partnership system in reserving of energy resources and a system of strategic energy stocks;
- Removing excessive limitations for the sake of efficient and flexible functioning of the energy infrastructure for hydrocarbon supply and transit;
- Development of the basic principles of the state sectoral policy based on cooperation of the state with society arranged according to the principles of efficient management, delegation of authority and division of responsibilities;
- Improvement of corporate governance in FEC companies with the state share exceeding 50% according to OECD Principles of Corporate Governance.

The ESU priorities shall correspond to national interests, interests of domestic consumers and requirements of Ukrainian economy; they shall ensure implementation of international environmental standards and commitments, as well as innovative renovation and growth.

3. PHASES AND IMPLEMENTATION OF ESU

3.1. Energy sector reform (till 2020)

Over the next three years the emphasis will be made on reform implementation and competitive environment development.

➤ Electricity generation with the use of fossil fuels

It is envisaged that Ukraine will have excess of generating capacities by 2025, and will face the need for their rapid upgrading after 2025.

As regards possibilities for reconstruction of TPPs, taking into account environmental requirements and extension of the period of NPP operating life, correspondent types of electricity generation will remain sufficiently efficient in the nearest future. To meet the demand till 2025 it would be enough just to extend the period of operation of NPPs (by 6 GW) and TPPs (by 9 GW). Besides meeting the demand for a short-term and mid-term period, another strategic task for the next ten years is preparation of the Ukrainian energy system to a large-scale upgrading of its capacities after 2025.

The main activities aimed at implementing strategic goals in the field of electricity generation are the following:

- Introduction of the new model of electricity market, which provides for adoption of the necessary regulatory documents envisaged by the Law of Ukraine “On Electricity Market”;
- Making all the market segments operational: market of bilateral contracts and day-ahead market; intraday market; balancing market, market of ancillary services;

- Separation of the functions of the distribution system operator from the functions of supply; establishing market operator;
- Approval of conditions of retail market functioning, nominating suppliers of universal services and supplier of “last resort”;
- Liquidation of cross-subsidizing between consumers, bringing the prices for households into to the market level;
- Considering introduction of incentive-based tariff setting and market pricing mechanisms, creation of investment incentives, increasing production and operational efficiency;
- Minimizing/removal of external technical and administrative limitations;
- Implementation of programmes for improvement of efficiency of the use of capacities of state owned companies, in particular increase of installed capacity use factor of NPPs;
- Creation of possibilities for export and import of electricity to/from EU countries on the market basis;
- Release of closed capacities through electricity grid development program and implementation of projects aimed at removal of external restrictions;
- Extension of the period of NPPs and TPPs operation; conservation of additional 2–6 GW of TPPs capacities and/or replacement thereof with modern flexible capacities;
- Approval of decisions on construction of new generating capacities to replace those to be taken out of operation after 2025;
- Approval of decisions and action plan for replacement of NPPs capacities to be taken out of operation after 2030;
- Selection of reactor technologies for construction of new nuclear energy blocks to replace NPPs capacities to be taken out of operation after 2030;
- Development and approval of the long-term Ukrainian Nuclear Power Development Program;
- Transition of a number of coal blocks of TPPs to gas coal, if technically and economically justified;
- Completion of privation of the state share in the companies with coal generation capacities;
- Setting requirements to equipment operation (regarding operational security, protection of facilities, energy supply reservation) in accordance with the commitments the EU-Ukraine Association Agreement;
- Setting the minimum security of supply standards, setting requirements for the quality of energy supply;
- Legislative regulation of repayment of debts of electricity and adjacent markets operators;
- Development of efficient mechanism for accumulation of resources to fund the works related to taking nuclear power blocks out of operation by nuclear facility operators.

Main and distribution electricity networks:

- Development of electricity market will promote incentives for efficient investment, as well as efficient maintenance and operation of electricity transmission and distribution systems;
- Support of development of main transmission networks, including through unblocking “closed” capacities of NPPs;
- Support of reconstruction and development of distribution networks in line with development of distributed electricity generation;
- Considering introduction incentive-based tariff setting;
- Reduction of operating costs and increase of investment into power grid development;
- Improvement of efficiency and economic operation of distribution networks through transition to higher voltage level;
- Establishing and ensuring fulfilment of requirements to quality of power supply, in particular to uninterrupted (reliable) power supply, commercial quality of services and power supply;
- Increasing share of installed automated electricity metering systems (SMART systems).

➤ **Environmental protection**

Environmental commitments and environmental safety of generation. Current level of pollutant emissions in Ukraine is on average 7-80 times than envisaged by the EU standards, depending on the type of such emissions. It is planned to reach the compliance with EU standards for SO₂ and dust till 2028, for NO_x – till 2033, applying a tailored approach to each energy block in order to meet the commitments undertaken.

The issue of decarbonisation and reduction of harmful substance emission to the updated 2020 level in general may be solved in Ukraine through reduction of the country’s GDP energy intensity, general reduction of the GPES scope on condition of partial taking of TPPs from operation.

Prospective (after 2020) requirements concerning greenhouse gasses and harmful substance emissions may be fulfilled through implementation of greenhouse gas emission credits trading scheme, setting specific rates for each main emission source and introducing other market and non-market instruments for reduction of emissions of greenhouse gases.

At the country level the main task in the field of environmental protection till 2020 shall be legislative definition of mechanisms to fund investment projects for construction of gas-purification equipment within the National Large Combustion Plants Emission Reduction Plan.

It is planned to establish fundamentals for development of fuel and energy complex waste disposal at the country level, in particular:

- To make amendments to regulatory documents concerning encouragement of owners and prospective consumers to increase the scope of waste disposal;
- To envisage coordination of operation of authorized bodies as regards handling bulk waste of the fuel and energy complex;
- To ensure introduction of advanced technologies and information exchange in fuel and energy complex waste disposal.
- To complete construction of storages for spent nuclear fuel and highly-radioactive wastes of processing thereof.

The main activities aimed at implementation of strategic goals in the field of environmental protection:

- Approval of National Large Combustion Plants Emission Reduction Plan (SO₂, NO_x and dust) and taking actions aimed at reconstruction and modernization of thermal power plants and combined heat and power plant;
- Ensuring financial support of investment project implementation within the National Emission Reduction Plan according to Ukraine's commitments in the framework of the Energy Community;
- Introduction of measures restricting the impact of energy on the environment, including environmental impact assessment;
- Introduction of environmental management and audit system (EMAS);
- Improvement of legal framework for ensuring high quality of atmospheric air and reduction of waste from generating facilities;
- Creating incentives for using waste for generation of thermal and electric energy;
- Development and approval of the State Target Environmental Program for taking uranium facilities out of operation;
- Carrying out a complex of exploratory studies in the areas, which are potentially fit for construction of facilities for nuclear waste disposal in deep geological formations;
- Development of legislation for introduction of greenhouse gas emission credits trading scheme and other market and non-market instruments for reduction of greenhouse gases emissions;

➤ **European integration**

- Ensuring full-fledged implementation of the provisions of the Third Energy Package, Directives and Regulations of the EU in accordance with Ukraine's commitments under the Protocol on the Accession of Ukraine to the Energy Community;
- Implementation of technical measures for integration of the power systems of EU and Ukraine;
- Implementation of measures aimed at market integration of Ukrainian electricity sector;
- Development of network infrastructure in regions potentially suitable for wind and solar energy generation;
- Development and adoption of necessary legal framework for potential transfer to heating with electric boilers, provided that this is economically feasible, the network stability and sufficiency of electricity supply in accordance with conditions for integration with ENTSO-E.

