Экономика химической промышленности / Под ред. В.Д. Якобсона. – М.: Высшая школа, 2007 – 350 с. **13.** Экономическая география России: Учебник / Под ред. В.И. Видяпина, М.В. Степанова. – М.: Инфра-М, 2007. – 507 с. **14.** *Якубовский Н.* Концептуальные основы страте гии развития промышленности Украины на пе риод до 2017 года / Н. Якубовский, В. Новицкий, Ю. Киндзерский // Экономика Украины. — 2007.- № 11. — С 4-20.

Надійшла до редколегії 14.02.2013

УДК 658.5: 66

Формування стратегії розвитку підприємств хімічної промисловості /П.Г.Перерва// Вісник НТУ „ХПІ". Серія: Технічний прогрес і ефективність виробництва. – Х.: НТУ „ХПІ". - 2013. - № 21 (994) - С. 112-119. Бібліогр.: 14 назв.

В статье рассмотрены основные факторы, которые могут быть использовано для формирования стратегии развития предприятий химической промышленности. Определенно и обоснованы наиболее важные направления функционирования предприятий химической промышленности.

Ключевые слова: химическая промышленность, производство продукции, стратегическое развитие, экономические факторы, эффективность.

Basic factors that can be it is used for forming of strategy of development of enterprises of chemical industry are considered in the article. Certainly and the most essential directions of functioning of enterprises of chemical industry are reasonable.

Keywords: chemical industry, production of goods, strategic development, economic factors, efficiency.

УДК 338

FERENC KOVÁCS, Prof. Em. Dr. h. c. mult. Dr. Ing. Member of Hungarian Academy of Sciences Research Group of Geoengineering, Hungarian Academy of Sciences

COAL RATES IN ELECTRICITY PRODUCTION. THE REALITY OF CLIMATE CAUSES

Recently, certain political, social and governmental groups have put down the changes in the Earth's climate to the effect of carbon dioxide (CO_2) of anthropogenic (human, industrial) origin. The first part of the paper provides important arguments to refute this view. Then, through the analysis of the rates of primary fuels in electricity production, it is proven what a significant rate coal types represent in the world and in some leading countries. It is also presented in detail what rates are forecast in electricity supply for the future (2020, 2035, 2050). Comments are made about the fact that in spite of her significant coal resources that can be economically exploited, Hungary is planning an unjustifiably low (4%) coal rate.

Keywords: fuel, norms of expense, economic efficiency, production of electric power, coal.

In the last 2 or 3 decades, the role of the greenhouse effect, global warming and the decarbonisation of the atmosphere have become almost decisive factors in the discussions concerning the issues of energy supply in a relatively wide circle,

in several European countries and in the official position papers of the European Union, as well. It is a widely aired view that the atmospheric concentration of CO_2 is a decisive factor in the variation of the Earth's climate. There are declarations and studies about the fact that the carbon dioxide of anthropogenic (human or industrial) origin is mostly produced during the use of fossil fuels, particularly coal and hydrocarbons, so the primary task of climate protection is to reduce the use of these fuels to the minimum. The basic direction of this 'struggle' is the reduction of coal use, and in a selfish manner because mineral oil is indispensable for motorisation while natural gas cannot be replaced in many of its uses (communal sector, chemical industry, etc.)

Primarily relying on references, the first part of the paper points out that the alarm raised about the change in the earth's climate and global warming and the stigmatisation of coal use as the cause of everything bad is a controversial issue and the 'struggle' against CO_2 does not rationally justify the abandoning of coal use. Not to mention the fact that due to supply and economic considerations, coal may not be dispensed with in the energy supply of the world for long decades to come.

As early as at the end of the 19th century, a group of scientists (Svante August Arrhenius, John Tyndall, Lecher and Pernter) examined what role the absorption of atmospheric gases played in the change of temperature on the Earth concluding that steam and CO_2 had an almost identical role in greenhouse effect. They also mentioned the role of methane (CH_4) as well as the cooling effect of SO_2.

In the last 800,000 years of the 4.5 billion years of the Earth's history, there have been nine 'ice ages' with cooling down followed by 4-5°C increases in temperature, and in some cases, with 10-14°C warming in periods of 10-12,000 years. This all took place at a time when no humans lived on the Earth and no fossil fuels were used. In the last 10-12,000 years, there have been three or four 'small ice ages' involving a 3-4°C temperature change. In this period, mankind has already existed but has not built coal-based power plants yet.

