ASSESSMENT OF MARKET PARTICIPANTS' CONTRIBUTION IN A LIBERALIZED ELECTRICITY MARKET FOR COST ALLOCATION PURPOSES

https://doi.org/10.5281/zenodo.20769581

Kurbonov Nurali Abdullayevich
teacher
Djurayev Shuxrat Ixtiyorovich
teacher
Babayev Otabek Elmurodovich
teacher
Karshi State Technical University

Abstract

This article examines the issues of allocating electricity transmission costs and power losses among participants in a liberalized electricity market. Methods for determining the share of network-related costs borne by generating and distribution companies based on the utilization level of power system elements and power flow distribution are proposed. The proposed approach enables economically justified tariff formation for transit services, ensures a fair assessment of power network utilization, and improves the accuracy of settlements within the electricity market.

Keywords

electricity market, transit services, power losses, electrical network, tariff formation, power flows, generating company, distribution company, network costs.

Аннотация

В данной статье исследуются вопросы распределения затрат на передачу электроэнергии и потерь мощности между участниками либерализованного рынка электроэнергии. Предложены методы определения доли затрат генерирующих и распределительных компаний на основе степени использования элементов электрической сети и потоков мощности. Предлагаемый подход позволяет экономически обоснованно формировать тарифы на транзитные услуги, обеспечивать справедливую оценку использования электрических сетей и повышать точность расчётов на рынке электроэнергии.

Ключевые слова

рынок электроэнергии, транзитные услуги, потери мощности, электрическая сеть, формирование тарифов, потоки мощности, генерирующая компания, распределительная компания, сетевые затраты.

Annotatsiya

Ushbu maqolada erkinlashtirilgan elektr energiyasi bozori sharoitida elektr energiyasini uzatish bilan bog‘liq xarajatlar va quvvat isroflarini bozor ishtirokchilari o‘rtasida taqsimlash masalalari tadqiq etilgan. Elektr tarmog‘i elementlaridan foydalanish darajasi hamda quvvat oqimlari asosida ishlab chiqaruvchi va taqsimlovchi korxonalarning tarmoq xarajatlaridagi ulushini aniqlash usullari taklif etilgan. Taklif etilgan yondashuv tranzit xizmatlari tariflarini iqtisodiy jihatdan asoslangan holda shakllantirish, elektr tarmog‘idan foydalanishni adolatli baholash va elektr energiyasi bozorida hisob-kitoblar aniqligini oshirish imkonini beradi.

Kalit so‘zlar

elektr energiyasi bozori, tranzit xizmatlari, quvvat isrofi, elektr tarmog‘i, tarif shakllantirish, quvvat oqimlari, ishlab chiqaruvchi kompaniya, taqsimlovchi kompaniya, tarmoq xarajatlari.

Introduction. Main transmission power networks provide only electricity transmission services, ensuring the delivery of electrical energy from power generation companies (power plants and neighboring energy companies) to customers (electricity supply companies and large-scale consumers).

Retail electricity companies purchase electrical energy directly from generators under contractual agreements and deliver it to consumers through the transmission network. Distribution companies hold a monopoly on supplying electricity to end-users. However, open access to the transmission network is provided for electricity generators, distribution companies, and large-scale consumers.

In this model, competition can expand significantly, allowing all electricity producers to sell electrical energy to a large number of consumers. The presence of numerous buyers makes the market more competitive and dynamic. The benefits of competition in electricity generation are further enhanced as market and technological risks are transferred back to the generating companies. Power plant owners operate within a more structured regulatory framework and are better positioned to evaluate the benefits of new technologies, enabling them to make more informed decisions regarding future investments. At the same time, the increased level of risk borne by power plant owners may lead to higher transmission costs and necessitates the establishment of market and network agreements. This model also allows the government to influence the selection and adoption of new electricity generation technologies through direct subsidies and policy directives.

Contracts are concluded between generating companies, energy companies of neighboring countries, and consumers. At the same time, these agreements provide for the compensation of electricity transmission (transit) costs.

The total charge for electricity transmission should consist of three components.

$\Delta S_T = S_{pos} + S_n + S_{p.}.$

S_{pos}- A subscription fee for network access, intended to cover depreciation and operating expenses (excluding transmission losses). It also includes the recovery of MES costs associated with the installation of additional equipment required to provide services for network transmission capacity and dispatch control of transit flows.