➤ **Energy efficiency**

The main directions of improvement of energy efficiency of Ukrainian economy shall be the following:

- Development of energy-saving mentality, encouraging use of energy efficient household appliances and lighting.
- Reduction of energy consumption by households, commercial and municipal sectors for heating purposes through increase of energy efficiency of residential and public buildings, as well as enhancing energy efficiency of heating devices;
- Completeness and transparency of metering of all types of energy and energy resources;
- Improving energy efficiency in the power production and transformation, primarily, in thermal power industry and district heating through optimization of the use of capacities, technical and technological modernization;
- Reduction of power losses in electric and thermal power transmission and distribution systems through technical, technological modernization and conceptual revision of energy provision schemes, with due account of developments in the field of decentralized power supply, in particular, through using RES, and energy consumption management;

- Evaluation of the capacity for optimizing district heating system via transition to individual heating with in regions and at facilities where it is economically expedient;
- Introduction of energy management system at national, municipal level as well as at the level of public and administrative buildings and companies

Structural changes will have a major impact on the economy's energy efficiency indicators in general. However, activities, which have general impact and on the economy and need to be specifically elaborated in the framework of the country's economic strategy are also necessary.

Taking into account the current energy efficiency situation, priority tasks for the economy in general and for different sectors thereof in the outlined strategic planning period shall be the following:

- Completion of transition to market pricing. Liquidation of "cost" methodology of tariff setting, improvement of the regulatory and legal framework of energy market regulation, raising competitiveness;
- Marking household goods according to energy consumption indicators, promoting energy efficiency household appliances and lighting devices, introduction of training programs, arrangement of awareness-raising campaigns and advertising, carrying out energy audit at the level of individual companies, buildings as well as promoting energy efficient means of transport.
- Application of energy servicing contracts (ESCO) in the budget sector and in the housing and utilities sector;
- Setting requirements for equipment and technologies in terms of the level of energy consumption and environmental parameters;
- Ensuring metering of energy resources consumption and development of multi-apartment residential buildings ownership (management) institute, thereby creating conditions for substantial increase of efficiency of energy resources use by residents; introducing sustainable mechanisms of state support of unions of homeowners' associations according to the principles of co-funding of thermal modernization measures;
- Improvement of thermal resistance of protective structures in buildings (thermal insulation of walls, roofs and vaults, replacement of windows and doors), replacement and/or installation of energy efficient equipment (boilers, heat exchangers, automatic management systems, etc.), carrying out activities aimed at ensuring regulation of thermal energy consumption by consumers (replacement of central heat stations with individual ones, rehabilitation of building-level thermal networks, installation of building-level and individual heat consumption regulators);
- Development of tools of state financial and technical support (including with involvement of foreign partners) for implementation of energy efficiency measures in residential buildings.

The main activities aimed at reducing energy consumption in district heating systems shall be the following:

- Optimization of heat generation sources with a focus on co-generation capacities and efficiency factor maximum enhancement;
- Potential transition from the most inefficient sources of the centralized heat supply to module building boiler-houses;
- Replacement of existing pipelines with preinsulated ones and reduction of energy transmission costs;
- Modernization of heat supply units;
- Use of heat generated in course of technological processes of industrial companies;
- Creation of conditions for free access of third parties to heat networks;
- Use of variable-frequency drive in pumping equipment;
- Use of automatic heat energy regulators at heat supply units based on external air temperature fluctuations;
- Transition to autonomous and/or individual heating in the cities where condition of district heating system causes excessive losses and inefficient use of resources;
- Unlocking industrial energy saving potential via introducing energy management and energy servicing systems, incentive-based state economic policy and gradual enhancement of energy efficiency requirements based on revision of energy consumption standards;
- Introduction of demand management mechanisms, in particular, "energy services" mechanism as an alternative to new energy production, which meet Ukraine's commitments under the Protocol on the Accession of Ukraine to the Energy Community.

➤ **Heat supply**

- Development of local energy systems on the basis of economic potential of local fuels, supply logistics, regional and national energy infrastructure;
- Optimization of co-generation use at combined heat and power plants for heat and electric power production;
- Considering introduction of incentive-based tariff for heat supply and cogeneration companies;
- Ensuring 100% commercial accounting of heat energy consumption in the household sector;
- Revision of district heating standards, taking necessary steps aimed at ensuring successful operation during Autumn and Winter periods on the annually basis;

- Completion of installation of metering devices throughout the heat supply system, including building meters, assessment of the possibility of shifting to individual apartment heat metering;
- Improvement of local heat supply systems on the basis of economic efficiency, coordination of centralization and de-centralization of heat supply.

➤ **Gas sector**

The following main tasks are outlined for the gas sector: optimization of natural gas consumption and increase of production, raising efficiency of gas distribution networks operation, GTS mains, underground gas storage facilities (UGS), etc.

Optimization of natural gas consumption balance. As regards consumption, active measures aimed at raising the energy efficiency of use of thermal energy and natural gas — both by households, and by industrial consumers — will result in reduced volumes of natural gas consumption in the medium-term period and optimisation of consumption in future. Such a result may be potentially reinforced by economic growth of the country. The action plan provided in energy efficiency chapters presupposes reduction of specific indicators of natural gas consumption to the level of the Central and Eastern European countries.

In the context of gas import minimization the primary tasks shall be development of own resource base and increasing extraction. It involves, in particular, promotion of:

- Increase in the scope of geological exploration works, ensuring growth of domestic resource base;
- Improvement and ensuring stability of tax regime for economic operators involved in hydrocarbons production;
- survey drilling at deep horizons and intensification of works in the development of complex hydrocarbon deposits;
- Increase in the scope of exploration and operational drilling, as well as geophysical studies at the deposits that are under development;
- Application of extraction intensification methods at available deposits;
- Construction of boosting compressor stations at deposits with remaining resources and reserves;
- Enhancement of natural gas recovery at the shore of the Black and Azov Seas, including in the offshore zone adjacent to the AR of Crimea upon return of the latter under the jurisdiction of Ukraine with participation of the leading international oil and gas companies;
- Increasing volumes of domestic natural gas recovery, in particular, from unconventional sources.