It is a basic statement made by Arrhenius and other scientists that the Earth and the atmosphere are in thermal equilibrium with the Earth emitting as much heat through radiation into outer space and the atmosphere as it has absorbed from the radiation of the Sun. They claimed that the amount and surface distribution of sun radiation reaching the Earth is essentially determined by the variation of the Earth's orbit in relation to the Sun as well as by the periodical variation of the parameters of the Earth's orbit (Milutin Milankovics, De Marchi, György Bacsák [1]). According to prominent earth scientists, the primary factors determining global warming and cooling, and the spread or withdrawal of ice cover are:

changes in the excentricity of the Earth's orbit, changes in the Earth's axial tilt and the movement of its rotation axle (precession). These factors surely exert their influence nowadays, too, and can hardly be affected by humans.

Ernő Mészáros's research results do not jusitfy 'blaming' anthropogenic (human, industrial) carbon dioxide for every problem, either, as in semi-developed countries (regions), the formation of anthropogenic CO_2 only amounts to 14-16% of total carbon dioxide release [2]. Then why do we fight only against this?

Analysing the thermal equilibrium issues of the Earth and its atmosphere, the basic conclusion made by Károly Reményi and Gyula Gróf is that in outer space, the Earth is thermal equilibrium, radiating all of the energy received from the Sun back into outer space. According to their detailed calculations (equilibrium temperature, the Stefan-Boltzmann and Beer laws), maximum 1°K temperature increase may be expected due to the increase of CO_2 concentration from 350 ppm to 500 ppm. The calculations reveal that the doubling of CO_2 content (700 ppm) may cause a 1 – 1.5°K temperature increase in 100 years [3].

Without detailed physical and thermodynamic calculations, Miklós Zágoni makes similar claims [4]: Earth-type atmospheres with partial cloud cover and sufficient water vapour maintain an energetically maximised greenhouse effect (saturated, non-increasable by emissions); the greenhouse gas market of the atmosphere is not a 'shortage economy, if the atmosphere could increase the temperature of the surface, it would have done so long before our emissions started as it possesses an infinite amount of the most important greenhouse gas, **water vapour** in the oceans; energetics equilibrium conditions display efficient reregulation; as long as the amount of incoming solar energy is unchanged, emissions may only give rise to small-scale fluctuations but not to long-term trends.

István Láng makes a general and concise statement: There have always been climate changes, there is one going on now, and there will also be climate changes in the future. They are basically caused by natural factors such as fluctuations in the Earth's axial movement and in the effects between the Sun and the Earth [5].

In addition to the above examples taken from the published results of scientific reaserch, the statements of leading experts and prominent politicians also arouse severe doubts about the fact that the fossil fuels used by human industry would play an exclusive and decisive role in the changes in the Earth's climate (global warming). From among these, here I should like to refer to Vaclav Klaus [6] and Ban Ki Mun UN General Secretary's interview with the BBC in which he stated that as IPCC reports, the allegiations made in them on the basis of unpublished data and particularly their forecasts were severely objectionable, he

would initiate a committee revision of the reporting and decisionmaking practices of IPCC. [7]

Concerning the climate problem, politicians and state leaders regularly make decisions with loud media coverage (Kyoto, Rio, Copenhagen), generally setting scientifically unjustifed and unrealistic objectives that cannot be achieved (and are, in fact, not achieved). Then, the EU and individual countries follow suit. Next, facing the fact that the objectives cannot be achieved, the world's leading industrial and economic powers (US, Canada, Russia and Japan) quietly make concessions and extend deadlines while other big emitters (China, India, Indonesia, Australia) do not even join the 'undertakings'.

The first part of the paper focussed on the view according to which the cause of a significant part of climate change is the getting into the atmosphere of carbon dioxide (CO_2) released in the course of the use of fossil fuels (coal, mineral oil, natural gas). All over the world, there are attempts to replace these fuels, particularly coal, which, in practice, means an increase in the proportion of renewable energies. Renewable energies (sometimes also called 'green' energies) (radiation of the Sun, wind and water power, biomaterials, geothermal energy) really involve reduced carbon dioxide emission in theory but as regards economic (cost) considerations, their use involves significantly higher costs than that of the coal types or the electricity produced by nuclear power plants.

