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ALTERNATIVE OPTIONS OF THE INTRODUCTION OF THE 'ENTRY-EXIT' TRANSPORT TARIFF MODEL IN UKRAINE

Compliance to the principles of free access to gas networks on a market basis, objectivity reflection of the system's cost, transparency and predictability of market participants requires changes to the tariff setting rules for transportation services. The introduction of the "entry-exit" tariff model is intended to ensure the achievement of new market requirements and the establishment of common European rules for conducting economic activities. Changing the internal model of gas transportation also results in a change in the pricing principles for services provided by the TSO. Henceforth, the charge for transportation services should be taken not for the transport distance, but for the capacity of the entrance and exit points which should be sold publicly and independently. It allows for a more objective consideration of the operating costs of servicing the system and providing greater commercial variability in ordering system services by business entities.

However, European legislation does not define a single standard for the "entry-exit" model. Depending on the technical features of the network and the priorities of the national policy, each country determines the best option for itself. In this paper we used a set of mathematical models to evaluate the implications of the introduction of three alternative variants of the tariff model in two variants of workload GTS (optimistic and pessimistic scenarios): full "entry-exit" model, two market zones, and "entry-exit" model with a long-term reservation. The results of the calculations were compared with the baseline scenario, which does not involve a change in the market model and gas transit is carried out in accordance with the terms of long-term contracts of 2009.

In general, changing the model for providing transport services in the gas market should lead to fundamental institutional transformations of contractual relations between all market actors and the principles of market functioning.

K e y w o r d s : natural gas market, transport operator, "entry-exit" model, long-term transit contracts

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Under the conditions of absence or ineffectiveness of the state policy on the issues that are vulnerable to the variability of the socio-economic and political environment, international obligations often represent the effective motivational factors for the implementation of reforms. These obligations determine the priority forms and directions of their implementation in the form of a certain "institutional franchise". These include the directives and regulations of the Third Energy Package of the European Union (EU), which Ukraine pledged to implement after joining the Energy Community (EnC) and signing the Association Agreement with the EU. In the natural gas market, the relevant measures are aimed primarily at improving institutional security, market liberalization, increasing its competitiveness, transparency and openness, which in general should contribute to addressing the accumulated over many years of crisis in the oil and gas complex.

The analysis of reforms on the Central European gas markets has shown that the formal implementation of EU directives into national legislation without a practical distribution of transport functions from delivery makes it impossible to promote competition. It leads to the barriers that prevent third-party access (TPA) in gas transmission system (GTS). The absence of available capacities and infrastructural opportunities for diversification of international delivery can lead to market monopolization. One of the most important issues of reforming according to the "European model" is the transformation of the model ***transportation services market*** and the introduction of a tariff-based "entry-exit" model. It essentially involves a fundamental change in economic relations between all market players. However, EU legal documents do not define a single approach to the implementation of the "entry-exit" model. Among the European countries, market changes in the gas transmission and delivery segment have always been put into effect taking into account the technical characteristics of gas transmission system (GTS), the nature of available institutional guarantee, existing international obligations, political expediency, priorities for the development of the gas sector and national economy as a whole.

In Ukraine, despite the existence of the necessary regulatory framework[3], the tariff-based "entry-exit" model is still inadequate and the expert community continues discussing what this model should be. This is due to the fact that previous long-term transit agreements continue to have effect with the outdated tariff-fixing rules, overcharged rate of tariffs for entry/exit points due to the use of accelerated depreciation (it transforms these tariffs into non-competitive ones). As well as at the market uncertain situations often arise due to constant legal lawsuits that withhold the action of important provisions of the National Energy and Utilities Regulatory Commission (NEURC).

[3] The National Energy and Utilities Regulatory Commission (NEURC) A decree dated December 29, 2015 №. 348 introduced new tariffs since January 1, 2016 for natural gas transportation services for entry/exit from the gas transmission system located on the state border of Ukraine and defined the relevant norms for ensuring production and technological costs and regulatory costs natural gas for exit points. In 2017, the Resolution dated March 28, 2017 №. 348 NEURC regulated internal rules for the transportation of natural gas and set tariffs for entry/exit points within the national gas transmission system.

In this article, we will consider several alternatives to the new market model in the field of gas transmission. These alternatives differ in the number of market zones, the conditions of GTS booking capacity and the legal regime of transport operator. This is a so-called full "entry/exit" model, the creation of two separate market zones for domestic transportation and transit. As well as it is a long-term "entry/exit" model. Every option for market transformation is characterized by its advantages and disadvantages that are manifested by various revenues of transport operator and its ability to invest in the upgrading and development of the system or the risks of tariff growth for end users due to changes in the proportions between domestic and transit volumes of transported natural gas. The expanded economic assessment of the consequences from introducing various options of the tariff-based "entry/exit" model is realized using Times-Ukraine's specialized instrumentarium and UGEM based on two forecasts of natural gas transit through Ukraine up to 2025.

Basic conditions and assumptions

The study of the economic consequences of the introduction of a new tariff model for transportation services in Ukraine needs to be coordinated with a number of initial assumptions, in particular regarding the predicted level of GTS load. This assessment should take into account the volumes of natural gas transportation for domestic consumers and for transit operations. In the next 10 years natural gas consumption in Ukraine will be determined by two mutually compensating tendencies: a gradual restoration of the pre-crisis level of economic activity and an increase in using of energy-efficient technologies, individual gas meters, effective (price) incentives for the population to rational use of energy resources. According to calculations made at the Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine [1] the domestic natural gas consumption will remain at the current level approximately 31–33 billion cubic meters (bcm) per year by the year 2025.

In the mid-term perspective gas transit volumes through the territory of Ukraine will depend primarily on the growth rates of the European economy, the gas consumption volumes, the European Union's natural gas production, the infrastructural capacities available for the gas imports from outside of the continent, the observance by the European countries of safety standards and diversification of energy sources and carriers. U.S. Energy Information Administration (EIA) [2] is forecasting that in ten years' time natural gas consumption in the EU will increase by 1.27% annually, while in non-EU countries the consumption will continue to decrease by 0.4%. By the year 2020 in non-EU countries the consumption will increase by 0.07% per year. According to the same forecast, the decrease in gas production in the European countries of OECD (in particular Norway, the Netherlands and the United Kingdom) will cease. In 2023 gas production will begin to increase. Nevertheless, natural gas production of the EU countries will be able to satisfy only half of the gas domestic needs.

If the countries of the region strictly obey the requirements of the Third Energy Package of the European Union the import of natural gas from the territory of the Russian Federation (RF) will not exceed the current volumes by the middle of the next decade [4][4]. These requirements foresee the dependence on one external source of natural gas supply to the EU and the Energy Community countries [3] more than 35%. In this article we will not consider the projects of new international gas transmission routes. We suppose the preservation of the existing gas pipeline capacity from the territory of Russia bypassing Ukraine. Today it is about 115 billion cubic meters (bcm).

