Analysis on the compliance of the environmental permit for Stanari thermal power plant with EU Directives

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Center for Environment is a non-governmental, not-profit and non-partisan organization of activists and professionals dedicated to protection and improvement of environment, advocating principles of sustainable development and larger public participation in decision-making on environment.

This scientific analysis describes the compliance of the environmental permit for the planned Stanari Power Plant in Bosnia and Herzegovina, issued on 19th May 2008 and then changed on 22nd September 2010 by the Ministry of Spatial Planning, Construction and Environment of the Republika Srpska Entity, (hereafter called the "Stanari PP Environmental Permit") [1)] – with some currently valid directives of the European Union, regulating industrial emissions and their environmental impact.

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[1] Stanari PP Environmental Permit was prolonged on 19.04.2013. (document number: 15-96-70/08) and it expires on 19.05.2018.

Stanari PP Environmental Permit compliance with the IED

The Stanari PP Environmental Permit can be compared to the most recent EU act, *i.e.* the *Industrial Emissions Directive* (*Directive 2010/75/EU of the European Parliament and of the Council, of 24 November 2010, on industrial emissions (integrated pollution prevention and control)*), hereafter called the IED. This document entered into force on 6th January 2011 and had to be transposed into national legislation by Member States by 7th January 2013. The IED replaces the IPPC Directive and the sectoral directives as of 7th January 2014, with the exemption of the LCP Directive, which will be repealed with effect from 1st January 2016 (http://ec.europa.eu/environment/air/pollutants/stationary/).

The IED regulates, in its Chapter III (*Special Provisions for Combustion Plants*), emission limit values for combustion plants with a total rated thermal input equal or greater than 50 MW_t (Article 28 – *Scope*: "*This Chapter shall apply to combustion plants, the total rated thermal input of which is equal to or greater than 50 MW, irrespective of the type of fuel used.*" Thus, taking into account that the Energy Community Ministerial Council on 24 October 2013 decided that the Energy Community countries – including Bosnia and Herzegovina – must implement Chapter III of the IED by 2018, it might concern Stanari PP, as, according to its Environmental Permit and the webpage of the investing company, *EFT Rudnik i Termoelektrana Stanari d.o.o* (http://www.eft-stanari.net/sr/tpp-stanari.html), it will be a lignite-fired combustion power plant, with total rated thermal input greater than 50 MW_t, for which none of the exceptions further listed in the same article *("This Chapter shall not apply to the following combustion plants: (a) plants in which the products of combustion are used for the direct heating, drying, or any other treatment of objects or materials; (b) post-combustion plants designed to purify the waste gases by combustion which are not operated as independent combustion plants; (c) facilities for the regeneration of catalytic cracking catalysts; (d) facilities for the conversion of hydrogen sulphide into sulphur; (e) reactors used in the chemical industry; (f) coke battery furnaces; (g) cowpers; (h) any technical apparatus used in the propulsion of a vehicle, ship or aircraft; (i) gas turbines and gas engines used on offshore platforms; (j) plants which use any solid or liquid waste as a fuel other than waste referred to in point (b) of point 31 of Article 3*." can be applied.

The emission limit values for combustion plants covered by the IED are then described in Article 30 ("*Emission limit values"*), and particularly in paragraphs 2 and 3 which generally distinguish two principal types of fuel combustion installations:
(a) those described in the first part of Article 30 paragraph 2 (30(2)), *i.e.* "*installations containing combustion plants which have been granted a permit before 7 January 2013, or the operators of which have submitted a complete application for a permit before that date, provided that such plants are put into operation no later than 7 January 2014*" – so-called "old" installations;
(b) those described in Article 30 paragraph 3 (30(3)), *i.e.* "*installations containing combustion plants not covered by paragraph 2*" – so-called "new" installations.