Coal, nuclear energy and natural gas will remain essential in electricity production for a long time. Due to different reasons (technical, cost), the use of renewable energies will not exceed 10-20% either in most countries or on a world average. Of course, there may be different rates in the individual countries depending on local natural features (e.g. water power).

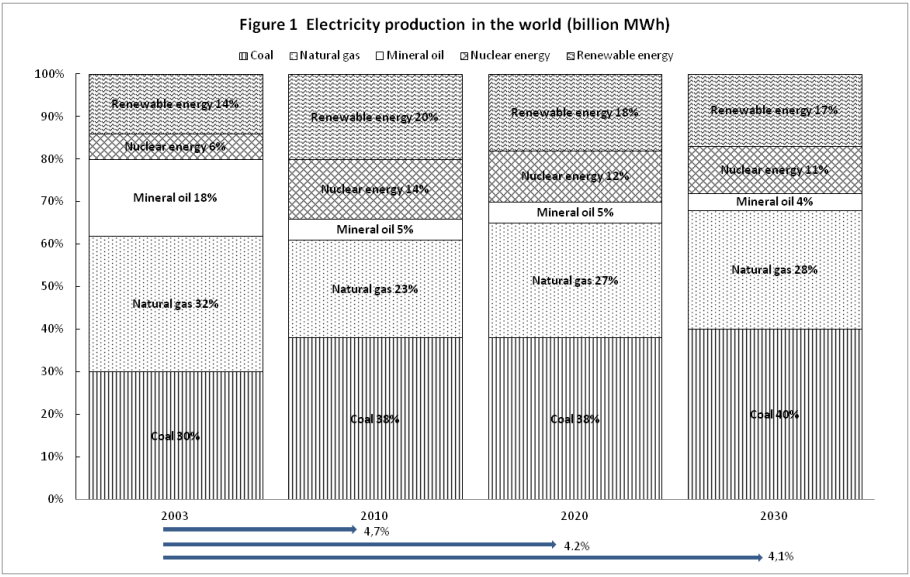
Obviously, political and social views concerning different fuels may also be different or may even go to the extreme in the different countries (e.g. after the tsunami in Japan or the social protest in Germany against nuclear power plants) although the pressing necessity of ensuring energy supply often overrules subjective or economic considerations.

Next, with the help of world data and data from different countries, let us consider what the current and forecast rates of primary fuels are in electricity production.

First, global forecast data for the period until 2030 are presented. [12] Figure 1 shows the forecast data of electricity production for the years 2010, 2020 and 2030 on the basis of 2003 facts according to a study published in According to it, by 2010, a total increase of 34% (with 4.7% average annual increase), by 2020, a total increase of 79% (with 4.2% average annual increase), and by 2030, a total increase of 112% (with 4.1% average annual increase) are predicted.

With two primary fuels specifically highlighted, it can be seen that the 30% coal rate of 2003 is likely to rise to 40% by 2030. The 20% total rate of renewables predicted for 2010 actually turned out to be 24% (Figure 2), and perhaps this was why the 2010 forecast predicted a 25% rate of renewables for 2035, including 13% water power (Figure 3). It is only an interesting detail or mere coincidence that according to the 2006 forecast, total electricity production was predicted to be 19.9 billion MWh in 2010 (Figure 1), which is practically identical with the actual amount of $20 \cdot 10^{12}$ kWh, published in literature.

In addition to global data and data for the US and Germany, Hungarian data are also presented. It is not because the economic potential of the country is comparable to that of the above countries but these figures are given as an extreme example. As regards coal resources (t/person, rate of industrial coal resources and production rate, supplies for 300-500 years), Hungary is in a much more favourable position than the world average, and still, the country hardly plans any coal production for the future. At the same time, with very limited resources of natural gas, Hungary is planning a 40% gas rate in electricity production with the use of imported gas. The well-foundedness of the Hungarian forecast data may also be questioned on the basis of the content of the decision of Parliament. [8]