S_p - A subscription fee for MES profitability.

S_n - A payment for energy losses (ΔW) in the MET transmission company. $W_{st} - W_{potr}$ to cover the difference.

The total cost of electricity (EE) transit should be allocated among market participants.

At the same time, the task arises of determining the respective shares of generation and distribution companies in covering the total costs of the transmission company. This problem can be addressed using approaches based on network utilization coefficients. There are various methods for determining these coefficients, and agreements concluded between market participants are also taken into account when defining them. Below, different methods of cost allocation are considered.

Allocation of costs proportional to the consumed electrical energy.

If transmission costs are covered by electricity supply companies (ETK) and large consumers, each customer should be charged the following payment:

$$\Delta Z_{li} = K_i * \Delta S_T. \quad (1)$$

Here, K_i - is a coefficient determined as the ratio of the electricity consumed by the i- th consumer to the total electricity consumption of all consumers.

$$K_i = \frac{W_{eli}}{W_{e\Sigma pot}}. \quad (2)$$

W_{eli} - i- the electricity consumed by the consumer, $W_{e\Sigma po}t$ - the total electricity consumption of all consumers.

If transmission costs are covered by the electricity transmission systems (ETS) and power systems (ES) of neighboring countries, the seller's payment is:

$$\Delta Z_i = K_j * \Delta S_T. \qquad (3)$$

K_j - a coefficient, where j- calculated as the ratio of the electricity sales volume of a given power plant to the total electricity sales volume of all power plants.

$$K_j = \frac{W_{stj}}{W_{st\Sigma}}. \qquad (4)$$

W_{stj} - the electricity sales of the j -th power plant, $W_{st\Sigma}$ - the total amount of electricity generated/sold by all power plants.

From this transit payment, it may appear that MESs are not incentivized to use their degree of flexibility to reduce constraints. However, this is not the case. By utilizing its degrees of freedom (such as network topology, transformer ratios, reactive power sources, etc.) to reduce network losses and increase the capacity of transmission lines, the transit company can expand its ability to attract additional customers and thereby generate additional profit.

Determination based on the share of power losses in the electrical network.

According to the above approach (1), it is assumed that all elements of the network participate equally in the process of delivering electrical energy from generators to distribution companies. However, such a model does not take into account important factors such as the actual loading of network elements and their contribution to the transmission of energy associated with a specific generating company (GC) or a specific distribution company (DC).

To address these shortcomings, a more advanced method for determining network utilization coefficients is proposed. This method is based on an approximate assessment of the participation level of each electrical network element in transmitting electricity from a specific generator to a specific consumer. The degree of participation is determined through the calculation of the steady-state operating mode of the electrical network. In this case, calculations may be performed either based on time-averaged parameters or, when sufficiently accurate data is available, in a manner close to real-time conditions.

Within this approach, it is also possible to determine utilization coefficients for allocating network costs among generating and distribution companies. In this case, the participation level of each network element in power transmission is based on steady-state calculation results. Furthermore, several methods can be applied to solve this problem, including approaches based on the principle of superposition and those based on the calculation of allocation coefficients in linearized systems.

When applying the principle of superposition, it is necessary to determine what portion of the total losses in each network element is attributable to a specific GC or DC. The degree of participation of an element is defined as the ratio of this portion to the total losses. Allocation coefficients can then be calculated as derivatives of power flows in network elements with respect to nodal powers. Based on this, the overall network utilization coefficient for each GC or DC is formed as the sum of the coefficients determined for individual network elements.

The proposed second approach is based on an approximate assessment of the participation of electrical network elements in power transmission among market participants. For this purpose, the steady-state operating condition of the electrical network is first calculated, and the currents, power losses in each element, and total losses (ΔP) are determined. Then, using the superposition method, the contribution of each element to power transmission is evaluated.

According to this method, generation sources are converted into nodal power injections represented as currents, while loads are represented as shunt elements. Then, the network operating mode is calculated for each individual node with an active current source, and the corresponding share of losses in each network element is determined. Based on this, the utilization coefficient of each network element is defined.