These two different types of combustion facilities are allowed to operate with various emission limit values, given for sulphur dioxide (SO_2), nitrogen oxides (NO_x), dust including fine particulate matter, and carbon monoxide (CO). However, the emission limit values for the latter substance are specified only for gas-fired combustion plants and not for those using solid fuels; this is why they will not be further discussed within this analysis (as Stanari PP is to use lignite, which is solid).

According to Article 30(2), the emission limit values for "old" installations are described in Part 1 of Annex V (*Emission limit values for combustion plants referred to in Article 30(2);* „(...) *shall include conditions ensuring that emissions into air from these plants do not exceed the emission limit values set out in Part 1 of Annex V*"). They are

dependent on the type of fuel and total rated thermal input of the power plant, which in the case of coal, lignite or other solid fuels (but not biomass or peat) are as follows:

SO_2 (paragraph 2): 400 mg/m^3 for 50-100 MW_t, 250 mg/m^3 for 100-300 MW_t, 200 mg/m^3 for > 300 MW_t;
NO_x (paragraph 4): 300 mg/m^3 for 50-100 MW_t (450 mg/m^3 in the case of pulverised lignite combustion), 200 mg/m^3 for 100-300 MW_t, 200 mg/m^3 for > 300 MW_t;
Dust (paragraph 7): 30 mg/m^3 for 50-100 MW_t, 25 mg/m^3 for 100-300 MW_t, 20 mg/m^3 for > 300 MW_t.

Among these "old" installations, there are some specific exclusions, referring to the oldest of them. These are "*Combustion plants, using solid fuels which were granted a permit before 27 November 2002 or the operators of which had submitted a complete application for a permit before that date, provided that the plant was put into operation no later than 27 November 2003, and which do not operate more than 1 500 operating hours per year as a rolling average over a period of 5 years*" (for which the emission limit value of SO_2 is 800 mg/m^3 – paragraph 2) as well as "*Combustion plants using solid or liquid fuels with a total rated thermal input not exceeding 500 MW which were granted a permit before 27 November 2002 or the operators of which had submitted a complete application for a permit before that date, provided that the plant was put into operation no later than 27 November 2003, and which do not operate more than 1 500 operating hours per year as a rolling average over a period of 5 years*" and "*Combustion plants using solid fuels with a total rated thermal input greater than 500 MW, which were granted a permit before 1 July 1987 and which do not operate more than 1 500 operating hours per year as a rolling average over a period of 5 years*" (for each, the emission limit value of NO_x is 450 mg/m^3 – paragraph 4). These cases, however, have no meaning for Stanari PP as it applied for a permit and will start to operate much later, and therefore they will not be further discussed within the present analysis.

According to Article 30(3), the emission limit values for "new" installations are described in Part 2 of Annex V (*Emission limit values for combustion plants referred to in Article 30(3)*; „(...) *shall include conditions ensuring that emissions into air from these plants do not exceed the emission limit values set out in Part 2 of Annex V*"). They are also dependent on the type of fuel and the total rated thermal input of the power plant, and in the case of coal, lignite or other solid fuels (but not biomass or peat) they are as follows:
SO_2 (paragraph 2): 400 mg/m^3 for 50-100 MW_t, 200 mg/m^3 for 100-300 MW_t, 150 mg/m^3 for > 300 MW_t (200 mg/m^3 in the case of circulating or pressurised fluidised bed combustion);
NO_x (paragraph 4): 300 mg/m^3 for 50-100 MW_t (400 mg/m^3 in the case of pulverised lignite combustion), 200 mg/m^3 for 100-300 MW_t, 150 mg/m^3 for > 300 MW_t (200 mg/m^3 in the case of pulverised lignite combustion);
Dust (paragraph 7): 20 mg/m^3 for 50-300 MW_t, 10 mg/m^3 for > 300 MW_t.

Generally, the emission limit values allowed by IED are higher for small than big installations, and lower for new than old facilities.