However, the actual loading of the bypass routes will be less – at the level of 75,5 billion cubic meters (bcm) since it is necessary to calculate the highly specialized gas pipelines to individual countries with the capacity of 22 billion cubic meters[5], as well as the impossibility of using the Nord Stream gas pipeline to the full extent through the EU antitrust rules. Thus, the situation will remain when the Ukrainian gas transmission network (GTN) will be guaranteed to be used for the transit of natural gas from the territory of the Russian Federation to European consumers, even if the entire existing gas pipeline network is used and the EU Third Energy Package is ignored. Taking into account the above mentioned assumptions which in future will be considered optimistic developments, the annual transit of natural gas from the territory of Russia through Ukraine to 2025 should be about 100 billion cubic meters (Fig. 1).

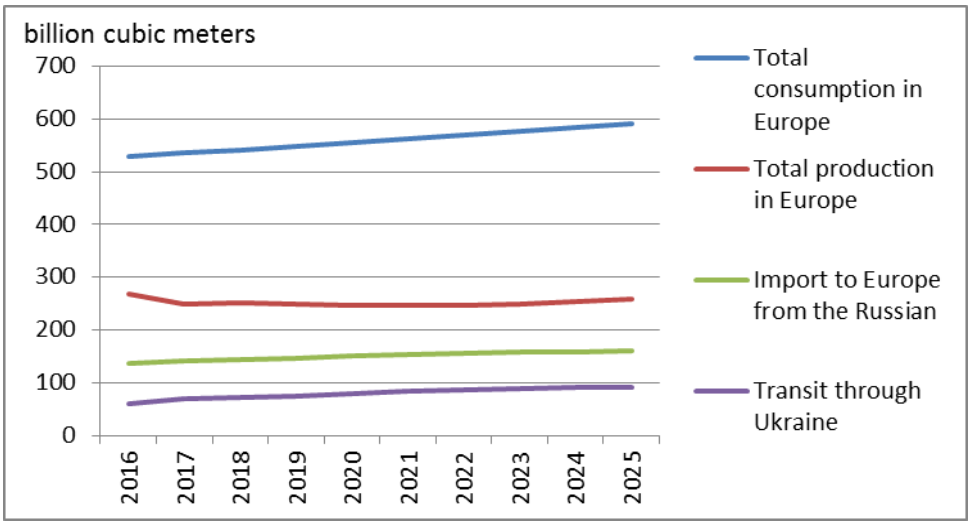

Fig. 1. Optimistic scenario of natural gas transit from the territory of Russia through Ukraine in 2016–2025 *(billion cubic meters)*

Source: own calculations [5].

[4] According to Gazprom Export from 2011 to 2017 the import of Russian gas to the European country ranged from 130,6 to 193,9 billion cubic meters.

[5] Bilateral gas pipelines to countries whose gas transport infrastructure is not connected with other countries and accordingly the supply of natural gas to these countries can not affect the single European gas market.

As an alternative to the optimistic scenario, we use the forecast commissioned by the European Commission [6], which is more restrained in terms of energy demand (or more ambitious in terms of energy efficiency and greenhouse gas emission reduction targets) and foresees an annual reduction in natural gas consumption in the EU by 1,5–0,5%. In other European countries, the reduction of gas consumption by 2020 is expected to be somewhat lower and after 2020 demand will begin increase by 0,07% per year. And although gas extraction among European countries will continue to decline throughout the forecast period, the drop in gas demand in Europe will reduce the transit of natural gas through Ukraine to 50 billion cubic meters per year (Fig. 2).

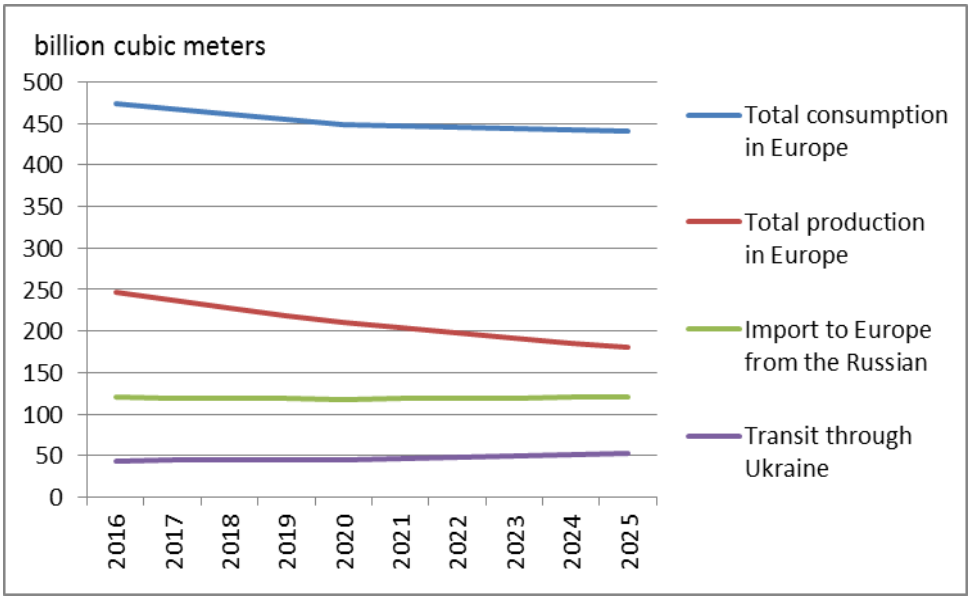

Fig. 2. Pessimistic scenario of natural gas transit from the territory of the Russian Federation through Ukraine in 2016–2025
(*billion cubic meters)*

Source: own calculations [6].

Forecasted estimates of various scenarios of the Ukrainian gas transportation system's load using the complex of mathematical models make it possible to assess the implications of introducing three alternative tariff model variants. These variants were formed on the basis of European national practices for adapting the requirements of the Third Energy Package in the reform of gas markets and the introduction of the model "entry-exit":

– complete "entry-exit" model,

– creation of two market zones,

– "entry-exit" model with long-term reservation.

In the future, the results of calculations should be compared with the baseline scenario which does not involve a change in the market model. Gas transit is carried out in accordance with the conditions of long-term contracts of 2009.

Tariff model "entry-exit"

Principles of free access to networks on a market basis, the objectivity of reflecting system costs, transparency and predictability of market participants' work involve changing the tariff setting rules for transportation services. It seems to be possible to achieve this by introducing a new "entry-exit" tariff model, the basic principles of which is that the payment for transportation services is now taken not from the transport distance, but for the power at the input and output points of the system and the sale of capacities on incoming and outgoing points is carried out independently.