In this case, the participation coefficient of the k– th consumer in the i−j network element, $\boldsymbol{K_{ijk}}$ is defined as follows:

$$K_{ijk} = \frac{I_{ijk}^{\ 2}}{I_{ij1}^{\ 2} + I_{ij2}^{\ 2} + \ldots + I_{ijn}^{\ 2}} \qquad (4)$$

I_{ijl} — (l = 1,..., ng) $_{i\text{–}j}$ branch current determined when the current at the lll-th generating node is applied (where ngn_gng is the number of generating nodes).

The obtained coefficient can be used to determine what portion of the power losses in the element is attributable to the power of the k-th node:

$$\Delta P_{ijk} = K_{ijk} * \Delta P_{ij} \qquad (5)$$

where: ΔP_{ij} — is the total active power loss in the i−j network element obtained from the initial steady-state operating condition calculation.

The network utilization coefficient for the k-th generating company is determined as follows:

$$K_{ik} = \frac{\sum \Delta P_{ijk}}{\Delta P_c} \qquad (6)$$

AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN
ISSN: 2996-511X (online) | ResearchBib (IF) = 9.512 IMPACT FACTOR
Volume-4| Issue-6| 2025 Published: |30-06-2026|

For a distribution company (DC), the determination of the network utilization coefficient is carried out in a similar manner; however, in this case, the nodal powers of generating sources are converted into shunt elements, while the powers of nodal loads are converted into current injections.

Allocation according to load currents

To determine tariffs for transit services, the transmission operator must conduct a technical analysis to assess the degree of impact of transit on its power system. First, the possible power flow paths across the entire network are analyzed. Furthermore, experience shows that it is necessary to examine the characteristics of the network elements that provide transit as well as the required services.

The available transmission capacity for providing transit services varies across different power systems and, furthermore, it may differ at various points within a single system. The unused transmission capacity of a system can only be utilized for a specific transfer and not for others (even if the transmitted power is the same). This is due to the physical configuration of the system, including the power supply structure and the dominant power flows within the transmission network.

These issues can be addressed by adopting an approach based on the contribution of individual generating companies (GCs) and distribution companies (DCs) to power flows in the electrical network. Various methods can be proposed to determine the degree of participation of market participants (GCs, DCs, and large consumers). Agreements between market participants should also be taken into account.

Ma'lumki, i-j tarmog'i uchun aktiv quvvat yo'qotishlari ΔPij quyidagi formula bilan aniqlanadi:

$$\Delta P_{ij} = I_{ij}^2 R_{ij}, \qquad (7)$$

where, R_{ij}, I_{ij} - i-j the active resistance and current of the branch.

For steady-state conditions, in order to allocate power losses among distribution companies (DCs), the nodal powers of generating sources are represented as shunt elements, while the powers of nodal loads are represented as current injections. The total power losses in a network element, determined using steady-state calculation methods, can be expressed as follows:

$$\Delta P_{ij} = (I_{ij1} + I_{ij2} + \ldots + I_{ijn})^2 * R_{ij} \qquad (8)$$

where I_{ij} n- (n=1,..., nl) i-j the branch current, corresponding to a circuit in which only the current at the nnn-th node is applied.

(3.8) by transforming the equation, we obtain:

$$\Delta P_{ij} = I_{ij1} R_{ij} (I_{ij1} + I_{ij2} + I_{ij3} \ldots + I_{ijn}) + I_{ij2} R_{ij} (I_{ij1} + I_{ij2} + I_{ij3} + \ldots + I_{ijn})$$
$$+ \ldots + I_{ijn} R_{ij} (I_{ij1} + I_{ij2} + I_{ij3} \ldots + I_{ijn}) = \Delta P_{ij1} + \Delta P_{ij2} + \ldots + \Delta P_{ijn}, \qquad (9)$$

Where $\Delta P_{ij}n$ –(n=1,...,nl) n-i-j - th is the share of the consumer in the active power losses of the network element.

(3.9) the contribution of the kkk-th consumer to the total power losses arising from can be determined as follows:

$$\Delta P_{ijn} = I_{ijn} R_{ij} \sum_{n=1}^{k} I_{ijn} . \quad (10)$$

The allocation of power losses among main power plants is determined in a similar manner; however, in this case, the nodal powers of generating sources are treated as current injections, while the powers of nodal loads are represented as shunt impedances.