At the same time, ESU sets the following tasks:

- *For short-term period:* solid revision of contractual relations with the RF via the negotiation process in a trilateral format EU – Ukraine – the RF, for the purposes of changing the scheme of acceptance and transmission of transit gas from the western to the eastern border of Ukraine with the European Union's support;
- *On a regular basis:* diversification of gas supply with minimization of dependence on any individual supplier or specific route;

Gas distribution systems in Ukraine. Due to unsatisfactory condition and imperfect structure of the GDS there is a risk of increased accident rate and natural gas losses in the distribution networks. For the purposes of solving these root problems special action plan will be developed.

Main GTS and UGS facilities. To achieve the ESU goals related to integration of the national GTS into the European one a set of steps aimed at ensuring maximum reliability, openness and transparency of the GTS operator's activity shall be taken. Implementation of this set of activities requires primarily separation of the gas transmission system operator from the vertically integrated company. This will contribute to a non-discriminatory and transparent access of natural gas market participants to the GTS and UGS capacities, as well as to engagement of foreign partners in the Ukrainian GTS management.

As for today the use of the UGS facilities is somewhat limited. Such limitations are caused by:

- Reduction of seasonal variations in the cost of natural gas due to reduced demand and increased capacity of pipelines in the nearest future;
- Availability of excessive UGS capacities in many European countries;
- Current technological regimes of the domestic UGS functioning;

- Improvement of interconnections with some countries as a result of use of interconnectors, which balances their markets.

At the same time potential of UGS is estimated as considerable. This allows attracting new partners, increasing efficiency of its maintenance, technical parameters and using best international experience in management thereof. In the last years Ukraine used up to 60% of total USC capacity for its own needs (48% in 2016). Thus, available capacities of UGS that can be used for seasonal storage of natural gas by other companies, including those foreign, are amounted to 8–15 bln cubic meters.

The main activities aimed at the implementation of strategic goals in the gas sector:

Natural gas market

- Taking necessary steps to meet the Ukrainian needs for domestic natural gas (with further opportunity for launching its export) till 2020 and further;
- Establishing market natural gas prices for all categories of consumers, further introducing targeted subsidies and monetization scheme, expected economic growth and consumer income (contributing to gradual increase of settlements for natural gas consumed to the level of no less than 98%);
- Bringing the energy legislation of Ukraine into full compliance with requirements of EU ENTSO-G network codes, setting natural gas transmission and storage services tariffs according to best EU practices, in particular, setting of tariffs for entry/exit points to/from the GTS;
- Establishing independent GTS operator via completion of its separation from the vertically integrated company and involvement of partners in the Ukrainian GTS management;
- Ensuring competition in all the segments of the wholesale and retail natural gas supply market, including supply to households and district heating companies;
- Improvement of regulation, operational efficiency and transparency of GTS/UGS/GDS operators' activity;
- Development and increase of liquidity of energy markets, in particular power exchanges, etc;
- Safeguarding consumer right to switch suppliers and providing support to end users in this process (including through setting up of ombudsmen office).

Issuance of permitting documents concerning subsoil use (applicable also in oil sector)

- Improvement of mechanism for administration of preparation of documents on allocation of land plots, licensed areas, approval of piping through agricultural land plots, water and forest areas, issuance of archaeological permissions, etc.
- Increasing transparency and consistency of issuance of special subsoil use permits;
- Ensuring non-discriminative access to geological information;

Natural gas extraction

- Creation of conditions for increase in the scope of natural gas extraction;
- Balanced state regulation and enhancing competence and efficiency of industry management, minimization of political influence on extraction companies;
- Involvement of foreign investors and partners, which apply best practices of hydrocarbon development and use state-of-art technologies, for the purposes of implementation of new capital-intensive projects or application of comprehensive approach in development of existing deposits;
- Introduction of accounting of hydrocarbon extraction on the level of separate wells;
- Improving accounting policy in the field of hydrocarbon extraction and introduction of EITI transparency standards for extractive industries, including development, approval and introduction of industry-specific methodology of cost accounting in individual hydrocarbon deposits;
- Creation of conditions, ensuring proper quality of technological equipment and involvement of the leading world companies in exploration of areas and development of oil and gas deposits in order to enhance domestic extraction of hydrocarbons.

As regards management of companies, the assets of which are located on temporarily occupied territories, a legitimate legal entity *Chornomornaftohaz State Joint-Stock Company* Public Joint-Stock Company shall be preserved, since it is a legitimate claimant against the RF for efficient protection of Ukraine's interests in international courts.

Gas distribution systems

- Settlement of the ownership issue, i. e. solving the problem of the lack of incentives to investment in gas distribution system, in particular through carrying out independent valuation of assets;
- Transparency and control, i. e. facilitating 100% installation of meters for all consumers;
- Renewal of outdated meters, installation of system for remote accounting and automatization of balancing;
- Facilitating measures aimed at increasing efficiency of the gas distribution system;

- Development and implementation of specific economically viable projects for optimisation and modernization of gas distribution system, reconstruction of necessary outdated networks;
- Considering introduction of incentive-based tariff setting.

Transmission and storage of natural gas

- Optimization of GTS capacities and technological parameters of its functioning, taking into account anticipated load scenarios;
- Implementation of European energy legislation, in particular, standard EU network codes, application of the best business practices of the European GTS operators;
- Bringing relations between the national GTS operator with all the transmission service consumers into conformity with energy legislation of Ukraine and the EU;
- Carrying out studies for the purposes of future implementation of most efficient options of using GTS and involvement of European energy companies in gas storage in Ukrainian UGS facilities;
- Involvement of a qualified partner in the GTS management in order to increase trust of European energy companies in respective services and keep the transit partner status of Ukraine, including as a result of relocation of Russian natural gas transmission points to the Ukraine — RF border;
- Taking steps to enable participation of Ukraine in gas transmission infrastructure development projects in Central and Eastern Europe;

Importance of natural gas in the liquefied form (LPG) will increase in the nearest future. The attitude to compressed natural gas, which is now mainly used for automotive transport, also may change. Proper justification of the CNG and LNG projects and their proved competitiveness will allow considering them as perspective.

➤ Oil sector

Oil and oil products consumption

- Promoting rational use of motor fuel and other energy resources via development of the respective technologies and application of high-technology equipment;
- Stimulation of increased use of environmentally safe motor fuels, increasing share of environmentally safe fuels in the consumption balance and promoting its further growth;
- Support of introduction of energy efficient, rational and environmentally safe technologies throughout the process: from production of oil products to supply thereof to end users.

