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The impacts of Ukraine's energy sector on air quality

For more information

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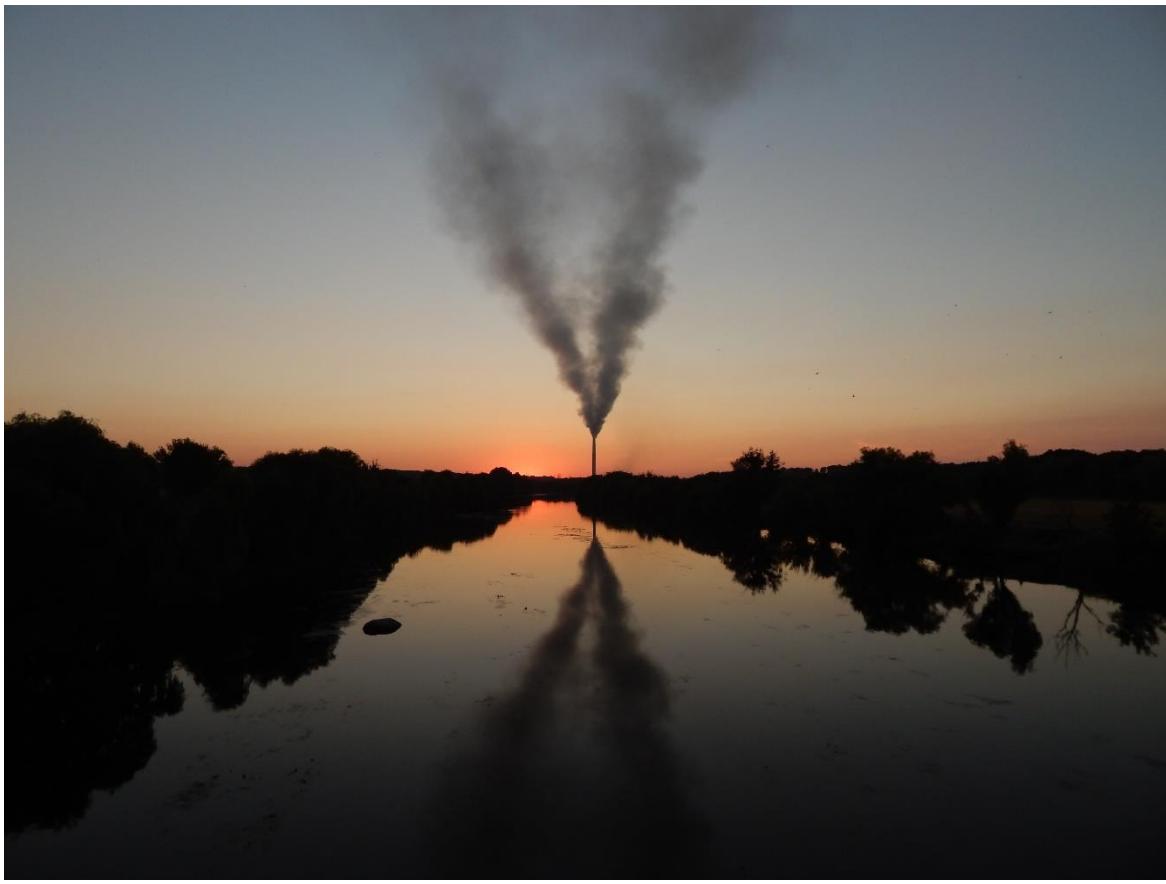

Ladyzhyn TPP, Ukraine – Oleg Savitsky

As a signatory of the Energy Community Treaty and a candidate for membership in the European Union (EU), Ukraine has a long list of environmental obligations. Air quality is usually one of the biggest problems in candidate countries, because it requires a strong, long-term, intersectoral effort in order to bring it within acceptable limits. Ukraine is no exception to this.

While there are many other sources of air pollution, like transport, waste management and household heating, targeting large industrial stationary sources is a no-brainer and should be the first course of action. The regulatory framework for these sources is already well-established in the EU and has delivered steady results, and with proper implementation it can bring huge improvements in air quality by addressing emissions at the source. Ukraine is taking its first steps towards EU membership, and implementing the air pollution measures included in the Energy

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Community Treaty acquis (namely directives 2001/80/EC and 2010/75/EU) sooner will probably reduce both the cost and the length of the necessary reforms.