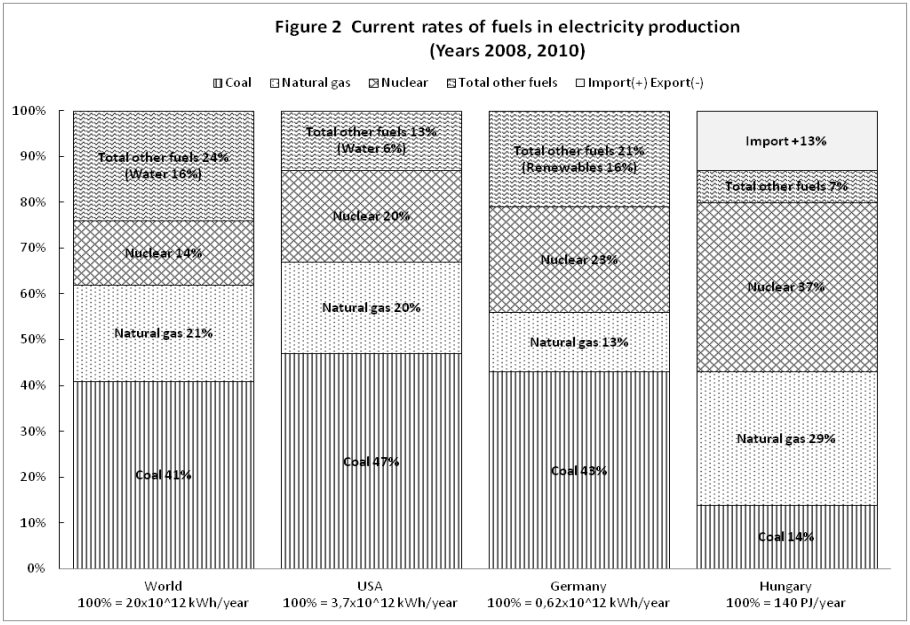


Figure 2 Current rates of fuels in electricity production
(Years 2008, 2010)
Coal
Natural gas
Nuclear
Total other fuels
Import(+) Export(-)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total other fuels 24%
(Water 16%)
Nuclear 14%
Natural gas 21%
Coal 41%
Total other fuels 13%
(Water 6%)
Nuclear 20%
Natural gas 20%
Coal 47%
Total other fuels 21%
(Renewables 16%)
Nuclear 23%
Natural gas 13%
Coal 43%
Import +13%
Total other fuels 7%
Nuclear 37%
Natural gas 29%
Coal 14%
World
100% = 20x10^12 kWh/year
USA
100% = 3,7x10^12 kWh/year
Germany
100% = 0,62x10^12 kWh/year
Hungary
100% = 140 PJ/year