Extraction of oil and gas condensate

- Development of new deposits and horizons (drilling of lateral holes, etc.);
- Construction of new wells at available deposits in order to increase oil and gas condensate extraction, determination of location of their remaining amounts on the basis of permanently functioning geological and technological models;
- Increasing transparency and publicity of issuance of special permits for subsoil use, ensuring its consistency, reducing the terms and the number of procedures related to issuance of special permits for subsoil use;
- Promoting development of deposits with hard-to-recover and depleted oil reserves via setting justified rent fees for deposit use;
- Promoting high-quality 3D seismic studies, provision of services, drilling of exploration wells in new areas and deposits;
- Ensuring non-discriminatory access to high-quality geological information and its exchange;
- Promoting active use of progressive methods and technologies to increase reservoir recovery rate
- Facilitating modernization of equipment and infrastructure, optimization of extraction from existing wells via repair/ replacement of electric borehole pumps, water insulation works; timely complete repairs of wells, logging operations, etc.

Processing of oil, gas and gas condensate

- Development of favourable policy for technical refurbishment and upgrading of OPP and UGS facilities using modern deep processing technologies;
- Establishing favourable tax conditions, tariffs and investment climate for crude oil supply for processing;
- Covering at least 50% of the internal market's needs for oil products not lower than Euro-5 standard with domestic output;
- Improving state system of oil product quality control (enhancing motor fuel quality standards and control over the compliance);

- Introduction of the system of market supervision over motor fuel quality, introduction of measures aimed at promoting compliance with defined quality standards and enhancing public awareness about companies responsible for poor-quality fuel distribution.

Oil transportation and diversification of supply

- Maintenance of the OTS of Ukraine in proper technical condition via maintenance, examination, repairing, reconstruction, technical refurbishment of equipment, systems and facilities of the oil pipeline system according to relevant regulatory documents;
- Further improvement of the efficiency of the system functioning in order to ensure its competitiveness in oil transportation services market;
- Efficient use of capacities of the OTS of Ukraine to ensure reliable functioning of available oil transportation routes and creation of new transportation directions;
- Extending volumes of oil transportation to domestic OPP, as well as by transit across Ukraine;
- Active participation in the projects relating to the integration of the OTS of Ukraine with oil transportation systems and oil processing facilities of other countries for the purposes of alternative supply;
- Raising competitiveness of oil supply from alternative sources on the basis of relevant tariff policy, reduced port duties, etc.;
- Ensuring protection of investments in oil transportation projects;
- Introduction of advanced technologies of transportation of different oil types and oil blending (mixing);
- Ensuring high environmental operational standards;
- Development of sea facilities of the oil transportation infrastructure to ensure flexibility and multimodality of oil and/or oil product supply;
- Increasing efficiency of operation of existing infrastructure for non-Russian oil supply to Europe;
- Carrying out activities aimed at promoting implementation of trans-European pipeline projects.

Oil products, liquefied and compressed gas market

- Taking measures aimed at ensuring reliable energy supply and protection of the energy infrastructure, diversification of oil products supply sources and routes, including overcoming dependence on the supply of energy resources from RF;
- Creation of conditions for reduction of dependence on import via expansion and use of domestic production capacities and diversification of import (no more than 30% from every single source);
- Ensuring competitive prices for consumers, reflecting real cost and quality;
- Introduction of state system of control over the quality of oil products and LPG;
- Creation of conditions and development of the respective infrastructure for further expansion of LPG and CNG use as a motor and heating fuel;
- Ensuring Ukraine's transition to the European gas quality standards EN 589;
- Bringing Ukrainian legislation in conformity with the requirements of EU directives as regards technological, fire and environmental safety at companies;
- Restoration of intermodal logistic network (railway + motor transport) based on central terminals (GDS): plant — producer — railway — GDS — low-tonnage motor transport — retail trade;
- ensuring further development of LPG supply through the ports of the Black and Azov Seas and western borders of Ukraine;
- Ensuring the most efficient use of infrastructure and transport fleet for LPG import by railroad.
- Creation of legal framework for raising economic attractiveness of purchase, manufacturing and use of compressed gas vehicles.
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Creating reserves of oil and gas resources

- Proper justification of the amount of strategic gas reserves and the concept of their creation using the world experience, establishing sustainable rules for a certain period with the possibility for their revision and adjustment no more than once in two years;
- Ensuring fulfilment of deadlines related to fulfilment of commitment to create the MROO;
- Creation of minimum oil and oil product reserves according to the 90-day (or 61-day) standard, establishing mixed management system; optimization of reserves according to consumption structure in the regions as well as to use scenarios;
- Assessment and substantiation of the LPG reserves creation as an additional reserve fuel for the Ukrainian economy.

➤ Coal sector

Key public goals in the coal sector during the First Phase of the ESU implementation:

- Optimization of the structure of extraction and other state companies of the coal industry, improvement of economic and technical activity indicators, reduction and liquidation of regulation and public support of the operational activity of coal extraction and processing companies;
- Development of the necessary infrastructure for improving Ukraine's capacity to carry out coal products export and import operations.

The main activities aimed at implementing strategic goals in the coal sector are the following:

- Reorganisation of coal extraction and other state owned companies operating in the coal sector and subordination thereof to one legal entity;
- Liquidation of non- specialised assets;
- Sector restructuring, preparation of prospective state mines for privatisation, liquidation/conservation of loss-making mines;
- Transition to self-financing extraction with re-orientation of state support towards protection of labour, environment and coal sector restructuring;
- Liquidation of public wholesale coal buyer and introduction of exchange trade in coal products;
- Ensuring development of domestic coal extraction.

Activities aimed at closure/conservation of loss-making state mines will be completed till 2025. Social and environmental consequences mitigation plan will be approved for each separate facility. In this framework the best world practices of mitigating social consequences, which, in particular, involve severance pays, consultative assistance to dismissed personnel, professional training and re-training, shall be applied (involving large-scale international assistance).

Measures aimed at mitigation of social consequences of coal industry restructuring shall be coordinated with programs for social reconversion of regions, where mines are closed/ conserved. This also shall be carried out based on the large-scale international assistance. According to the best European practices such programs envisage arrangement of community works for infrastructure restoration, creation of new jobs, consultative and financial support to entrepreneurial initiatives, establishment of business incubators and introduction of temporary special regimes of economic activity in the mine closure raions.

Besides, in course of mine conservation and liquidation it is necessary to take steps aimed at reducing environmental risks, the most threatening of which are the following:

- Waste banks and pit heaps that are burning, possible slides;
- Violation of hydrological regime and flooding of soil surface;
- Release of methane from closed mines to the surface.

➤ Nuclear fuel sector

The primary task in the sector is to ensure increase of uranium and zirconium reserves, preparation of deposits fit for open mining for commercial development, development of explored deposits and optimization of extraction.

Ukraine produces components for nuclear fuel fabrication. It would be expedient to expand the range of such components, including those of zirconium, for further development and import substitution of nuclear fuel fabrication.

The key tasks are the following:

- Further diversification of the sources of nuclear fuel supply for NPP;
- Actualization of the general state program for development of mineral and raw material base of Ukraine in the long-term period aiming at expanding its own resource base of uranium and other minerals via exploration, development and putting new uranium deposits into operation;
- Assessment of possibilities for creation of nuclear fuel fabrication capacities in Ukraine;
- Creation of a storage of nuclear fuel (uranium concentrate);
- Development and approval of the Concept for Handling Spent Nuclear Fuel of NPPs of Ukraine.