Bankwatch is leading a successful air pollution campaign in the Balkan region, targeting coal facilities that are major sources of pollution. The objectives of this campaign – installation of air quality monitoring, real-time access to air quality data and implementation of continuous monitoring and pollution control equipment in coal-fired power plants – are also relevant for the Ukrainian energy sector. Improvements in these areas in Ukraine will allow for proper assessment of the impact of coal facilities on air quality and will also contribute to achieving the primary objective of Bankwatch's air pollution work: introduction of air quality specific legislation in the Energy Community Treaty.

Introduction

Ukraine is the second largest country in Europe, located in the eastern part of the continent. It has a total area of 603,550[1] km^2 and a population of approximately 42 million[2]. The landscape of Ukraine consists mostly of fertile plains (or steppes) and plateaus, crossed by rivers such as the Dnieper (Dnipro), Seversky Donets and Dniester.

The country has an abundance of natural resources that include iron ore, coal, manganese, natural gas, oil, salt, sulphur, graphite, titanium, magnesium, kaolin, nickel, mercury and large areas of arable land. Just like the rest of the former Soviet bloc, the country's industry was heavily centralised and adjusted to make the best use of local resources. This is why key industries in Ukraine were and still are the extraction of fossil fuels, electricity generation, ferrous and non-ferrous metals, machinery and transport equipment, chemicals, industrial farming and food processing.

With a predominant share of resource- and energy-intensive industries like these, the anthropogenic load on the environment in Ukraine is several times higher than in most developed countries.

Although Ukraine's environmental legislation is massive and contains more than 300 different legal acts, until recently it completely lacked monitoring and enforcement mechanisms, as well as public participation in environmental decision making. This resulted in the absence of proper monitoring and state control over major polluters, who avoided investing in emission control equipment. This in turn led to a continuous exacerbation of environmental problems that include extremely high levels of air pollution, highly polluted surface water bodies, various forms of land degradation, and improper treatment of hazardous and toxic waste.

In recent years, approximation of Ukrainian law with European Union legislation has accelerated, especially after Ukraine joined the European Energy Community in September 2010 and signed the Association Agreement with the European Union in September 2017[3]. The Law on Environmental Impact Assessment[4] for the assessment of the impact of individual projects was introduced in 2017. Assessment of environmental impact at the planning stage of development policies, plans and programs started in March 2018 when the Law on Strategic Environmental Assessment[5] finally entered into force. These, and other relevant legislation, should improve public participation in environmental issues, and if implemented properly they can steer the overall direction of the development of certain sectors away from the heavy polluting alternatives inherited from Soviet times.

[1] Approximately 43,133 km^2, or about 7.1% of Ukraine's area, is Russian occupied; the seized area includes all of Crimea and about one-third of both Luhans'k and Donets'k oblasts.
[2] Including the occupied territories.
[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02014A0529(01)-20200201
[4] https://zakon.rada.gov.ua/laws/show/2059-19#Text
[5] https://zakon.rada.gov.ua/laws/show/2354-19#Text

Air Pollution

Air pollution is identified as one of the country's key environmental challenges in the Law on Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the Period up to 2030.[6] Emissions to air mainly consist of nitrogen oxides (NO_x), carbon dioxide (CO_2), sulphur dioxide (SO_2) and dust, but high concentrations of polycyclic aromatic hydrocarbons (PAHs) and heavy metals (chromium, nickel, cadmium, lead and beryllium) have also been constantly recorded in the air in industrialized cities.

According to the State Statistics Service *Environment of Ukraine 2018* report[7], stationary sources account for more than 60% of emissions. Approximately 90% of these are produced from extractive (~30%) and processing (~20%) industries and from energy generation (~40%). Non-stationary sources are mostly related to road transport, which accounts for around 35% of total pollution.