Conclusion. The proposed methodologies can be applied in determining tariffs for electricity transmission as well as in forming tariffs for electricity supply to individual distribution companies (DCs).

Thus, this approach enables a more accurate and fair assessment of electrical network utilization and plays an important role in the scientifically grounded formation of tariffs for transit services.

The proposed methodology can also be used in setting tariffs for electricity transit and in forming tariffs for electricity supply to individual consumers.

REFERENCES:

1. Shouket, H. A., Ameen, I., Tursunov, O., Kholikova, K., Pirimov, O., Kurbonov, N., ... & Mukimov, B. (2020, December). Study on industrial applications of papain: A succinct review. In *IOP Conference Series: Earth and Environmental Science* (Vol. 614, No. 1, p. 012171). IOP Publishing.

2. Usmanov, E., Rajabboeva, A., Kurbonov, N., & Kurbanova, K. (2024, June). Operational logic scheme of the sketch base for an educational simulator in the fundamentals of power supply. In *AIP Conference Proceedings* (Vol. 3152, No. 1, p. 050029). AIP Publishing LLC.

3. Turdiboyev, A., Aytbaev, N., Mamutov, M., Tursunov, A., Toshev, T., & Kurbonov, N. (2023, March). Study on application of electrohydraulic effect for disinfection and increase of water nutrient content for plants. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1142, No. 1, p. 012027). IOP Publishing.

4. Saidkhodjaev, A., Kasimova, G., Akbarkhodjaev, S., & Kurbonov, N. (2025, November). Structure and principles for selecting a rational urban power supply schemes. In *AIP Conference Proceedings* (Vol. 3331, No. 1). AIP Publishing.

5. Abdullayevich, Q. N. Muzaffar o'g'li, NT (2024). *NORMALIZATION MODES OF HYDROGENERATORS. THE THEORY OF RECENT SCIENTIFIC RESEARCH IN THE FIELD OF PEDAGOGY*, *2*(25), 368-371.

6. Abdullayevich, Q. N. (2023). REACTIVE POWER COMPENSATION. *IMRAS*, *6*(6), 506-508.

7. Abdullayevich, Q. N. Almardon o'g'li, NA, & Bahodir o'g, QOA (2024). *INFLUENCE OF ELECTRICAL ENERGY QUALITY ON ELECTRICAL ENERGY WASTE. Научный Фокус*, *1*(9), 786-789.

8. Abdullayevich, K. N. (2024). ЭНЕРГИЯНИ ТЕЖАШ ВА ЭНЕРГИЯ САМАРАДОРЛИГИ СОҲАСИДА ИННОВАЦИОН ФАОЛИЯТНИ БОШҚАРИШДА ЛОЙИҲА ЁНДАШУВИДАН ФОЙДАЛАНИШ. *THE THEORY OF RECENT SCIENTIFIC RESEARCH IN THE FIELD OF PEDAGOGY*, *2*(25), 363-367.

9. Abdullayevich, Q. N., & Qizi, Q. M. S. (2023). Ways to Reduce Losses in Power Transformers. *Texas Journal of Engineering and Technology*, *20*, 36-37.

10. Mahmutxonov, S. J., Qurbonov, N., & Babayev, O. (2022). ELEKTR TARMOQLARIDA SIFAT KO 'RSATKICHLARI VA ISROFLAR. *Innovatsion texnologiyalar*, *47*, 14-15.

11. Abdullayevich, K. N. (2024). ЭЛЕКТР ЭНЕРГИЯ СИФАТИНИ ЭЛЕКТР ЭНЕРГИЯ ИСРОФИГА ТАЪСИРИ. *PEDAGOG*, *7*(9), 183-188.

12. Abdullayevich, K. N., & Olimjon o'g'li, E. J. (2024). Using consumer-regulators to equalization of electrical energy system load schedule. *Journal of Multidisciplinary Bulletin*, *7*(4), 25-29.

13. Abdullayevich, K. N. (2024). Analysis and evaluation of the effectiveness of energy saving in industrial enterprises. *SCIENTIFIC APPROACH TO THE MODERN EDUCATION SYSTEM*, *3*(28), 75-81.