➤ Renewable energy sources

Sustainable expansion of the use of all the types of renewable energy is expected. It will become one of the tools of guaranteeing energy security of the state. The ESU provides for increase of the share of renewable energy up to 12% of GPES in the short- and mid-term period (till 2025) and not less than up to 25% till 2035 (including all hydropower capacities and thermal energy).

Wind and solar energy. If the RES further become cheaper, their economically substantiated potential will increase. Therewith expansion of the use of renewable energy directly by consumers shall not be subject to energy system restrictions and shall form the opportunity for dynamic local development. The state policy must be oriented at encouragement of private market player's initiatives. Development of decentralized renewable energy (e.g., photoelectrical systems and solar collectors on the roofs of residential buildings, etc.), estimated capacity of which is ~5% of electricity consumption by residents, shall also be promoted.

Biomass. The share of the electricity sector using solid biomass and biogas as an energy resource will increase. This results from relative production stability (in case of resource base availability) and a trend of local generating capacity development.

Preference is given to simultaneous production of thermal and electric power with co-generation facilities and replacement of hydrocarbon fuels.

Hydropower. Hydropower plays an important role in the stability of the UES of Ukraine since it provides the energy system with highly flexible capacities for regulation of daily schedules of load, coverage of the peaks and filling night gaps/ Moreover it has the function of emergency capacity reserve.

It is necessary to complete reconstruction of existing HPPs capacities, as well as construction of HPPs and HAPPs by 2025. This will allow preserving the most economical and flexible of them in the generation structure, as well as to increase capacity thereof.

The main activities aimed at implementation of strategic goals in the RES sector:

- Application of sustainable and predictable policy as regards facilitation of SPSs and WPSs construction;
- Arranging international communication campaigns to attracts international strategic and financial investors to the RES market;
- Construction and putting into operation of 5 GW capacities of RES (except high-power hydropower plants);
- Increasing use of biomass in generation of electric and thermal power via:
 - Promoting use of biomass as a fuel at companies generating biomass as a residual product;
 - Informing about the possibilities of biomass use as a fuel in individual heating;
 - Promoting creation of competitive biomass markets/

Management system

- Exclusion of political influence on the economic activity of state companies, in particular taking into account leading corporate governance standards (e.g., OECD principles);
- Distribution of functions and mandates of the authorities in regulation of each energy market in line with requirements of the Third Energy Package;
- Introduction of modern practices of corporate governance of state energy companies;
- Introduction of the practice of analysis and responding energy facilities operation threats at the level of business entities (contingency planning);
- Decentralization of authorities, transfer of resources and responsibilities for provision of the housing and utility services and functioning of municipal energy to the local level;
- Promoting decentralization of energy supply systems, use of local fuels and renewables;
- Ensuring publication of the structure of natural gas, electricity, heat energy and transmission tariffs for to consumers.

3.2. Optimization and innovative energy infrastructure development (till 2025)

The second phase of energy strategy implementation will be focused on operation in market conditions featuring better competitive environment that influence the choice of the generation type and decisions on selection of facilities to be modernized or newly constructed in order to achieve higher energy efficiency values. This phase envisaged complete integration of the UES of Ukraine into the European energy system.

General actions:

- Development of target energy balance till 2035;
- Defining expediency of conservation of TPPs with due account of the dynamics of electricity market development;
- Development of the program for replacement of disposed capacities with new ones, with specification of the structure of new capacities by the generation types and according to GPES forecast development of the relevant replacement mechanism.

➤ **Electricity generation from fossil fuels**

Capacities ensuring ~80% of current production (~20–25 GW) may be taken out of operation with no opportunity for operational period extension till 2035. Considering the time needed for design and construction of capacities to replace them, including cycling (flexible) ones used to balance energy system, decisions on the targeted configuration of capacities that will be operational after 2035 shall be approved by 2020.

In particular, in nuclear power industry the following shall be envisaged:

- Approval of decision on extension of the operation period of functioning power blocks of NPPs based on the results of regular security re-assessment;
- Putting into operation NPPs with total installed capacity of 1 GW;
- Design and construction of nuclear power blocks under the Program of Nuclear Power Development of Ukraine.

➤ **Networks and metering**

- Creation of conditions for completion of projects for improvement of energy system reliability, improvement of connection with the continental Europe energy system, liquidation of restrictions in the capacity of generating companies;
- Promoting introduction of “smart grids” and “smart metering” of users’ electricity consumption;
- Facilitating creation of infrastructure for electric transport development, including public transport;
- Enhancing security of energy supply (SAIDI, SAIFI).

➤ **Environmental protection**

- Setting new objectives of greenhouse gas emission reduction and ways to reach them

➤ **European integration**

- Development of regulatory framework for Ukraine’s participation in the regional association of electricity markets;
- Integration of the Ukrainian energy system into the ENTSO-E’s Continental Europe zone in operation regime.

➤ **Energy efficiency**

- Enhancement of requirements for equipment and buildings (standards, regulations, certification, etc.); introduction of energy efficiency standards for transport;
- Development of infrastructure and institutions for concentration and provision funding to undertakings for the purposes of technological modernization (exchange market development, commercial crediting expansion);
- Introduction of the mechanisms of energy efficiency promotion between domestic consumers (energy service, energy audit, financial tools, etc.); support of initiatives aimed at raising energy efficiency of buildings, implementation of demonstration and pilot projects.

➤ **Heat supply**

- Development of local energy systems considering economically justified potential of local types of fuel, supply logistics, regional and national energy infrastructure;
- Promoting reconstruction of heat network units for the purposes of minimization of losses;
- Facilitating implementation of projects related to co-generation at CHPs and biofuel co-generation;

- Support of construction of high efficiency cogeneration, reconstruction of CHPs in accordance with requirements of environmental standards and introduction commercial settlement system based on quality indicators of heat supply and cooling services;
- Re-assessment of technical and economic characteristics of projects related to long-range heat transportation from large energy facilities (TPPs and NPPs) and approval of decisions on the expediency of their implementation;
- Development of a program for support of modernization or replacement of outdated boilers, transition of heat consumers to autonomous and/or individual heating, where this is economically expedient;

➤ **Gas sector**

- Creating conditions and facilitating keeping achieved levels and further increase of domestic production, in particular, at continental shelf and within exclusive (marine) economic zone of Ukraine;
- Optimization of sources, routes and ways of diversification of natural gas supplies, including export;
- Creation of conditions for full-fledged functioning of the liquid domestic gas market with a view to establish a gas hub on their basis and on the basis of technical capacities of the GTS and the UGS facilities of Ukraine;
- Participation of the GTS and UGS operators in sales agreements on natural gas transportation and storage services in the domestic and European markets of such services;
- Optimization of the GTS capacities in line with its estimated load and concluded agreements;
- Creating conditions for integration of Western Ukrainian UGS facilities into the security supplies system of the Eastern European countries and EU in general;
- Promoting introduction of smart metering and automated gas balancing system;
- Facilitating expansion of opportunities for further improvement of the efficiency of available capacities and implementation of new infrastructural projects.