While air pollution is definitely a national problem, there are regions that experience particularly heavy pollution, especially the capital Kyiv and the large industrial cities Kharkiv (north-east), Zaporizhia (south-centre), Dnipro and Kryvyi Rih (south-east), and Mariupol and Odessa (south). The Donetsk and Dnipropetrovsk regions are the most notorious polluters, and in 2013 these regions accounted for 42% of the estimated emissions of pollutants in the air.[8]

Largely due to environmental pollution, life expectancy in Ukraine is significantly lower than in the rest of Europe, with an average of about 66 years (in Sweden, this average is 80 years and in Poland, 74). The carcinogenic risk in 2009 reached 6.4-13.7 cases of cancer[9] per one thousand people, which is much higher than the international risk indicators.

The estimated health losses from urban air pollution (PM2.5) alone in Ukraine was 27,000 excess deaths in 2006, or about six per cent of total mortality in Ukraine[10]. According to the WHO's information on mortality and the burden of disease from ambient air pollution for 2016[11], Ukraine has 2,538 disability-adjusted life years (DALYs) lost annually per 100,000 people. This makes Ukraine the country with the highest health impact from air pollution in Europe. The economic losses in 2006 were estimated at around UAH 13 billion (USD 2.6 billion), or four per cent of GDP.[12]

Relevant air quality legislation in Ukraine

The backbone of air quality legislation in Ukraine is the Law on Protection of Ambient Air.[13] The Law gives the framework for air quality standards, emission limit values from stationary sources, measures for the protection of ambient air, obligations of the state and enterprises regarding air quality, monitoring of air quality and penalty provisions. The Law is aligned with the EU's Air Quality Directive, but most of the specifics, like thresholds, monitoring provisions and short- and long-term action plans for the improvement of air quality, are included in bylaws. This law also sets up the overall framework for more specific pieces that tackle air pollution at the source, such as the Large Combustion Plants Directive (LCPD).

Additional, more specific legislation is transposed in several bylaws. Specifically for air quality, the Order of state monitoring of ambient air[14] is the most important bylaw, which contains most of the provisions from Directive 2008/50/EC on ambient air quality. It sets up the zones and agglomerations for air quality monitoring, the pollutants monitored, assessment

[6] https://zakon.rada.gov.ua/laws/show/en/2697-19#n14
[7] http://ukrstat.gov.ua/druk/publicat/kat_u/2019/zb/11/Zb_dovk_2018.pdf
[8] International Bank for Reconstruction and Development/World Bank, *Ukraine Country Environmental Analysis*, January 2016, 6, http://documents.worldbank.org/curated/en/327881470142199866/pdf/AUS16696-WP-OUO-9-Ukraine-CEA-has-been-approved-P151337.pdf.
[9] https://www.iarc.fr/wp-content/uploads/2018/07/pr221_E.pdf
[10] https://www.researchgate.net/publication/5023565_Air_Pollution_Costs_in_Ukraine
[11] https://www.who.int/gho/phe/outdoor_air_pollution/burden/en/
[12] https://www.researchgate.net/publication/5023565_Air_Pollution_Costs_in_Ukraine
[13] https://zakon.rada.gov.ua/laws/show/en/2707-12
[14] https://zakon.rada.gov.ua/laws/show/827-2019-%D0%BF#n18

thresholds and limit values. The limit values for ambient air quality are in line with the Air Quality Directive and are given in the Table 1.

Table 1. Legal limit values for certain pollutants in Ukraine

Pollutant	Averaging period	Limit value
SO_2	1-hour	350 µg/m^3, not to be exceeded more than 24 times a calendar year
	24-hour	125 µg/m^3, not to be exceeded more than 3 times a calendar year
NO_2	1-hour	200 µg/m^3, not to be exceeded more than 18 times a calendar year
	1 year	40 µg/m^3
CO	daily 8-hour mean	10 mg/m^3
PM10	24-hour	50 µg/m^3, not to be exceeded more than 35 times a calendar year
	1 year	40 µg/m^3
PM2.5	1 year	25 µg/m^3
O_3	daily 8-hour mean	120 µg/m^3, not to be exceeded on more than 25 days a year, averaged over 3 years

Since large stationary sources account for more than 50% of all emissions, legislation that regulates these emissions is also highly relevant for the air quality sector. The Order on approval of technological standards of permissible emissions of pollutants from thermal power plants with a nominal thermal capacity exceeding 50 MW[15] is the Ukrainian equivalent of Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (the LCPD).[16] The emissions limit values (ELVs) in the Order are completely aligned with the LCPD.