It seems to be possible to achieve this by introducing a new "entry-exit" tariff model. The model is about the payment for transportation services is now taken not from the transport distance, but for the power at the entry and exit points of the system and the sale of capacities on incoming and outgoing points is carried out independently. This makes it possible to more objectively consider the operating costs of servicing the system and provide greater commercial variability to order system services by business entities. The basis of the model is the principle of the division of the transport system into market zones – they can cover the entire territory of the state or some part of it. Natural gas can enter the system at any entry point and leave the network at any exit point. Gas suppliers can reserve the power at the "entry" and "exit" points independently without their reference to each other and the calculation will be done separately for each point. The rates at these points are set by the relevant state authorities in advance and do not depend on the distance of transportation. For each gas distributing zone, the operator of the gas transmission system creates a single virtual point of exit to the gas distribution system, which covers all points of the system, located within the licensing powers of the distribution network operator. If gas distribution or biogas production and other types of gas from alternative sources are connected to the distribution system, then for each gas distribution zone, the operator of the gas transmission system creates one virtual point of entry from the gas distribution system [7].

The introduction of a new model for the transportation of natural gas will change the list of services that a transport operator must provide on the market. Now the responsibility of the GTS operator is to provide access to facilities at the point of entry or exit from the gas transportation system. The ordering of physical transportation of natural gas by the gas transportation system on the basis of the approved nomination and the provision of services for balancing the volumes of natural gas supplied to the gas transmission system and taken from it [8]. The supplier in order to carry out the supply of natural gas must make a typical contract for transportation [9] with the operator of the GTS. In addition, in order to confirm its reliability before the GTS operator, the supplier must make at least 20% of the natural gas cost which is planned to be transported next month on the basis of the planned volumes of natural gas transportation and the estimated cost of the gas base price.

Entry and exit points are set separately and should create preconditions for effective gas trade and competition development. Consumers should be aware of

available maximum capacity taking into account technical security constraints. Power transfer capability should be distributed on the basis of standardized mechanisms in the form of an auction.

Adjacent transmission system operators that function in adjacent market areas should offer common interconnected cooperative services: simultaneous power sales at the entry and exit points. In the event of overloads in the gas transmission system through the prior reservation of capacities, it is necessary to apply the "used or lost" mechanism. The system operator should be delegated the right to sell unused capacity on the main non-guaranteed (intermittent) power "24 hours in advance". Under such conditions there is the possibility of creating secondary sales markets for those who are willing to resell the reserved capacity that they do not want to lose.

The implementation of the "entry-exit" model involves the establishment of daily regimes of balancing in the relevant market area. In case of an imbalance the system operators sell gas to consumers for balancing or in case of an excessive supply of natural gas from suppliers, automatically organize its transportation to gas storage facilities.

Comprehensive "entry-exit" model

The basis for the *first scenario* was the introduction of a complete tariff-based "entry-exit" model for both natural gas transportation services for the transit route as well as for servicing the domestic market. In order to set new tariffs according to the new model it was necessary to analyze the cost of the GTS, to estimate the cost of production of services and on the basis of the implementation of RAB-regulation [10] it is necessary to determine the cost of services in the new methodology. For this purpose the annual reports of "Ukrtransgaz" [11] and "Naftogaz of Ukraine" [12] were used to estimate the cost of the GTS components and the cost of production of services / the cost of production of work. The basis for assessing the value of the regulatory framework for the GTS was the assessment approved by the National Energy and Utilities Regulatory Commission (NEURC) about 310,353 billion UAH. The volumes of investments and depreciation for 10 years were determined according to the approved NEURC Development Plan of "Ukrtransgas" [13]. Operating controlled consumptions are foreseen taking into account the forecasts of the rates of change of the consumer price index, the index of producer prices of industrial products and the change in the rates of employee compensation at 2015 values. The change in the rates of employee compensation is determined on the basis of forecasts of GDP accession rates [14] and changes in the population of Ukraine. It is expected in the next decade it will decrease and salaries will increase by 0,35%. Operating uncontrolled consumptions are foreseen on the basis of the consumer price index and the change in the rates of employee compensation. In accordance with the RAB-regulation methodology, regulatory periods are defined in which the main criteria and requirements for the operation of gas transmission network operators are set. According to the scenario, the cost effectiveness of the services and work of the gas transmission operators is foreseen to increase by 1%

annually. The regulatory rate of income for the regulatory asset base is set at 15,13% [15]. The profit tax rate is set at 18%.

These basic components form the basis for determining the estimated revenue of the transport operator and accordingly the forecast of the required volume of estimated income until 2025 is carried out.

Two market zones

The practice of the existence of several market zones within a single country is not atypical for the EU. Two market zones exist in Germany and Belgium, in France there are three market zones. In Poland, there are separate gas pipeline systems that are not integrated with the internal market and serve only transit contracts. European regulatory legal acts and technical regulations do not set special economic, legal or technical requirements for the functioning of market zones. Therefore the functioning of certain of them is determined by the administrative boundaries of national states or the historical practice of industrial centers with appropriately formed gas infrastructure for their provision. Thus, existing market zones are not necessarily optimal in size and within the EU there are ongoing processes for the unification of smaller market zones. Moreover, the European policy according to the Gas Target Model, declares the creation of a single European gas market and in the future it only means the unification of national market zones. The creation of large market zones has advantages as it increases the market liquidity, expands the opportunities for trade and reduces price fluctuations within the zone. These fluctuations may arise as a result of the existence of various contracts and tariffs.

In order to avoid the risks of reallocating the costs of maintaining the GTS between domestic consumers and transit, the Ukrainian gas transmission system can be divided into two market zones. The division of the GTS of Ukraine into two market zones should provide the opportunity to attract private investments for the development of the GTS, provide a stable income from the transit of natural gas and optimize tariff formation for the transmission of gas to Ukrainian consumers.

The essence of the division into two market zones is mainly to separate the revenue from transit services from the income generated by the transport of natural gas to domestic consumers. The first market zone could combine all entry points from Belarus and Russia into one. It is the virtual point of exit from the first zone where the gas streams will branch out. The second market zone would immediately include the domestic market of Ukraine. This approach will help to separate the transit revenues received in the first zone from transport revenues in another market zone [16].

In these market zones it is advisable to privatize the GTS. Proceeding from privatization should be recorded as capital disbursements in the regulatory framework for asset calculation. Potential investors should be ready to pay for the infrastructure in the first market zone in view of future transit revenues. The revenue from transit activity for 2015 is taken as the base, which is UAH 35,625557422 billion

or $ 1,631206841 USA. It is assumed that the interest rate will be 10%, then for the privatization of the first market zone, it is possible to get up to UAH 350,625 billion or USD 16,054 billion. The national regulator attributes the acquisition of the first zone to capital expenditures and sets the regulatory base for assets at a standard 10% rate of return.

The regulatory rate of return for the regulatory asset base is set the same as for the entire transport operator according to the scenario of a full "entry-exit" tariff rate 15,13%. All other performance indicators are defined for the operation of transport operators – both for domestic and transit – remain the same as for the simple "entry-exit" tariff scenario. Only tariffs for services for each market zone are calculated separately, according to financial indicators and activity forecasts.