➤ **Oil sector**

As regards raw materials *supply*:

- Further increase in the scope of geological exploration, as well as oil and gas condensate extraction — mainly for the needs of domestic consumers;
- Optimization of the sources, routes and ways of supply diversification;
- Establishing and ensuring permanent preservation of the general crude oil and oil product reserves that is (higher value out of the two): 1) equivalent to the volume of at least 90-day average daily import into Ukraine, or 2) the volume of 61-day average intraday oil and oil product consumption in Ukraine.

As regards raw materials *transportation*:

- Creating conditions and encouraging supply of oil and gas condensate to Ukrainian processing enterprises, in particular, by sea or pipelines.

As regards raw materials *processing*:

- Facilitating production of the fuels safe for the consumer and the environment, in particular, LPG, LNG and CNG, second generation biofuel, as well as use of electricity in transport.

As regards oil products *supply*:

- Keeping volumes of supply of each type of oil products from one supplier at the rate of no more than 30% of the overall import;
- Increasing the share of renewable energy used in transport up to 20%.

As regards oil products and motor fuel *retail trade*:

- Gradual approximation to the standards of oil products quality and taxation rates applied in EU Member States;
- Creating incentives for wide use of gas and alternative (to oil) fuels;
- Promoting development of “fuelling stations” chains offering fuels that are safer for consumers and the environment.

➤ Coal sector

Completion of implementation of industry reform program, including reform of state mines (second phase):

- Privatisation of perspective state-owned mines prepared during the first phase;
- Optimization of economic and technical activity indicators, reduction and liquidation of regulation and financial support of operation activity of coal extraction and coal processing companies after the reintegration of the UCT of Donetsk and Luhansk oblasts;
- Liquidation/conservation of inefficient mines, implementation of social and environmental consequences mitigation plans for each company;
- Implementation of programs of social reconversion of mine closure regions;
- Reaching the level of coal production sufficient to cover the major part of energy coal demand with domestically produced fuel.

➤ Renewable energy sources

- Facilitating SPS and WPS construction, promoting creation of electricity generation forecasting system;
- Commissioning of new HPP and HAPP units (provided that environmental safety of the projects is confirmed);
- Increasing use of geo- and hydrothermal energy for the purposes of heat energy generation;
- Increasing biomass use in electricity and heat generation;
- Promoting electricity generation by low-capacity RES plants;
- Ensuring implementation of projects aimed at local energy supply decentralization (using renewable energy, “smart grids”, increasing energy efficiency);
- Creating conditions for development of the system of logistics and infrastructure for collection of biological raw materials and their further transportation;
- Exploration of possibilities and, if expedient, introduction of use of accumulation systems to balance the energy system, including for the purposes of levelling volatile functioning of RES generating capacities;
- Improving the mechanism for stimulation of production of energy equipment in Ukraine.

3.3. Ensuring sustainable development (till 2035)

The third strategy phase is focused on innovative development of the sector and construction of new generating capacities. Besides optimization and construction of additional generation capacities, it is also expected that in the long-term period a number of measures will be taken to optimize consumption structure via reduction of losses in grids, level consumption peaks as a result of smart grids introduction and use of new energy accumulation technologies.

- Consideration of possible alternative approaches to tariff setting after completion of grid facilities refurbishment (in particular, Price Cap Regulation);
- Introducing commercial payments system based on quality indicators of heat and cooling services provision;
- Transfer of heat energy consumers to individual heating, where it is economically expedient.

➤ Gas sector

- Investing into the exploration and development of new gas and gas condensate deposits, including those situated at continental shelf and within exclusive (marine) economic zone of Ukraine;
- Increasing volume of domestic extraction up to 30-35 bln m³/year as a result of natural gas extraction from unconventional hydrocarbon deposits;
- Continuation of involvement of the leading world companies in the development of the Black Sea coast and development of unconventional hydrocarbon deposits;
- Carrying out comprehensive technical, institutional and legislative integration into the European gas transmission networks, cooperation with the countries of the North-Western, South Europe and other regions for the purposes of joint implementation of projects aimed at diversification of natural gas supply to the Central and Eastern Europe;
- Ensuring participation of Ukraine in international projects aimed at resource base developing and advanced technologies sharing.

➤ Oil sector

As regards raw materials extraction:

- Completion of digitization of oil deposits via development of visualized web platforms, which enable business entities to measure and trace all the data coming from the deposit;

- Increasing the volume of extraction of hard-to-recover resources using advanced intensification technologies; facilitating development of raw materials consumption optimization technologies.
-

As regards raw materials *processing*:

- Transition from “dirty” processes to technologies meeting the “green chemistry” and energy saving principles;
- Focusing on petrochemical industry development, using by-products and waste from other industries;

In the field of oil products *sales*:

- Promoting development of electric “fuelling stations” network and substitution of hydrocarbon fuel.

➤ **Coal sector**

- Maximizing efficiency of production for Ukraine’s domestic needs;
- Completion of implementation of measures for social reconversion of regions and settlements where mines were closed.

➤ **Renewable energy sources**

Increase of RES share up to 25% of the GPES via:

- Putting into operation new units of HPPs (provided that environmental safety of the projects is confirmed);
- Expansion of the infrastructure for vehicles using non-hydrocarbon fuels;
- Ensuring functioning of district heating systems working on renewable energies (biopelletes, domestic waste, etc.);
- Replacement of carbon fuel types with other types, where it is economically grounded and technical feasible.

Successful implementation of social and economic reforms and improvement of the quality of state governance are the pre-conditions for implementation of the aforementioned ESU tasks.

4. CREATING PRE-CONDITIONS FOR INVESTMENT ATTRACTIVENESS

A fundamental pre-condition for development of favourable investment climate in the energy sector is substantial improvement of the business climate in Ukraine in general, including affirmation of the rule of law, introduction of independent permanent and efficient supervision over competition, as well as prompt introduction of market pricing conditions based on non-discrimination principles.

In view of the aforesaid, it is necessary:

- To establish transparent and liquid energy markets;
- To implement the Law of Ukraine “*On Electricity Market*”, as well as the respective by-laws, to integrate the Ukrainian infrastructure and regulatory framework with those of the EU countries;
- Integration of the energy infrastructure of Ukraine into the European one.

Also, integration with ENTSO-E and ENTSO-G is necessary from the technical, institutional and legal points of view. Ukraine, as a member of the Energy Community, will apply joint regulatory policy with the EU countries, namely will improve legislation regulating the activities in the energy sector with due account of the EU *acquis* requirements.

Investment attractiveness of the Ukrainian economy and, primarily, of its energy sector will remain insufficient in case of failure to take a set of measures aimed at encouraging investment and preventing the outflow of domestic funds through tax heaven schemes.