This Order has been in force since October 2008, but its implementation only started recently, when the LCPD came into force through the Energy Community Treaty in January 2018. Since none of the large combustion plants in Ukraine is anywhere near compliance with the ELVs, they are all included either in the National Emissions Reduction Plan (NERP) that allows for gradual decrease of emissions from all power plants under a national ceiling[17], or in the opt-out list that allows plants to run without pollution control equipment for a certain amount of operating hours.[18] In this regard, the Energy Community and the European Commission have been generous towards Ukraine by allowing them six additional years for the plants in the NERP to achieve compliance, as compared to other Contracting Parties, and to allow plants on the opt-out list twice as many operating hours as those in other countries.

[15] https://zakon.rada.gov.ua/laws/show/z1110-08#n15
[16] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02001L0080-20090625
[17] Under this mechanism, all Energy Community Contracting Parties must bring their emissions in line with the newer Industrial Emissions Directive emission limit values by 1 January 2028, except Ukraine who has a derogation to prolong this deadline until the end of 2033 for NO_x emissions of several plants
[18] https://energy-community.org/implementation/Ukraine/ENV.html

In July 2019, in spite of reactions from the civil society sector, the Ukrainan government approved changes to the NERP[19] that allow for longer deadlines for the modernization of some large combustion plants. These changes are not approved by the Energy Community Secretariat.

A separate Law on industrial emissions (transposition of the 2010/75/EU Directive on Industrial Emissions) is now under consideration in the Parliament.

Current situation with air quality and sources of air quality information

There are several state bodies responsible for environmental monitoring, but their responsibilities are not clearly delegated at the national and regional levels. The efficiency of their work is also undermined by outdated facilities, the lack of qualified personnel, and insufficient funding.

Air quality monitoring is officially conducted in 53 cities in Ukraine at 162 stationary stations, two route posts, and two transboundary transport stations. Mandatory monitoring of air quality at the national level comprises seven pollutants: dust (using an archaic method that measures only total suspended particles (TSP)), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon dioxide (CO_2), formaldehyde (H_2CO), lead and benzopyrene. However, the air quality monitoring system is extremely old and degraded, does not aggregate data in one location and does not provide real-time information.

The annual environmental reports[20] produced by the State Statistics Service do not give any information on air quality compared to the limit values, only total emissions from stationary sources given in tonnes. The same applies for historical data on emissions in the air.[21]

According to the concept for the reform of state supervision in the area of environmental protection, a new body will be created that should also assume monitoring functions. This would require, however, a significant increase in institutional, technical and financial capacities.

To fill the information void, a rather wide network of citizen-installed particulate matter (PM) monitoring stations was established in the last two years. Data is aggregated on several platforms, including the leading one in Ukraine, SaveEcoBot[22], designed by Save Dnipro activists, and Eco City[23] established by the NGO Free Arduino. Additional information on air quality can be found on the Kyiv Smart City website[24] and the website of the Donetsk region[25].

Coal-fired power plants as a major source of air pollution

Energy generation is one of the leading causes of air pollution in Ukraine. The energy sector mostly relies on fossil and nuclear fuels. More than 70% of the primary energy consumption is from various fossil fuels and most of it is used in large combustion plants. 34% of the electricity in the country is produced by the enormous fleet of 20 coal-fired power plants with a total of 108 units.[26] All of them were built before 1976, none of them have desulphurisation equipment and most of them lack a properly functioning dust filter. Since many of them are used for heat production as well, it is common for them to be located in densely populated areas, together with accompanying facilities such as ash disposal sites.

[19] https://menr.gov.ua/documents/2519.html
[20] http://www.ukrstat.gov.ua/druk/publicat/kat_u/2018/zb/11/zb_du2017.pdf
[21] http://www.ukrstat.gov.ua/operativ/operativ2018/ns/vzap/arch_vzrap_u.htm
[22] https://www.saveecobot.com/maps
[23] https://eco-city.org.ua/
[24] https://air.kyivsmartcity.com/
[25] http://ecology.donoda.gov.ua/avtomatizovana-sistema-monitoringu-dovkillya-u-doneckij-oblasti/
[26] Excluding the plants in the non-controlled territory.

Some of them are barely operational, and accidents, like the one on 19 February 2020[27] at the Prydniprovska power plant, happen every few months.