14. Курбонов, Н. А., Халикова, Х. А., & Неъматов, Б. А. О. (2024). ВОПРОСЫ ПАРАЛЛЕЛЬНЫЕ РАБОТЫ ЭНЕРГОСИСТЕМЫ АФГАНИСТАНА, УЗБЕКИСТАНА И ТАДЖИКИСТАНА С УЧЕТОМ НОВОГО СТРОИТЕЛЬСТВА. *Eurasian Journal of Academic Research*, *4*(6-1), 37-41.

15. Abdullayevich, Q. N., & Elmurodovich, B. O. (2023). ПРОВЕДЕНИЕ ЛАБОРАТОРНЫХ ЗАНЯТИЙ ПО ЭЛЕКТРИЧЕСКИМ СХЕМАМ. *Новости образования: исследование в XXI веке*, *1*(7), 1006-1010.

16. Abdullayevich, Q. N. (2023). REDUCING ELECTRICITY LOSSES IN ELECTRICAL DISTRIBUTION NETWORKS DUE TO MULTICRITERIA OPTIMIZATION OF LINE SECTIONS. *MODELS AND METHODS FOR INCREASING THE EFFICIENCY OF INNOVATIVE RESEARCH*, *3*(28), 275-279.

17. Abdullayevich, K. N. (2024). ОЦЕНКА ВЛИЯЮЩИХ ФАКТОРОВ НА ПОКАЗАТЕЛИ УДЕЛЬНОГО РАСХОДА ЭЛЕКТРОЭНЕРГИИ НА ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИИ. *PROSPECTS AND MAIN TRENDS IN MODERN SCIENCE*, *2*(13), 531-536.

18. Abdullayevich, K. N. (2024). ИНТЕЛЛЕКТУАЛЬНЫЙ МОНИТОРИНГ РЕЖИМОВ ЭЛЕКТРИЧЕСКИХ СЕТЕЙ. *Новости образования: исследование в XXI веке*, *3*(26), 203-208.

19. Abdullayevich, K. N., & Abduzairovna, N. M. (2024). ЭЛЕКТР ТАЪМИНОТИ ТИЗИМИДА РАҚАМЛИ ПОДСТАНЦИЯЛАРДАН ФОЙДАЛАНИШ МАСАЛАЛАРИ. *Eurasian Journal of Social Sciences, Philosophy and Culture*, *4*(9), 71-75.

20. Abdullayevich, K. N. (2024). НОРМАТИВНЫЕ ПОТЕРЬ ЭЛЕКТРОЭНЕРГИИ В РАСПРЕДЕЛИТЕЛЬНЫХ СЕТЯХ 10, 6 и 0, 4 кВ. *THE THEORY OF RECENT SCIENTIFIC RESEARCH IN THE FIELD OF PEDAGOGY*, *2*(21), 55-60.

21. Abdullayevich, Q. N., & Ikrom o'g, T. A. A. (2023). Efficiency OF Use OF Frequency Converter with Smooth Control OF Asynchronous Motor Speed. *Galaxy International Interdisciplinary Research Journal*, *11*(5), 448-449.

22. Abdullayevich, K. N., O'G'Li, M. F. A., O'G'Li, E. J. O., & O'G'Li, P. A. B. (2024). MARKOV ZANJIRI USULI VA O 'LCHANGAN SHAMOL TEZLIKLARIDAN FOYDALANGAN HOLDA YANGI SHAMOL TEZLIKLARINI BASHORAT QILISH. *Eurasian Journal of Academic Research*, *4*(11-2), 7-12.

23. Abdullayevich, K. N., Akrom o'g, N. M. B., & Olimjon o'g'li, E. J. (2024). Functions of facts devices with innovation technology in the electrical energy system. *Journal of Engineering Sciences*, *7*(5), 12-16.

24. Abdullayevich, K. N., & Abdullayevna, X. X. (2024). EFFECTIVENESS OF USING A FREQUENCY CONVERTER WITH SMOOTH SPEED CONTROL OF AN INDUCTION MOTOR. *Новости образования: исследование в XXI веке*, *3*(27), 151-154.

25. Abdullayevich, K. N. Shuhrat o'g'li, OS, & Olimjon o'g'li, EJ (2024). *STRUCTURE OF LOW VOLTAGE ELECTRICAL NETWORKS. AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN*, *2*(5), 112-119.