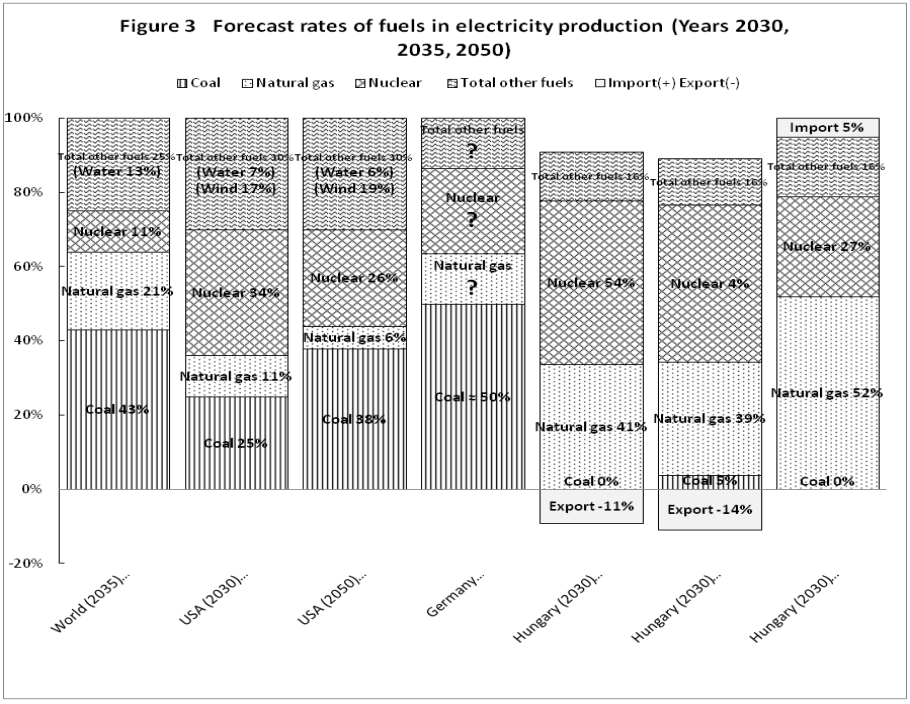


Figure 3 Forecast rates of fuels in electricity production (Years 2030, 2035, 2050)
Coal
Natural gas
Nuclear
Total other fuels
Import(+) Export(-)
100%
80%
60%
40%
20%
0%
-20%
Total other fuels 25%
(Water 13%)
Nuclear 11%
Natural gas 21%
Coal 43%
Total other fuels 30%
(Water 7%)
(Wind 17%)
Nuclear 34%
Natural gas 11%
Coal 25%
Total other fuels 30%
(Water 6%)
(Wind 19%)
Nuclear 26%
Natural gas 6%
Coal 38%
Total other fuels
?
Nuclear
?
Natural gas
?
Coal = 50%
Total other fuels 16%
Nuclear 54%
Natural gas 41%
Coal 0%
Export -11%
Total other fuels 16%
Nuclear 4%
Natural gas 39%
Coal 5%
Export -14%
Import 5%
Total other fuels 16%
Nuclear 27%
Natural gas 52%
Coal 0%
World (2035)...
USA (2030)...
USA (2050)...
Germany...
Hungary (2030)...
Hungary (2030)...
Hungary (2030)...

In the introductory part of this decision, where principles are laid down, the long-term (2030) maintenance of the 14% coal use rate of 2010 is indicated as objective while in four of the five alternative solutions elaborated, coal is entered with the value of zero (0) per cent, and it is only in one that there is a 5% coal rate in electricity production.

As regards details, Figure 2 shows the rates of primary fuels in the electricity production of the world [9], the US [10], Germany [11] and Hungary [8].The rates of primary fuel use are approximately identical on a global level, for the US and Germany: coal 41-47%, natural gas 13-21%, nuclear energy 14-23%, renewables 13-21% while the global rate of water power is 16%. The Hungarian data display extremely low values for coal (in spite of the considerable lignite resources) while imported natural gas and nuclear energy have extremely high rates.

Figure 3 presents long-term forecast data (global 2035, US 2050, Germany post-2020, Hungary 2030). In the highly developed economies, the rate of coal is 43-38-50% and a rate of 40% is expected even for the period between 2020 and 2050. In my opinion, it is quite incomprehensible that the Hungarian forecast is a mere 5%. On the basis of the large natural gas resources, global gas rate is 21%, the equivalent figure for the US is 6% right now without the increase in the exploitation of gas shales while in Hungary, it is 39-41-52%, relying on imported gas! In Germany, due to current concerns, there is political (government) commitment to avoiding the use of nuclear power. The global figure for electricity produced by nuclear power plants is 10%, US forecast is 26%, and the Hungarian figure is 27-54-54% without any uranium ore production, relying on imported heating elements. Whatever pressing conditions may bring, German coal mining is ready to replace nuclear energy.

Forecast data in Figure 3 indicate that the global (US, German) long-term expectations for coal-based electricity production continue to be 40-50%. After this, natural gas and nuclear energy are expected to have a more reduced role while among the renewable energies, wind and water power may acquire a bigger role as an optimum solution in the remote future.

With respect to the analysis of the above data, it is worth mentioning that while in the years 2008-2010, the US accounted for 17.5% world production , the forecast for its share is 'only' 12% for the years 2030-2035.

In addition to the above 'average/global' data, there are also countries with unique features. For example, in Poland, the coal + lignite rate in electricity production has been 92-93% for decades while in the 2020 156.1 tWh forecast, the rate of coal is 62.5%, and in the forecast for 2030, there is a 56.5% coal + lignite rate, 15.6% nuclear energy and 19.3% renewable energy in the 201.8 tWh production.

On the basis of the forecast data presented above (Figure 3), the author's opinion is that in spite of the very significant lignite resources in Hungary, the country is planning an unjustifiably low coal rate while the high gas import and the rate of nuclear energy

also relying on imported heating elements in lack of uranium ore production will produce a very unfavourable situation with respect to the energy dependence of the country.