As part of its obligations towards the Energy Community, Ukraine has had to report emissions from large combustion plants to the European Environmental Agency since 2018. The report must contain all relevant information for plants that are in the NERP and on the opt-out list. Out of the 108 coal-fired units, 71 are in the NERP,[28] 19 are on the opt-out list that allows them to operate for 20,000 hours until 31 December 2023 and 18 are on the opt-out list that allows them to operate 40,000 hours until 31 December 2033. At the end of these periods, all of them must be compliant with the ELVs from Annex V of the Industrial Emissions Directive or cease operations and enter decommissioning.

Because of the political situation in Ukraine and lack of access to information for the power plants in the non-controlled territories, emissions reports for both 2018 and 2019 are incomplete. Another problem is that none of the coal-fired power plants have continuous monitoring of emissions at the stack, which is an obligation from the LCPD. All reported emissions are based on calculations made from periodic measurements.

The report for 2018 is also missing emissions data for 15 of the stacks that had reported operating hours and should have reported emissions. In addition, several of the power plants' emissions are reported on a plant level, not by stack, as required by the LCPD.

According to the reported emissions for 2018 from large combustion plants[29], the coal-fired power plants emitted 474,598 tonnes of SO_2, 92,140 tonnes of NO_x and 148,047 tonnes of dust.

The highest emitter of SO_2 was Vuhlehirska TPP, with 85,561 tonnes, followed by Zaporizka TPP, with 74,519 tonnes. Zaporizka TPP also had the highest emissions of NO_x, with 23,222 tonnes, almost 2.5 times more than the runner-up Luhanska TPP, with 9,670 tonnes. The dust emissions from Prydniprovska TPP were by far the highest, with 43,712 tonnes of dust emitted.

The reported emissions for 2019 are more comprehensive and include all required data. But for several stacks the **reported emissions are exactly the same as the individual ceiling** from the NERP (this is the case with many of the figures in the 2018 report, too). This, together with all the other inconsistencies in the reporting, makes the accuracy of the data questionable.

In 2019, the highest emitter of SO_2 was Burshtynska TPP, with 123,519 tonnes. Zaporizka TPP remained the highest emitter of NO_x, with 21,830 tonnes, and Kurakhivska TPP was the leading dust emitter, with 30,244 tonnes.

Table 2. Reported emissions from coal-fired power plants in 2018 and 2019[30]

	SO_2 (t)		NO_x (t)		Dust (t)	
Plant Name	2018	2019	2018	2019	2018	2019
Luhanska TPP	13,501	21,702	9,670	5,985	8,451	16,764
Kurakhivska TPP	48,441	71,888	4,551	9,079	15,795	30,244

[27] https://www.facebook.com/savednipro/videos/508356770105074/

[28] The deadline for implementation of the NERP is 31 December 2028 for the SO_2 and dust ceilings and 31 December 2033 for the NO_x ceiling.

[29] http://cdr.eionet.europa.eu/Converters/run_conversion?file=ua/eu/lcp_ied/envxppjxw/lcp-ied_art72_1.xls&conv=tohtml&source=local

[30] The table does not include the power plants in the temporarily non-controlled territory. The full list of coal-fired power plants with more detailed information can be found here: https://docs.google.com/spreadsheets/d/1auCrtXy4ELO6GB1gCqhkOY3SMUPCOAxMYLJKeZxDoyY/edit?usp=sharing

Myronivska CHP	3,693	2,753	637	454	285	219
Zaporizka TPP	74,519	68,825	23,222	21,830	4,901	4,193
Prydniprovska TPP	520	17,863	3,002	3,577	43,712	2,302
Kryvorizka TPP	18,637	19,980	3,602	5,374	8,271	3,856
Burshtynska TPP	46,759	123,519	4,499	11,019	6,681	26,768
Dobrotvirska TPP	21,494	23,701	2,672	3,665	3,534	3,742
Ladyzhynska TPP	43,437	39,905	5,493	5,409	4,414	4,903
Vuhlehirska TPP	85,561	62,229	7,765	7,768	5,807	6,961
Zmiivska TPP	18,464	37,659	1,238	3,575	6,166	15,389
Trypilska TPP	33,595	32,483	3,821	5,422	16,007	17,758
Slovyanska TPP	29,751	44,805	6,491	7,611	7,786	6,741
Darnytska CHP	4,620	4,572	2,336	2,131	3,025	2,665
Kaluska CHP	14,753	10,599	783	612	2,997	2,354
Kramatorska CHP	1,578	1,966	740	685	2,052	1,891
Kharkivska CHP-2	0	3,241	0	1,258	0	2,817
Cherkaska CHP (2)	8,717	4,488	8,690	7,804	4,051	3,626
Chernihivska CHP	5,799	5,782	2,474	1,305	2,781	1,869
Sumska CHP	759	598	454	345	1,332	829
Total	474,598	598,557	92,140	104,908	148,047	155,891