26. Abdullayevich K. N., Tulqin o'g'li X. M., Mansur o'g'li C. D. УМЕНЬШЕНИЕ ПОТЕРЬ ЭЛЕКТРОЭНЕРГИИ В РАСПРЕДЕЛИТЕЛЬНЫХ ЭЛЕКТРИЧЕСКИХ СЕТЯХ ЗА СЧЕТ МНОГОКРИТЕРИАЛЬНОЙ ОПТИМИЗАЦИИ СЕЧЕНИЙ ЛИНИЙ //IMRAS. – 2025. – Т. 8. – №. 3. – С. 35-43.

27. Shouket, H. A., Ameen, I., Tursunov, O., Kholikova, K., Pirimov, O., & Kurbonov, N. & Mukimov, B.(2020, December). Study on industrial applications of papain: A succinct review. In *IOP Conference Series: Earth and Environmental Science* (Vol. 614, No. 1, p. 012171).

28. Abdullayevich K. N. et al. ВОПРОСЫ ПАРАЛЛЕЛЬНЫЕ РАБОТЫ ЭНЕРГОСИСТЕМЫ АФГАНИСТАНА, УЗБЕКИСТАНА И ТАДЖИКИСТАНА С УЧЕТОМ НОВОГО СТРОИТЕЛЬСТВА //Eurasian Journal of Academic Research. – 2024. – Т. 4. – №. 6-2. – С. 19-23.

29. Abdullayevich Q. N. CONDUCTING LABORATORY CLASSES ON ELECTRICAL CIRCUITS. Finland International Scientific Journal of Education //Social Science & Humanities. – 2023. – Т. 11. – №. 1. – С. 1095-1098.

30. Abdullayevich K. N., Mansur o'g'li C. D. МЕТОДЫ И МЕРЫ ЭНЕРГОСНАБЖЕНИЯ В СИСТЕМЕ НАРУЖНОГО ОСВЕЩЕНИЯ ГОРОДА //INNOVATIVE DEVELOPMENTS AND RESEARCH IN EDUCATION. – 2025.

31. Abdullayevich K. N., Shuhrat o'g'li O. S., Olimjon o'g'li E. J. STRUCTURE OF LOW VOLTAGE ELECTRICAL NETWORKS //AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN. – 2024. – Т. 2. – №. 5. – С. 112-119.

32. Muminov, A., Yusupov, D., Kutbidinov, O., Mukhammadjonov, M., Norboev, A., Zaynieva, O., ... & Radjabov, S. (2026, May). Development and analysis of a health index-based multi-criteria assessment model for power transformer condition monitoring. In *AIP Conference Proceedings* (Vol. 3447, No. 1, p. 040011). AIP Publishing LLC.

33. Muxitdinova, A. S. (2024). METHODOLOGICAL ANALYSIS OF SCIENTIFIC KNOWLEDGE IN TEACHING SCIENCE. *SUSTAINABILITY OF EDUCATION, SOCIO-ECONOMIC SCIENCE THEORY*, *3*(25), 155-158.

34. Аликулова, С. (2023). Формирование специальных компетенций будущих инженеров инженерно-энергетической профессии в технических высших учебных заведениях. *Общество и инновации*, *4*(11/S), 113-117.

35. Аликулова, С. М. (2023). ТЕПЛОВАЯ ЭФФЕКТИВНОСТЬ СИСТЕМЫ СОЛНЕЧНОГО ОТОПЛЕНИЯ НА ОСНОВЕ ПЛОСКИХ РЕФЛЕКТРОВ, УСТАНАВЛИВАЕМЫХ С СЕВЕРНОЙ СТОРОНЫ ЗДАНИЯ. *Oriental renaissance: Innovative, educational, natural and social sciences*, *3*(4-2), 556-559.

36. Shukurova, O., Pirimov, O., Alikulova, S., & Juraev, H. (2024, November). Problems of control of compressor devices in GTL technologies and construction of a model of the injection process. In *AIP Conference Proceedings* (Vol. 3244, No. 1, p. 060008). AIP Publishing LLC.

37. Karimov, I., & Alikulova, S. Pedagogik Mahorat Asosida Ta'lim Metodlarining Samaradorligini Oshirish. *Maktabgacha va Maktab Ta'limi Jurnali*, 676124.