References. 1. *Kovács, Ferenc:* Meddig és mit bányásszunk? ('What to produce in mining and for how long?') In: Mindentudás Egyeteme 3. kötet pp. 69-95. **2.** *Mészáros, Ernő:* Az üvegházhatású gázok légköri körforgalma Magyarország fölött. ('Atmospheric circulation of greenhouse gases above Hungary.') In: Ezredforduló. Stratégiai tanulmányok a Magyar Tudományos Akadémián. 2003/1. pp. 14-19. **3.** *Reményi, Károly – Gróf, Gyula:* Megjegyzések a globális felmelegedéshez. ('Remarks on global warming.') In: Magyar Tudomány 169.(2008) évf. 4. sz. pp. 458-461. **4.** *Zágoni, Miklós:* Új tudományos fejlemények és következményeik a beruházási, alkalmazkodási és pénzügyi politikára. ('New scientific developments and their consequences for investment, adaptation and financial policies.') (Manuscript of lecture) **5.** *Láng, István:* A vidék és a klímaváltozás. ('The provinces and climate change.') In: Párbeszéd a vidékért. II. évf. 1. sz. pp. 23-24. **6.** *Szarka, László:* Kellemetlen igazság. ('The unpleasant truth.') In: Természet Világa. 138. (2007) évf. 4. sz. pp. 149. (Klaus, Vaclav: Modrá, nikoli zelena planetu.). **7.** *Hargitai, Miklós:* IPCC reform: a klímaőrök körmére néznek. ('IPCC reform: climate guards are being checked.') In: Népszabadság 2010. március 12. pp. 14. **8.** Nemzeti Energiastratégia 2030 ('National Energy Strategy') (2011) In: 77/2011 (X. 14.) Országgyűlési Határozat. (Magyar Közlöny 2011. évi 119. szám). **9.** *Fabian, Jan* (2011): Steinkohle – lokale Anwirkungen eines globalen Aufschwungs. 12. November, 2011. Clausthal – Zellerfeld. **10.** *Karmis, Michael* (2010): Carbon Capture and Storage (CCS) – The Road to Deployment. Annual General Meeting, Society of Mining Professors, Tallinn, Estonia, June 2010. **11.** *Karcher, Christian* (2012): RWE The Energy to Lead. Bergheim, 18.04.2012. **12.** Department of Energy/Energy Information Administration, Washington, 2006.

Надійшла до редколегії 14.02.2013

УДК 338

Coal rates in electricity production. the reality of climate causes/Ferenc Kovács // Вісник НТУ „ХПІ". Серія: Технічний прогрес і ефективність виробництва. – Х.: НТУ „ХПІ". - 2013. - № 21 (994) - С. 119-126. Бібліогр.: 12 назв.

В последнее время определенные политические, социальные и правительственные группы ослабили свое внимание к изменениям в Земном климате, которые происходят при выбросах в атмосферу углексилого газа (CO_2) антропогенного (человеческий, индустриальный) происхождения. Первая часть статьи посвящена аргументам, опровергающим это утверждение. С использованием анализа норм использования топлива в производстве электричества, доказано, что существующие типы угля могут безопасно использоваться в мире и в некоторых лидирующих странах. Представлены нормы использования угля для производства электроэнергии на перспективный период (2020, 2035, 2050). Приведены выводы о том, что несмотря на большие экономически целесообразные возможности Венгрии по использованию угля для производства электроэнергии, этот вид топлива используется недостаточно- всего на уровне 4%.

Ключевые слова: топливо, нормы расхода, экономическая эффективность, производство электроэнергии, уголь.

Останнім часом певні політичні, соціальні і урядові групи ослабили свою увагу до змін в Земному кліматі, які відбуваються при викидах в атмосферу углексилого газу (CO_2) антропогенного (людський, індустріальний) походження. Перша частина статті присвячена аргументам, якы спростовують цы твердження. З використанням аналізу норм використання палива у виробництві електрики, доведено, що існуючі типи вугілля можуть безпечно використовуватися у світі і в деяких лідируючих країнах. Представлені норми використання вугілля для виробництва електроенергії на перспективний період (2020, 2035, 2050). Приведені висновки про те, що, незважаючи на великі економічно доцільні можливості Угорщини по використанню вугілля для виробництва електроенергії, цей вид палива використовується недостатньо - всього на рівні 4%.

Ключові слова: паливо, норми витрати, економічна ефективність, виробництво електроенергії, вугілля.