Conclusions

This analysis and previous experience from the air pollution campaign in the Balkans indicate that several priority locations in Ukraine will benefit from proper air quality monitoring and can provide valuable data for further analysis.

The Darnytska power plant in Kyiv and Prydniprovska in Dnipro are located in the middle of densely populated areas and are accompanied by ash disposal sites and other support facilities. Their surrounding areas should be of high priority for air quality monitoring.

Dobrotvirska and Burshtynska are geographically closest to the EU. However, the electricity produced there is also exported to the EU, so these plants' emissions are already unacceptable according to EU standards, even without considering their transboundary impacts. To make things worse, they are also two of the plants that have incomplete data in the 2018 emissions reports.

Kurakhivska, Myronivska, Burshtynska, Dobrovitska and Ladyzhynska are among the plants that have reported the exact volume of emissions as allowed in the NERP. This raises questions about the real exposure to air pollution in the towns in which they are located, and this is something that can be partially addressed through air quality monitoring.

In spite of the Slovyanska power plant significantly breaching the individual NERP ceilings, especially for dust emissions which were an outrageous 25 times higher than the ceilings in both 2018 and 2019, the Ukrainian government is planning to provide state guarantee for part of the construction of a new unit worth USD 684,296 million set to be built by Chinese Dongfang Electric International Corporation (DEIC).[31] This will add more emissions in the area, will require more support facilities like ash disposal sites and in the end significantly worsen the environmental situation in Slovyansk.

Recommendations

In order to protect human health and the environment from air pollution in Ukraine, urgent action is required on different levels.

- The Ukrainian government must urgently address the plants' non-compliance with the NERP and take all necessary measures to keep emissions within their individual ceilings, including reducing operating hours during peak pollution periods.
- The Ukrainian government must cancel all plans for new coal-fired power plants and the authorities must not provide the state guarantee for the new unit in Slovyansk.
- Environmental authorities in Ukraine must ensure that air pollution in locations prone to high emissions because of coal mining and combustion activity is thoroughly monitored and must make this data available to the public.
- All coal-fired power plants must install continuous monitoring of emissions and publish the data.
- National authorities are encouraged to design a long-term vision that would prioritise a decarbonised energy generation sector, putting energy efficiency first, and requiring cleaner/alternative fuels and electrification for all modes of transportation, as well as strict enforcement of air quality standards.
- The European Commission and Energy Community must ensure LCPD enforcement in Ukraine. The country is already given a longer timeframe for this compared to other Energy Community contracting parties and any delays in the necessary investments and measures to bring emissions within the ceilings set out in the NERP must not be tolerated.
- The European Commission should table a proposal for the adoption of the Air Quality Directive or National Emissions Ceilings Directive, adapted for network energy, in the Energy Community as soon as practicably possible. The Energy Community is recommended to adopt and implement this legislation promptly after a proposal is presented by the Commission, in order to avoid further worsening of air pollution and its deadly impacts on health.
- The European Commission and EU Member States develop mechanisms to ensure that plants not complying with the LCPD cannot so easily export electricity to the EU, such as a CO_2 tax or carbon border tax. They should also withhold financing for projects related to electricity interconnectors and other projects that might aid non-compliant plants in selling their electricity to the EU.

31 https://de.com.ua/en/news/novosti/o._buslavec_%c2%abstroitelstvo_novogo_bloka_na_slavtes_vkljucheno_v_energostrategiju_ukrainy_obsuzhdajutsja_puti_realizacii_proekta%c2%bb