"Entry-exit" model with long-term reservation at the external borders

In the case of the domestic GTS, it is unlikely that it would be possible to speak about the existence of large local systems in it, where there would be a significant shortage of capacities. Significant branching of the GTS of Ukraine and large available transport capacities may serve as the basis for the creation of a single market national "entry-exit" model. EU regulatory documents make it possible to use long-term reservations which would save the possibility of obtaining stable transit revenues. These sale items would no longer be gas flows but the system's capacity. Upon the condition of the power distribution through the auction, the observation of coordinated minimum rate of return and an accurate control of material costs by an independent state regulator, the management of power sales could be transferred to a private entity (experienced European operator to maximize the involvement of the domestic GTS to the distribution of interregional gas flows).

Within the framework of introducing the tariff-based "entry-exit" model for Ukraine, as a compromise option, it would be advisable to introduce long-term reservations at the external borders for the transit of Russian natural gas. It would be appropriate to allocate a certain contracted for the long-term period (5–10 years) the volume of power efficiency at the points of entry and exit exclusively for the needs of Gazprom or the Russian Federation. Providing input and output capacities for such a long period of time makes it possible to apply load retention rate tariffs, as in this approach, the gas transmission operator performs a predictive function over a significant period of its activity. At the same time, under such conditions, long-term reservation at the external borders does not hinder competition, does not create a special regulatory regime for transit and meets the requirements of European directives.

By selling natural gas on the eastern border with Ukraine, Russia will be able to avoid the risks of non-fulfillment of obligations with regard to gas supply to European consumers. Russia will no longer be responsible for the lack of necessary capacity requirements at entry and exit points of national gas networks. European practice proves that the transition to the "entry-exit" model often leads to a reduc-

tion in the available free transfer capability of GTS through its reserving by various consumers. At the same time the reserving of stable volume for the reservation will help the Russian Federation avoid this problem and have permanent transit capacity that will not fall within interrupt mode [17].

The proposed scenario involves the allocation of capacities for a ten-year period of 70 billion cubic meters annually at a reduced rate of tariff 50% out of the basic rate. Capacity over this volume will be priced at a basic rate which is equal to the calculated tariffs for the use of a simple "entry-exit" model. All other scenario components and assumptions will be the same as for the use of a simple "entry-exit" tariff scenario.

Long-term transit contracts

The scenario for the storage of long-term transit contracts or the "zero scenario" does not imply the introduction of some new rules for the transmission of natural gas. The market model does not change and the institutional provision of previous periods is largely maintained. Transit of natural gas is carried out according to long-term contracts. In case of Ukraine transit will be carried out according to the agreement with the Russian Federation until 2019.

The Energy Charter Treaty (Article 10 of the draft Transit Protocol of Natural Gas) states that "Transit tariffs are based on operating and investment costs, including a reasonable rate of return" [18]. Tariff setting for transit and internal transportation services was based on a "cost–plus" method [19]. The tariff for transportation begins to be determined by establishing the level of necessary income and distributing revenues among system users for usage. The total level of required income depends on the valuation of the asset base, depreciation and profit margins. By setting the transit rate according to the old approach in setting tariffs for transit, "Naftogaz" estimated these components opaque because the depreciation was charged at the book value of the asset base that was not revalued. This resulted in a significant understatement of the final amount. Also incorrectly the national company used the concept of "profit margin". According to the European methodology, the profit margin is understood as the investment expenditure and the cost of capital and it is calculated as a product of investment assets at the rate of capital cost. It is unclear what index number was used to calculate the profit margin of Naftogaz it is quite possible that only the index number of book profit was used. These drawbacks respectively led to a lowering of the transit rate and a reduction in the revenue side of the state-owned company [20].

While calculating this scenario, in view of the inert position of Naftogaz and using the previous methodology of tariff formation, an attempt was made to predict a change in the transit rate for ten years ahead. For the estimation of the value of the GTS, the balance sheet data for 2014 were taken, where the data were indicated until the last revaluation of 2015, which was already carried out according to the new methodology. The forecasting of changes in the cost fluctuation of services, works and depreciation were also based on projections for changing these indicators in previous scenarios. The volumes of domestic natural gas consumption were

calculated on the basis of the forecast of the "Times-Ukraine" model developed by the Institute of Economics and Forecasting of the National Academy of Sciences of Ukraine.

The results of evaluation to the alternative variants introduction of "entry-exit" transport model

The main indicators for comparing the four scenarios for changing the model of natural gas transportation were selected: the changes in tariffs for domestic transportation, the changes in tariffs for transit, the changes in the volume of revenues of the transport operator for internal transportation and changes in revenues of the transport operator for transit (Figure 3-4).

The scenarios that were considered as different variants of the introduction of the "entry-exit" system demonstrated the significant dependence of the tariff formation for the services of internal transportation and transit from the volume of transportation of natural gas through the Ukrainian gas transmission system. The transit tariff is less dependent on forecast gas transit scenarios through Ukraine than the domestic tariff for transportation services. Various scenario variants of the "entry-exit" model allow providing a lower rate of decline in the revenue of the transport operator in the pessimistic scenario of natural gas transportation through Ukraine, which is especially relevant at a time when a possible decrease in the volume of natural gas transit.

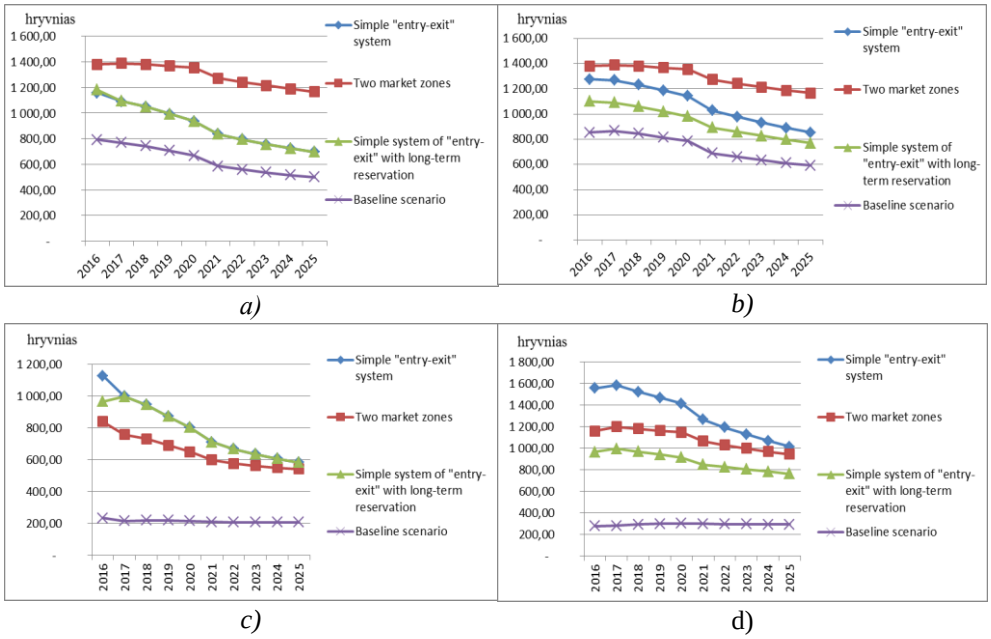

Fig. 3. Tariffs for domestic transport (a, b) and transit (c, d) for the optimistic (at the left) and pessimistic (at the right) forecasts of transit volumes according to the scenarios of the implementation of the "entry-exit" model in Ukraine

Source: own calculations.