Furthermore, in the second part of Article 30(2), there is another specific exclusion of "*installations containing combustion plants which had been granted an exemption as referred to in Article 4(4) of Directive 2001/80/EC and which are in operation after 1 January 2016*", for which "*all permits* (...) *shall include conditions ensuring that emissions into air from these plants do not exceed the emission limit values set out in Part 2 of Annex V*"). The quoted Directive 2001/80/EC, usually called the *Large Combustion Plants Directive* (LCPD; for details see below), in Article 4(4) gives the existing power plants the right to ask for some exemptions ("*Without prejudice to Directives 96/61/EC and 96/62/EC, existing plants may be exempted from compliance with the emission limit values referred to in paragraph 3 and from their inclusion in the*

national emission reduction plan on the following conditions: (a) the operator of an existing plant undertakes, in a written declaration submitted by 30 June 2004 at the latest to the competent authority, not to operate the plant for more than 20 000 operational hours starting from 1 January 2008 and ending no later than 31 December 2015; (b) the operator is required to submit each year to the competent authority a record of the used and unused time allowed for the plants' remaining operational life". However, this case has again no meaning for Stanari PP as it did not exist in 2001, and therefore it will not be further discussed within the present analysis.

In all cases, the IED refers to emission limit values in standard conditions of T = 273.15 K, p = 101.3 kPa and 6% O_2 content for solid fuels, after correction for water vapour content in the waste gases (as specified by paragraph 1 in Part 1 of Annex V and paragraph 1 in Part 2 of Annex V). Furthermore, the IED uses the so-called 'normalized cubic metre' (Nm^3), while within the present analysis the symbol of classic cubic metre, m^3, is generally used (for simplicity).

In respect to the IED, there are some questions how to classify Stanari PP in terms of: (a) total rated thermal input; (b) regarding it as an old or a new installation.

According to the Environmental Permit, Stanari PP was to have 410 MW power, which was later changed to 300 MW. However, in this document it was not clarified whether it was thermal (MW_t) or electric (MW_e) power, as well as whether these were gross or net values. According to the webpage of the investing company (*„Instalisana snaga TE Stanari je 300 MW; Neto snaga bloka 265 MW, Bruto stepen korisnosti bloka 38.5%*"; http://www.eft-stanari.net/sr/tpp-technology.html) one can suppose that 300 MW is rather the electric gross power (300 MW_e) while 265 MW is the electric net power (265 MW_e), and none of these values is the thermal power. Moreover, taking into account the declared 38.5% gross thermal efficiency, the thermal power of Stanari PP can be evaluated as 300 MW_e / 0.385 = *ca.* 780 MW_t.

In this case, the respective IED emission limit values applied for Stanari PP must correspond to lignite-fired power plants with a total rated thermal input above 300 MW, using circulating fluidised bed combustion. However, they will be dependent on the status of this facility in respect to its age, as follows:

SO_2: 200 mg/m^3, NO_x: 200 mg/m^3, dust: 20 mg/m^3 – if Stanari PP is regarded as an "old" installation;

SO_2: 200 mg/m^3, NO_x: 150 mg/m^3, dust: 10 mg/m^3 – if Stanari PP is regarded as a "new" installation.

The problem of classifying Stanari PP as an "old" or "new" installation, however, is quite complicated. The respective environmental permit was issued on 19th May 2008, while the concession for building, again according to the webpage of the investing company, was signed by the Minister of the Economy, Energy and Development of the Republika Srpska Entity in February 2008 (*„U februaru 2008. godine, EFT-Rudnik i Termoelektrana Stanari d.o.o. je sa Vladom Republike Srpske potpisala koncesioni ugovor za izgradnju i korišćenje Termoelektrane Stanari."*; http://www.eft-stanari.net/sr/tpp-project.html). From this point of view, Stanari PP should be regarded as an "old" installation because it fulfils the first condition included in Article 30(2), *i.e. containing a combustion plant which has been granted a permit before 7 January 2013, or the operator of which has submitted a complete application for a permit before that date*.