Considering the foregoing, the following is necessary:

- Taking transparent tactical decisions that definitely meet the set long-term goals indicated in ESU;
- Development of clear and understandable mechanisms of public private partnership and transparent European-based regulation of investment into the FEC;
- Development of programs and investment projects for achievement of top national priorities set in the ESU, meeting business’ and consumers’ interests;
- Availability of understandable mechanisms of ensuring adequate return on invested capital;

- Application of clear mechanisms of ensuring better competition, including through granting third party access to existing infrastructure, and adequate profitability of energy companies having the features of natural monopolies (for instance, via introducing tariff setting according to the price cap regulation principles);
- Taking steps to prevent outflow of the capital of energy distribution and gas distribution companies (oblenerho, oblhz) to tax havens;
- Comprehensive introduction of transparent public procurement mechanisms;
- Introducing tax legislation, which promotes investment into the FEC, in particular, into RES and energy efficiency improvement.

5. THE ESU PERFORMANCE MONITORING

The ESU implementation shall be coordinated and controlled by the Cabinet of Ministers of Ukraine and the National Security and Defence Council of Ukraine within their competences.

The Government of Ukraine shall ensure control over the necessary organizational and administrative steps related to mandatory consideration of the ESU provisions in:

- approval of programs and action plans of executive authorities;
- development of draft laws and regulations;
- approval of social and economic development programs (at the national, sectoral and local levels);
- provision of state aid to business entities (preferential credits, certification and licensing, etc.);
- annual approval of estimated (for five years) balance of production and consumption of fuel and energy resources of Ukraine (under the IEA form);
- introduction of requirements related to development of contingency plans, including emergency plans in the energy sector of Ukraine for the purposes of ensuring energy security of the country;
- setting and regular adjustment of the energy security assessment indicators, with due account of current energy security threats and risks.

Objectives, tasks and mechanisms of the ESU implementation shall be taken into account while developing action plans for state authorities, business entities and state target programs.

Ministries, departments and regulating authorities, the activity of which is related to legal relations in the field of energy, shall participate in the policy development and ensure the ESU implementation in their respective field. The ESU provisions shall also be taken into account by state authorities and local self-government bodies, economic entities in the development of their operation plans.

Responsibility for the ESU development, monitoring of results, coordination and specification of measures related to its implementation shall be placed on the main central executive authority responsible for the development and ensuring implementation of the state policy in the fuel and energy sector (MECI).

The MECI shall ensure monitoring of the ESU implementation and make proposals on adjustment of target values and strategy implementation mechanisms. Monitoring of the ESU implementation shall be performed on the basis of the indicators (“goalposts”), provided in *Annex 1*.

To ensure sustainability of the state energy policy and implement the ESU objectives the MECI shall:

- develop an action plan for ESU implementation that will be subject to approval by the Cabinet of Ministers of Ukraine;
- prepare and publish the National Report on the State Energy Policy Implementation. The report shall assess in detail the dynamics of the ESU objectives achievement, effectiveness of steps taken (or reasons not taking them) and suggest the mechanisms and tools for the next phase of the ESU implementation;
- carry out annual monitoring of consideration of the ESU provisions in the activities of energy sector entities and publish respective report;
- submit an annual ESU implementation progress report to the Cabinet of Ministers of Ukraine and the National Security and Defence Council of Ukraine.

Regulatory authorities and national regulators shall ensure:

- taking into account the ESU provisions and objectives in development of legislation regulating activities in the energy resources markets and markets of ancillary services;
- balance of interests of the state, natural monopolies and consumers of goods (services) produced (provided) by the natural monopolies;

- reflection of the ESU provisions and objectives in the requirements for licensed activity in energy resource markets and markets of ancillary services.

Ministry of Economic Development and Trade of Ukraine shall ensure consideration of the ESU provisions in the development and implementation of the state economic policy via:

- development of draft state targeted programs;
- development of state programs for business support and implementation of public private partnership programs;
- coordination of foreign economic policy, determination of economic cooperation priorities in a dialogue with trade partners;
- encouragement of structural changes in the economy through raising the share of industries with low energy intensity of final products (engineering, light industry, fine chemical industry, etc.) in the GDP structure, development of service sector;
- optimization of technological chains in existing resource- and energy intensive industries to obtain products with higher degree of processing and creating more added value per unit of resources/energy.
- Improvement of the system of collection, systematization and dissemination of energy statistical information

Ministry of Regional Development, Construction and Housing and Communal Services of Ukraine shall ensure fulfilment of the ESU provisions via:

- development and implementation of the state policy in the field of heat supply to settlements (municipal heat supply, heat supply to social and budget sectors and individual consumers, scheme for optimization of local district heating systems);
- approval of regional programs for modernization of public heat energy facilities;
- approval of plans (schemes) for development of local heat supply systems;
- coordination of investment plans of utility heat energy companies;
- development of strategic initiatives concerning energy efficiency of buildings and constructions.

Ministry of Foreign Affairs of Ukraine shall ensure that the ESU provisions are taken into account in the foreign political activity of Ukraine via:

- holding negotiations and signing international treaties, participation of Ukrainian party in international initiatives on energy and climate change;
- representation of Ukraine's views in international organizations, development of strategic energy and environmental initiatives at the international level;
- advocating the interests of Ukraine's energy sector in implementation of projects of transboundary energy infrastructure development, regional energy market development;
- holding preliminary consultations and negotiations on the ways of diversification of the sources of energy supply to the country and their export to the external markets.

Ministry of Ecology and Natural Resources of Ukraine shall ensure:

- consideration of the ESU provisions in the foreign policy of Ukraine in negotiations, conclusion of international treaties and participation of Ukraine in international initiatives on climate change and environmental protection;
- consideration of the ESU provisions while drafting low carbon development strategy of Ukraine in the framework of the Paris Agreement;
- creation and functioning of greenhouse gasses emission credits trading scheme;
- fulfilment of obligations undertaken by Ukraine in the framework of Paris Agreement, Kyoto Protocol and United Nations Framework Convention on Climate Change;
- control over fulfilment of international environmental treaties, in particular, obligations related to introduction of environmental impact assessment under the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), etc.

Local executive authorities, local self-government bodies shall ensure the ESU implementation within their respective competences, in particular, via:

- development and approval of plans (schemes) for development of local energy supply systems, regional programs for modernization of public heat energy sector;
- approval of investment plans of public utility energy companies;
- unlocking local energy saving, energy efficiency and renewable energy potential.

Civil society shall exercise public control over the activities of executive authorities in the framework of the ESU implementation via:

- public evaluation of draft regulations;
- participation in public councils within state bodies responsible for energy policy implementation and informing the society on the activities of executive authorities related to the ESU implementation.