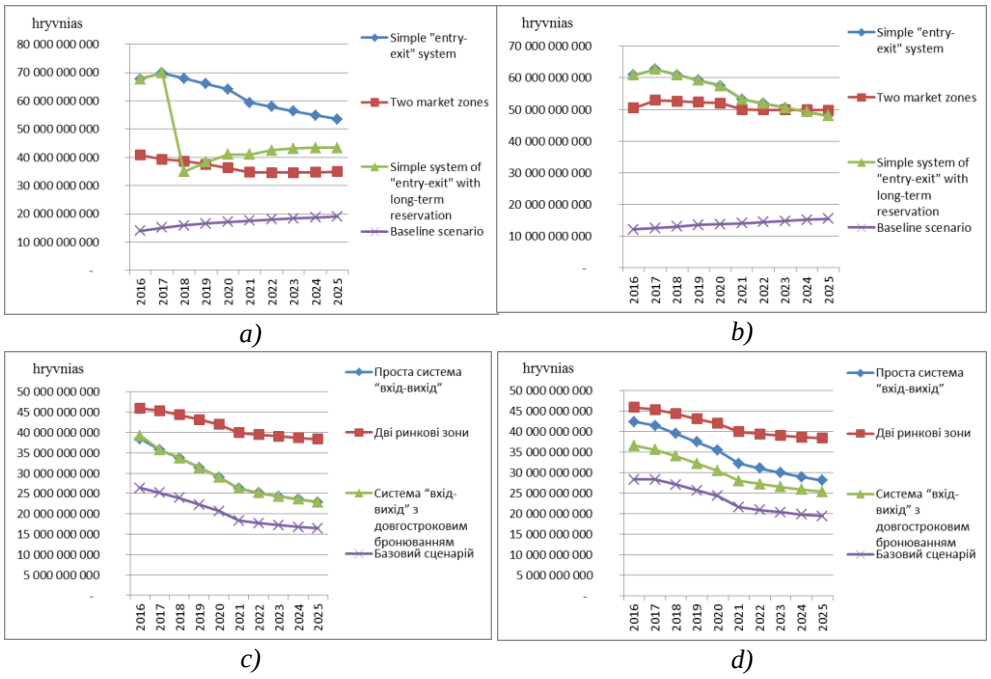

Fig. 4. Income of transport operator from transit (a, b) and internal transportation (c, d) for optimistic (at the left) and pessimistic (at the right) forecasts of transit volumes according to scenarios of implementation of the "entry-exit" model in Ukraine

Source: own calculations.

The results of the calculations showed the reduction of domestic transport tariffs according to all scenarios with optimistic and pessimistic forecasts compared to the base year. This happened due to the increased efficiency from the full implementation of the investment plan for upgrading networks. The largest reduction of the tariff is observed according to the scenario "a simple entry-exit model" (by 40%), the least – according to the scenario "two market zones" (by 15%). This decrease is the same for both transit forecasts and is achieved due to the fact that the market inland transportation operates independently of transit and the volume of transit does not affect the internal tariff formation. The situation is similar with transit tariffs: according to most scenarios the tariff is reduced to 2025, except for the basic scenario for the pessimistic transit forecast (by 5% increase). The most heterogeneous results when comparing the two transit forecasts are observed in the scenario "two market zones" – they demonstrate the effect of transit volumes on the actual tariff (according to the optimistic forecast, the tariff is reduced by 36%, for the pessimistic forecast – by 19%).In the context of the economic consequences of implementing scenarios, two peculiarities can be distinguished. Firstly, in the case of negative effects, for example, slowing GDP growth most striking they appear during the first years of implementation of the investigated activities. The main factor of this nature of the processes is the investment lag, which leads to an increase in

production efficiency after some time after investing. Secondly, among the majority of scenarios, the absolute change in tariffs for transit and internal transportation (relative to the basic scenario) decreases over time. The exception is the scenario of "two market zones" where the relative size of the tariff for domestic transport increases with time. This causes more sharp growth of fixed capital accumulation in the long run compared to other scenarios.

Interindustry nature of the consequences of tariff policy implementation dictates the need for the use of integrated model tools for their evaluation [21]. Taking into account the world experience of similar studies, we used a dynamic, Computable General Equilibrium (CGE) Model of Ukraine with an extended power-generating unit developed by the Institute for Economics and Forecast [22]. This model is adapted to assess the consequences of changing the policy of tariff setting in the natural gas markets [23] and electricity [24]. The instrumentarium of this type is used by many leading international organizations in studying the socio-economic implications of changing tariff policies.

In order to calibrate the computable general equilibrium (CGE) model of Ukraine in terms of optimistic and pessimistic scenarios for natural gas transit, it is selected GDP growth rates and output that are corresponding to the growth rates of natural gas transit volumes during 2016–2025.

The Computable General Equilibrium (CGE) Model of Ukraine is based on the "cost-release" data tables, indexes of the national economic accounting, data from the microfiles of household surveys and other statistical sources, summarized into a common database – a Social Accounting Matrix (SAM). The Computable General Equilibrium (CGE) Model of Ukraine describes the main interbranch and macroeconomic relationships, takes into account the behavior of these economic agents as financial and non-financial corporations, general government, households, non-profit organizations serving households and the rest of the world.

In the framework of CGE model of Ukraine the initial SAM is based on the data of 2012. Although the State Statistics Service of Ukraine has already published the tables "cost-release" (which are the basis of SAM) of later periods. These data were due to the factors such as: significant structural changes, the changes in the statistical base and the permanence of energy policy consequence analysis. Year 2012 appears to be the most adequate of all the available with statistical data. At the same time during the years 2013–2016 the substantial modifications have taken place in the Ukrainian economy connected with the influence of internal and external factors. These processes are accompanied by a change in the structure of GDP, output, final consumption, foreign trade flows, etc. Failure to consider these changes can have a significant effect on the results of the investigated measures of energy politics on the basis of CGE instrumentarium of Ukraine. In order to update the SAM data taking into account available factual and forecasting information the real changes in volumes of output, intermediate consumption, taxes and other categories of SAM were estimated at 2012 values. Then the RAS method was adapted for balancing the matrix [25, 26].

According to conducted computations in general the realization of the investigated measures is characterized by moderate positive macroeconomic consequences (Figures 5–10). Their character mainly depends on the balance between the growth of tariffs for transit and domestic transportation. Thus, taking into account that the greatest growth in domestic transport tariffs will be observed under the "two market zones" scenario and at the same time the growth of transit tariffs is relatively moderate. According to this scenario it can be observed a moderate decline in GDP growth in regard to the base level (at 0,5–1,5%, Fig. 6, 9).