However, the same Article 30(2) also includes the second condition, which must be fulfilled simultaneously, *i.e.* the operator had to *provide that such a plant is put into operation no later than 7 January 2014.* This is of course the future which is by definition uncertain; however, one can doubt whether Stanari PP can really start to operate before this date – as, again according to the webpage of the investing company, construction has started very recently, *i.e.* in May 2013 (*„18.05.2013. Počela izgradnja termoelektrane Stanari. U Stanarima kod Doboja danas je svečano obeležen početak izgradnje istoimene termoelektrane, koju gradi energetska kompanija EFT Group.*

Ceremoniji polaganja temelja TE Stanari prisustvovali su visoki zvaničnici Republike Srpske, mnogobrojni predstavnici diplomatskog kora, predstavnici energetskih kompanija iz Kine i Evrope i medjunarodnih finansijskih institucija"; http://www.eft-stanari.net/sr/news/sr/pocela-izgradnja-termoelektrane-stanari.html). In consequence, according to EU law, the legal status of Stanari PP is highly dependent on whether it will start to operate before 7th January 2014 or not.

Nevertheless, independently of the classification of Stanari PP as an "old" or a "new" installation, its emission limit values given in the Environmental Permit, are in the case of SO_2, NO_x and dust 2-10 times higher than those allowed by the IED for the concerned class of > 300 MW_t lignite-fired power plants using circulating fluidised bed combustion):

SO_2 : 400 mg/m^3 instead of 200 mg/m^3;
NO_x : 650 mg/m^3 instead of 200 or 150 mg/m^3;
Dust (called "particulates" in the Environmental Permit, which is more or less the same): 100 mg/m^3 instead of 20 mg/m^3 or 10 mg/m^3.

In fact, in the case of sulphur dioxide and nitrogen oxides the emission limit values allowed by the Stanari PP Environmental Permit are in accordance only with those permitted for the oldest power plants in the EU – which *were granted a permit before 27 November 2002 or the operators of which had submitted a complete application for a permit before that date, provided that the plant was put into operation no later than 27 November 2003* (800 mg/m^3 of SO_2) or which *were granted a permit before 1 July 1987 and do not operate more than 1 500 operating hours per year as a rolling average over a period of 5 years* (450 mg/m^3 of NO_x; valid for installations with total rated thermal input greater than 500 MW_t). In the case of dust, the emission limit values allowed by the Stanari PP Environmental Permit are not consistent with any type of power plants in the EU.

As an example illustrating a large difference between the parameters allowed by the Stanari PP Environmental Permit and power plants currently under construction in the EU, we can look at the new lignite-fired block 11 in Turow PP in Poland. Its planned emission limit values of SO_2, NO_x and dust are given in the respective Environmental Impact Assessment (EIA report): SO_2 150 mg/m^3, NO_x 200 mg/m^3, dust 10 mg/m^3, which is consistent with the IED parameters for new lignite-fired installations with a total rated thermal input > 300 MW_t and pulverised lignite combustion (this technology will be used in Turow PP).

In case of SO_2, the IED provides one exception, described in Article 31 paragraph 1: *„For combustion plants firing indigenous solid fuel, which cannot comply with the emission limit values for sulphur dioxide referred to in Article 30(2) and (3) due to the characteristics of this fuel, Member States may apply instead the minimum rates of desulphurisation set out in Part 5 of Annex V, in accordance with the compliance rules set out in Part 6 of that Annex and with prior validation by the competent authority of the technical report referred to in Article 72(4)(a).*" However, this statement cannot be applied to Stanari PP, as this installation is going to use lignite with a relatively low content of sulphur (1% S). The reason for the planned high emission of SO_2 by Stanari PP is not the high amount of S element in the fuel, but rather the low desulphurization rate of the fumes.