Annex 1

to Energy Strategy of Ukraine for the period up to 2035 “Security, Energy Efficiency, Competitiveness”

Table A.1. Key ESU performance indicators over time

Description of the key performance indicator	Type	2015	2020	2025	2030	2035
Improved energy efficiency						
GDP energy intensity, GPES in toe/thousand dollars of GDP (PPP)	Objective	0.28	0.20	0.18	0.15	0.13
Fuel consumption for electricity volume directed to the energy market, generated by TPPs, grams of s.f./kWh	Objective	396	384	367	353	334
Specific costs of heat production at boiler houses, kg of s.f./Gcal	Objective	165	160	155	150	145
Loss percentage in electric networks, %	Objective	>12%	10%	9%	8%	<7.5%
Loss percentage in heat distribution networks, %	Objective	>20%	<17%	<13%	<11%	<10%
Energy independence						
Integration with the continental part of the ENTSO-E European energy system	Objective	Not achieved	Not achieved	Achieved	Achieved	Achieved
Need for gas import from the RF to balance demand, bln m ³	Limitation	6.1	0	0	0	0
The share a single supplier in the nuclear fuel market, % (in each separate stage of NF generation)	Limitation	>90	<70	<60	<60	<60
Import dependence (gross import of energy resources in GPES, %)	Limitation	51.6%	<50%	<33%	<33%	<33%
Level of integration of the electricity (gas) markets of Ukraine and the EU, % (cross-border capacity of interconnectors compared to domestic market volume)	Objective	2 (20)	2 (30)	15 (40)	15 (40)	18 (40)
Security of service						
SAIDI (as the result of unplanned interruptions for the energy company's fault), minutes/year/subscriber	Objective	617	<450	<200	<175	<150
Heat distribution networks in emergency condition, %	Objective	>20%	<18.6%	<4.4%	<3%	<1%
Security and environment						
Share of RES (including hydropower and thermal energy) in GPES, %	Objective	4%	8%	12%	17%	25%
Share of RES (including hydropower and thermal energy) in electricity generation, %	Objective	5%	7%	10%	>13%	>25%
Share of local alternative fuels in local fuel and energy balances, % of the overall consumption	Objective		10	15	18	20

Description of the key performance indicator	Type	2015	2020	2025	2030	2035
CO2 emission compared to 1990 level	Limitation	–	<60%	<60%	<60%	<50%
Reduction of emission in CO ₂ , equivalent final fuel consumption, % of 2010	Objective		>5	>10	>15	>20
Share of heat generation capacities meeting environmental requirements of the EU (SO ₂ , NO _x , ash emissions), %	Objective	<1%	<10%	<40%	85%	100%
Access to energy resources in emergency situations, months of consumption	Objective	0.5	1.5	3	3.5	4
Access to energy resources of private companies in emergency situations, months of consumption	Objective	0.5	1	1	1	1
Strategic energy resources reserves, months of consumption	Objective		0.5	2	2.5	3
Minimization of total costs of energy generating systems						
Electricity and heat costs to GDP (nominal), %	Limitation	5.6%	<6%	<6%	<6%	<6%
Share of exchange trade in energy resources, % in internal consumption, including electricity, coal, oil, gas and other fuels	Objective	10%	25	50	55	60

Note:

* *Applicable only for the markets that are not naturally monopolized.*

Annex 2

to Energy Strategy of Ukraine for the period up to 2035 “Security, Energy Efficiency, Competitiveness”

Table B.1. The structure of GPES of Ukraine, Mtoe

Description of primary energy source	2010	2015	2020 (estimated)	2025 (estimated)	2030 (estimated)	2035 (estimated)
Coal	38.3	27.3	18	14	13	12
Natural gas	55.2	26.1	24.3	27	28	29
Oil products	13.2	10.5	9.5	8	7.5	7
Nuclear power	23.4	23.0	24	28	27	24
Biomass, biofuel and waste	1.5	2.1	4	6	8	11
Solar and wind power	0.0	0.1	1	2	5	10
HPP	1.1	0.5	1	1	1	1
Geothermal energy*		0.5	0.5	1	1.5	2
Total	132.3	90.1	82.3	87	91	96

Note:

*Ambient thermal energy and anthropogenic discharges.

Table B.2. Structure of GPES of Ukraine, %

Description of primary energy source	2015	2020 (estimated)	2025 (estimated)	2030 (estimated)	2035 (estimated)
Coal	30.4	22	16.1	14.3	12.5
Natural gas	28.9	29.3	31	30.8	30.2
Oil products	11.6	11.5	9.2	8.2	7.3
Nuclear power	25.5	29.3	32.2	29.7	25.0
Biomass, biofuel and waste	2.3	4.9	6.9	8.8	11.5
Solar and wind power	0.1	1.2	2.4	5.5	10.4
HPP	0.5	1.2	1.1	1.1	1.0
Geothermal energy*	0.6	0.6	1.1	1.6	2.1
Total	100	100	100	100	100
Including fossil fuels	96	92	88	83	75
Including renewables	4	8	12	17	25

Note:

*Ambient thermal energy and anthropogenic discharges.

Table B.3. Indicative estimation of electricity generation till 2035, bln kWh

Components of electricity generation structure (basic scenario)	2015	2020	2025	2030	2035
NPP	87.6	85	91	93	94
TPP/CHPP	67.5	60	64	63	63
Hydro	7	10	12	13	13
RES (solar and wind)	1.6	9	12	18	25
Total (electricity generation)	163.7	164	178	185	195

Estimated volumes of natural gas transit and storage using the GTS of Ukraine

It is highly probable that the volume of the Russian gas transit will amount to 50–80 bln m³/year within 2019. At the same time, as for today there is no documentary ground for transit of the Russian gas through the territory of Ukraine after 2019.

As of 2017 the Stockholm arbitration proceedings relating to the transit contract are going on. Gazprom does not confirm its readiness to sign a new contract, at the same time it gradually and successfully implements its own

projects to build alternative gas transmission routes to Europe (increased gas transmission via the Nord Stream and access to OPAL gas pipelines capacities, projects Norm Stream-2 and Turkish Stream on implementation phase).

Considering success in promotion of initiatives leading to increased dependence of Europe on the Russian gas supplies, received permissions for gas pipeline construction, signed contracts with subcontractors, publicized plans of partial dismantling of the GTS of the RF at the entrance point to Ukraine, it is impossible to make any forecast regarding keeping volumes of the Russian gas transit through the GTS of Ukraine at current levels. It appears that Ukrainian route for the Russian gas supply will continue to exist with the volumes of 15-40 bln m³/year (primarily, in the southern direction, i. e. to the Balkans) until the Turkish Stream will be put into operation in 2019 only due to the sanctions and restrictions in relation to the RF and Gazprom, as well as the effort taken by the European Commission.

It is expected that the volume of gas transmission for Ukrainian consumers will amount to 26-30 bln m³/year; the share of European energy companies in gas transit through Ukraine will make up over 50%; and the share of foreign companies storing gas in Ukraine's UGS facilities will be no less than 20%.