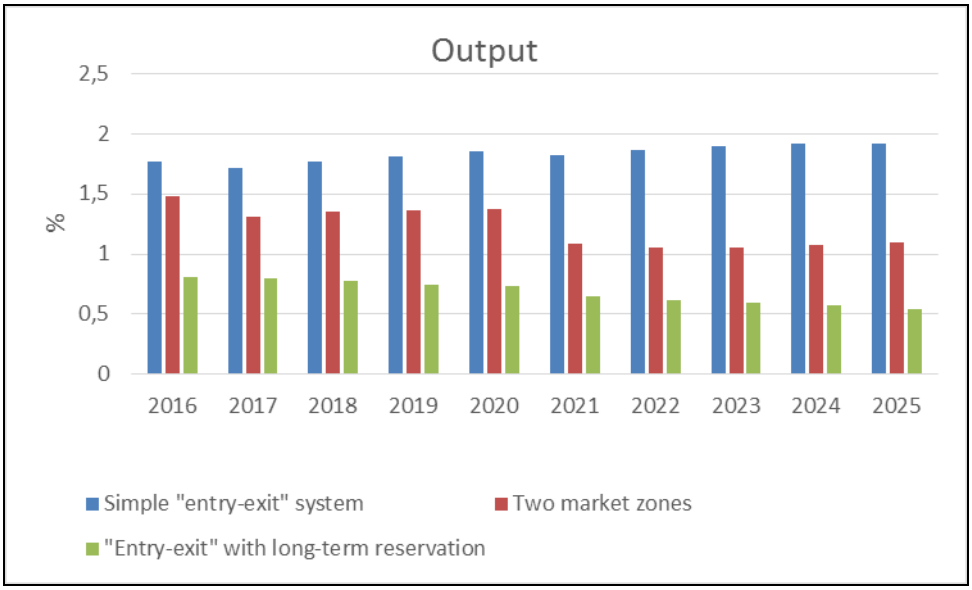

Fig. 5. Change in quantity of production capacity in the context of transit baseline scenario

Source: own calculations.

The growth of transit volumes and activation of investment activity are accompanied by a moderate increase in aggregate quantity of output (Figures 5, 8). There are no significant structural changes at the industry-specific level. A moderate slowing down of accession rate is observed in some sectors of service industries [26].

The main factors of GDP growth in the context of the investigated scenarios are the reduction of the trade balance deficit due to rising fees for transit of natural gas, the intensification of investment processes and the growth of real household incomes (Figures 7, 10). The growth of real household incomes is indirect consequence in the increase of productivity enhancement and the reduction of trade balance deficit.

In the context of the time dynamics of the observed effects two features can be distinguished. Firstly, in the case of negative effects, for example, the slowing down of GDP growth (Figures 6, 9) they are manifested during the first years of investigated measures implementation. Thus, the decline or zero growth during

2016–2018 is observed for all three scenarios analyzed while in the long run only for "two market zones". The main factor in this nature of the processes is the investment lag which leads to an increase in the efficiency of production not immediately, but after some time after investing.

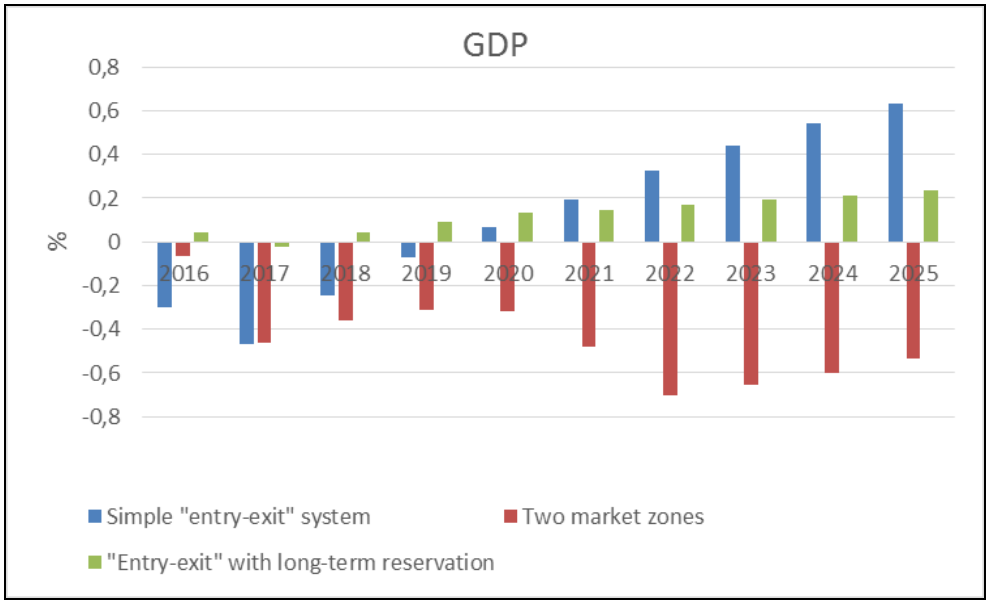

Fig. 6. Changes of GDP volume in the context of transit baseline scenario

Source: own calculations.

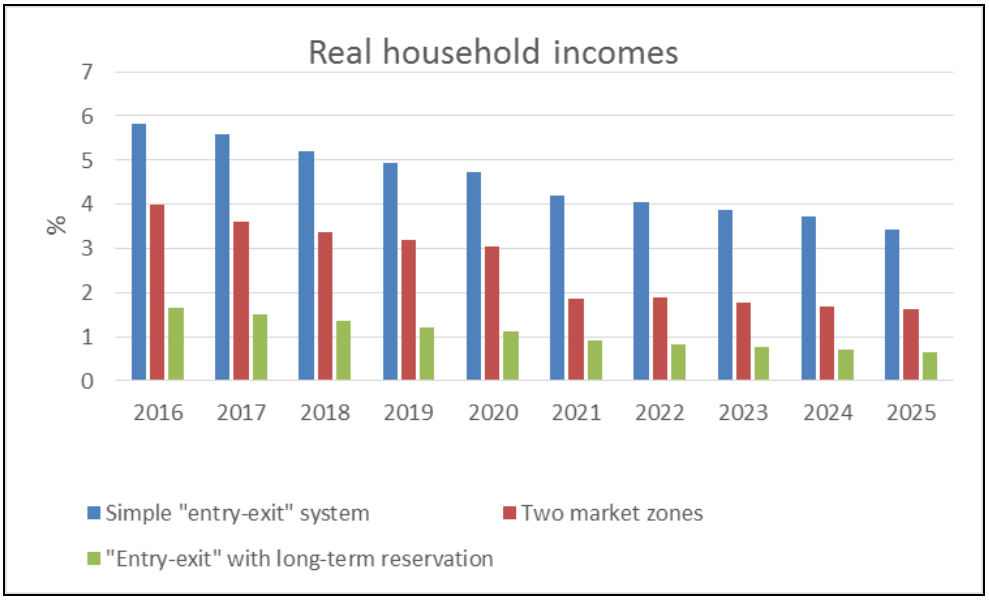

Fig. 7. Changes in the volume of real household incomes in the context of transit baseline scenario

Source: own calculations.

Secondly, according to most scenarios, the absolute value of changing tariffs for transit and domestic transportation (relative to the baseline scenario) decreases over time. Thus, in general the scale of observed effects also reduces in the long run.

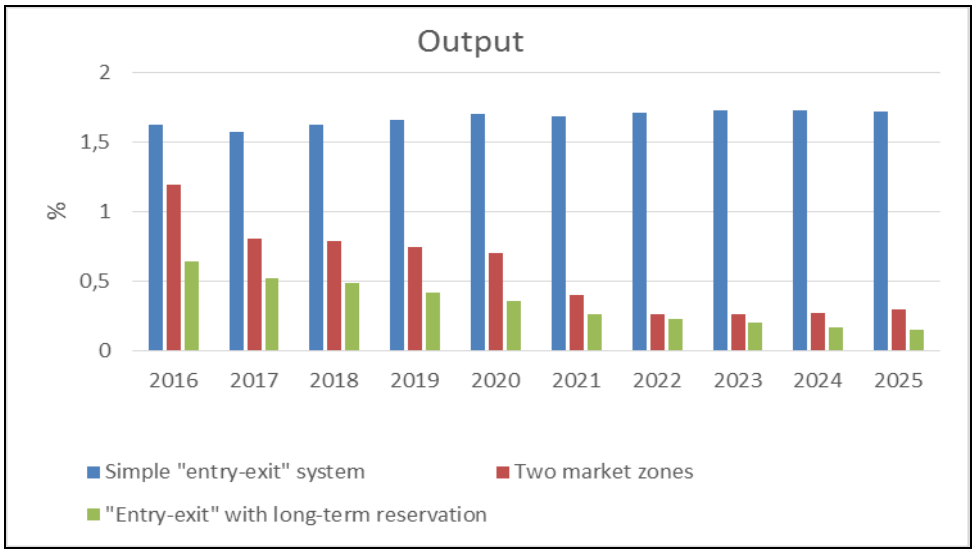

Fig. 8. Change in volumes of production capacity in the context of optimistic transit scenario

Source: own calculations.

A certain counteraction to slowdown in the dynamics of consequences in the long run is also made by the accumulated nature of the growth of production efficiency as a result of the intensification of investment processes.

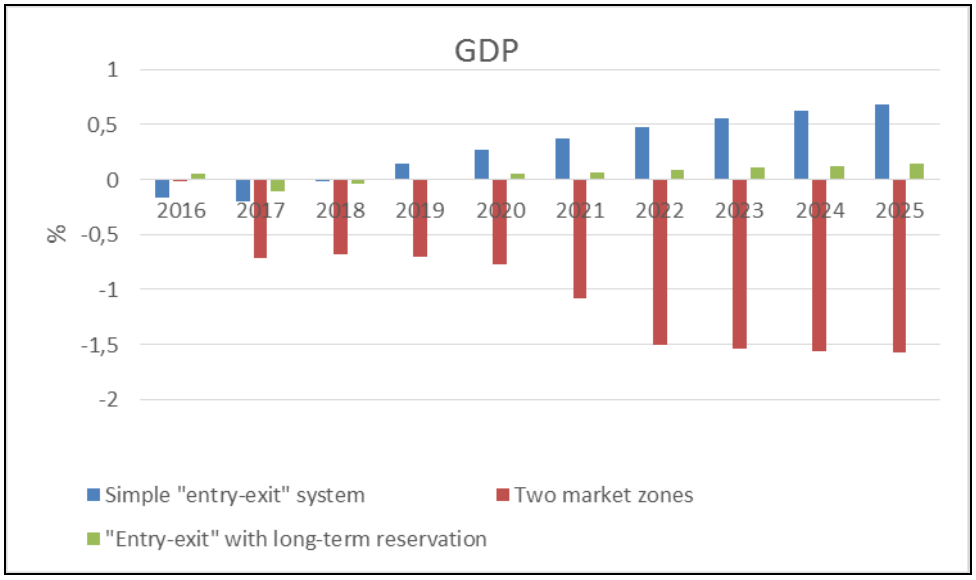

Fig. 9. Changes in GDP in the context of an optimistic transit scenario

Source: own calculations.

Interpreting the simulation results, it should be noted that all the implications of this study are estimated against the baseline ("zero") scenario and correspond to the differences between the indicators for a certain year. In this context, a decrease in the indicator such as GDP in relation to the baseline scenario does not mean a decrease in its absolute level but corresponds to a deceleration of average annual growth rates.

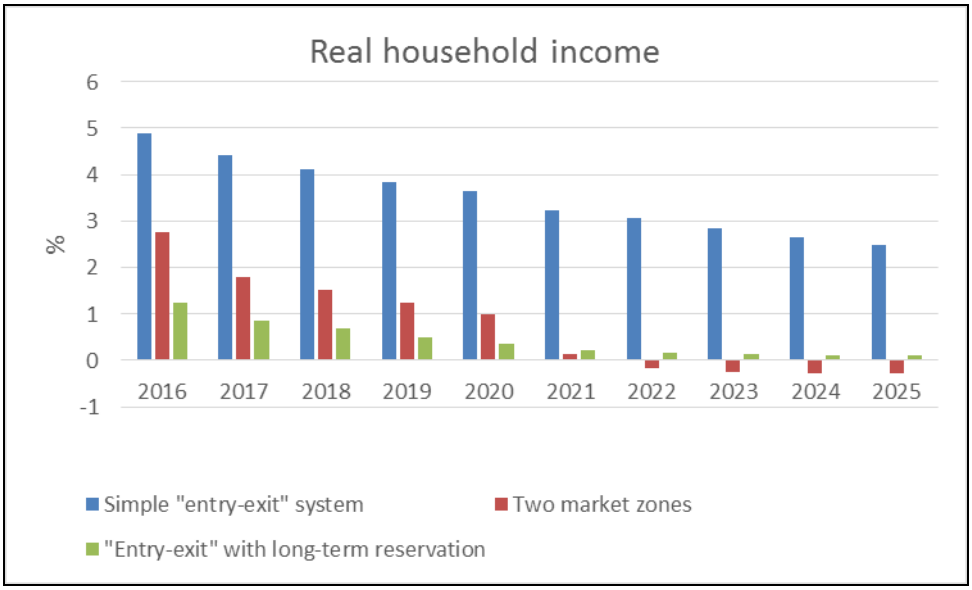

Fig. 10. Change in real household income in the context of the optimistic transit scenario

Source: own calculations.

In the context of basic and optimistic scenarios there is a qualitatively homogeneous nature of the consequences and in both cases the least attractive from a macroeconomic point of view is the scenario of "two market zones". However, the uncertainty to the possible increase in the efficiency of production as a result of the intensification of the investment processes, it is observed most pronounced in the framework of the above scenario, may affect the overall nature of the consequences.

Conclusions

An assessment of alternative options for introducing a tariff-based "entry-exit" model made it possible to find out that the division of Ukraine into two market zones avoids the risk of costs redistribution for maintenance of gas transmission system (GTS) between domestic consumers and transit. In such circumstances the formation of tariffs for domestic transportation will not depend on the transit volumes and the determining factor will be the assessment of assets of the regulatory framework of GTS. However the division into two market zones will lead to the formation of the highest tariffs for domestic transport according to all consid-

ered scenarios. Transit tariffs, on the contrary, will be the lowest according to this scenario. It may create economic incentives for increasing transit operations through Ukraine. Long-term reservation of definite volumes of power with a discount tariff is the most adapted scenario for ensuring the use of transit potential of Ukraine. This scenario creates an attractive tariff for the exporting countries, provides the minimum stipulated load and predictability of GTS operation. However, in terms of the profitability of a transport operator from transit operations, there are risks of a reduction in profits through the sale of capacities at a discounted price.

Within the limits of pessimistic and optimistic forecasts of the volume of gas transit through the territory of Ukraine, a moderate increase in the volume of gross fixed capital accumulation, an increase in aggregate output volumes, an increase in GDP growth. The least attractive from a macroeconomic point of view in both cases is the scenario involving the separation of internal transport and transit operations into two market zones.

The combined use of economic and mathematical models of different classes for the economic assessment of the consequences of changing the tariff model in the field of gas transportation enables to expand the spectrum of analysis of sectoral and macroeconomic effects (impact on the level of tariff, return on transport operator, final price of gas and the corresponding reaction of consumers, investment costs, aggregated macro indicators) and ensure consistency of forecast conditions, assumptions and results.

In general, these scenarios provide an opportunity to assess possible risks, threats and opportunities for the development of competitive relations in the market of transport services of the gas market. In any case, the tariff national system in the natural gas market of Ukraine should be reformed in order to further integrate the gas market into a single European energy space and create favorable conditions for the further use of the Ukrainian GTS at the appropriate level of congestion. The tariffs should be formed transparently, openly, widely to cover the system costs and give the market participants the opportunity to carry out the projected economic activity and Ukraine – to benefit from its transit situation. The establishment of such tariffs is possible only at the time of extensive consultations among all market participants who should be carried out by the National Energy and Utilities Regulatory Commission of Ukraine. It should become a peculiar area for the creation of trust in market players to the generally accepted rules of the game. Therefore, the development of tariff policy should be conditioned by the state sectoral policy, which in turn will be consistent with the strategic priorities of GTS development and the search for optimal solutions. It will enable the most efficient use of the transit potential of Ukraine and on a market basis, to fully satisfy the requirements of domestic consumers.

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АЛЬТЕРНАТИВНІ ВАРІАНТИ ЗАПРОВАДЖЕННЯ ТРАНСПОРТНОЇ ТАРИФНОЇ МОДЕЛІ "ВХІД-ВИХІД" В УКРАЇНІ

Дотримання принципів вільного доступу до мереж на ринкових засадах, об'єктивності відображення витрат системи, прозорості та прогнозованості роботи учасників ринку потребує зміни правил тарифоутворення на послуги транспортування. Впровадження тарифної моделі "вхід-вихід" покликано забезпечити досягнення нових вимог ринку та встановлення єдиних європейських правил ведення економічної діяльності. Зміна внутрішньої моделі транспортування газу зумовлює також зміну принципів тарифоутворення на послуги, що надаються оператором ГТС. Відтепер плата за послуги з транспортування повинна братися не за протранспортовану відстань, а за потужність у вхідних та вихідних точках системи, причому продаж потужностей на вхідних і вихідних точках здійснюється незалежно. Це дає змогу об'єктивніше враховувати операційні витрати обслуговування системи та забезпечувати більшу комерційну варіативність у замовленні системних послуг господарюючими суб'єктами.

Однак європейське законодавство не визначає єдиної типової форми моделі "вхід-вихід". Залежно від технічних особливостей мережі та пріоритетів національної політики розвитку сектора кожна країна визначає для себе оптимальний варіант. У роботі з використанням комплексу математичних моделей нами було оцінено наслідки від впровадження трьох альтернативних варіантів тарифної моделі за двома варіантами завантаженості ГТС (оптимістичний та песимістичний сценарії): повна модель "вхід-вихід", створення двох ринкових зон та модель "вхід-вихід" із довгостроковим бронюванням. Результати розрахунків порівнювалися з базовим сценарієм, що не передбачає зміну ринкової моделі, транзит газу за якого здійснюється відповідно до умов довгострокових контрактів 2009 р.

Загалом зміна моделі забезпечення транспортних послуг на ринку газу повинна зумовити кардинальні інституційні перетворення контрактних відносин між усіма суб'єктами ринку та й, власне, самих принципів функціонування ринку.

Ключові слова: *ринок природного газу, транспортний оператор, модель "вхід-вихід", довгострокові транзитні договори*

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АЛЬТЕРНАТИВНЫЕ ВАРИАНТЫ ВВЕДЕНИЯ ТРАНСПОРТНОЙ ТАРИФНОЙ МОДЕЛИ "ВХОД-ВЫХОД" В УКРАИНЕ

Соблюдение принципов свободного доступа к сетям на рыночных принципах, объективности отражения расходов системы, прозрачности и прогнозируемости работы участников рынка требует изменения правил тарифообразования на услуги транспортировки. Внедрение тарифной модели "вход-выход" призвано обеспечить достижение новых требований рынка и установления единых европейских правил ведения экономической деятельности. Изменение внутренней модели транспортировки газа обуславливает также изменение принципов тарифообразования на услуги, предоставляемые оператором ГТС. Отныне плату за услуги по транспортировке нужно брать не за протранспортированное расстояние, а за мощность во входных и выходных точках системы, причем продажа мощностей на входных и выходных точках осуществляется независимо. Это позволяет более объективно учитывать операционные издержки обслуживания системы и обеспечивать большую коммерческую вариативность в заказе системных услуг хозяйствующими субъектами.

Однако европейское законодательство не определяет единой типовой формы модели "вход-выход". В зависимости от технических особенностей сети и приоритетов национальной политики развития сектора каждая страна определяет для себя оптимальный вариант. В работе с использованием комплекса математических моделей нами были оценены последствия внедрения трех альтернативных вариантов тарифной модели по двум вариантам загруженности ГТС (оптимистический и пессимистический сценарии): полная модель "вход-выход", создание двух рыночных зон и модель "вход-выход" с долгосрочным бронированием. Результаты расчетов сравнивались с базовым сценарием, не предусматривающим изменения рыночной модели, транзит газа при котором осуществляется в соответствии с условиями долгосрочных контрактов 2009 г.

В целом изменение модели обеспечения транспортных услуг на рынке газа должно способствовать кардинальным институциональным изменениям контрактных отношений между всеми субъектами рынка и, собственно, самих принципов функционирования рынка.

Ключевые слова: *рынок природного газа, транспортный оператор, модель "вход-выход", долгосрочные транзитные договоры*