The latter coefficient is not *explicite* given in the Stanari PP Environmental Permit, however, it can be approximately evaluated by simple chemical calculations. Combustion of 1 kg of lignite containing 10 g of S (if assuming 1% content of sulphur) will probably yield *ca.* 5-10 m^3 of fumes (the range typical for burning of lignite or coal) and *ca.* 20 g = 20000 mg of primary SO_2 (in the reaction $S + O_2 \rightarrow SO_2$, 1 mol of sulphur (= 32 g S) is converted to 1 mol of sulphur dioxide (= 64 g SO_2); hence, the mass of SO_2 is *ca.* 64/32 = twice as large as the mass of S). If there was no desulphurization, the concentration of SO_2 in fumes would range from *ca.* 20000 mg / 5 m^3 = *ca.* 4000 mg/m^3 to *ca.* 20000 mg / 10 m^3 = *ca.* 2000 mg/m^3; if after desulphurization it is expected to be

as much as 400 mg/m^3 (according to the Stanari PP Environmental Permit), it means that the amount of captured SO_2 is between 4000 - 400 = 3600 mg/m^3 and 2000 - 400 = 1600 mg/m^3. In such a case, the respective desulphurization rate would vary from 3600/4000 = *ca.* 90% to 1600/2000 = *ca.* 80%. These values are low and unacceptable from the viewpoint of IED, which requires in Part 5 of Annex V (*Minimum rate of desulphurization*), for combustion plants with total rated thermal input > 300 MW_t, 96% desulphurization rate for "old" (paragraph 1) and 97% for "new" installations (paragraph 2). Moreover, even in the case of the oldest installations ("*Plants which were granted a permit before 27 November 2002 or the operators of which had submitted a complete application for a permit before that date, provided that the plant was put into operation no later than 27 November 2003*") the allowed desulphurization rate is, with total rated thermal input > 300 MW_t, 96% (paragraph 1). In fact, *ca.* 80-90% desulphurization rate is allowed by the IED only in the case of the oldest and the smallest power plants with a total rated thermal input of 50-100 MW_t (> 80%).

As already mentioned, the IED does not regulate, for lignite-fired power plants, emission limit values for CO, so the value of 150 mg/m^3, allowed in the Stanari PP Environmental Permit, is not comparable to EU law.

The IED provides also some derogations, which are described in Articles 32 (*Transitional National Plan*) and 33 (*Limited life time derogation*), allowing for higher emissions during some transitional periods (from 1 January 2016 to 30 June 2020, and from 1 January 2016 to 31 December 2023, respectively). However, Article 32 concerns only the oldest installations in the EU, *i.e.* those which "*were granted the first permit before 27 November 2002 or the operators of which had submitted a complete application for a permit before that date, provided that the plant was put into operation no later than 27 November 2003*", so it has no application to Stanari PP. In contrast, Article 33 concerns installations mentioned in Article 30(2), *i.e.* the "old" ones, so its application to Stanari PP depends on its classification as an "old" or a "new" installation. Paragraph 1 of this Article says: *"During the period from 1 January 2016 to 31 December 2023, combustion plants may be exempted from compliance with the emission limit values referred to in Article 30(2) and with the rates of desulphurisation referred to in Article 31, where applicable, and from their inclusion in the transitional national plan referred to in Article 32 provided that the following conditions are fulfilled: (a) the operator of the combustion plant undertakes, in a written declaration submitted by 1 January 2014 at the latest to the competent authority, not to operate the plant for more than 17 500 operating hours, starting from 1 January 2016 and ending no later than 31 December 2023; (b) the operator is required to submit each year to the competent authority a record of the number of operating hours since 1 January 2016; (c) the emission limit values for sulphur dioxides, nitrogen oxides and dust set out in the permit for the combustion plant applicable on 31 December 2015, pursuant in particular to the requirements of Directives 2001/80/EC and 2008/1/EC, shall at least be maintained during the remaining operational life of the combustion plant. Combustion plants with a total rated thermal input of more than 500 MW firing solid fuels, which were granted the first permit after 1 July 1987, shall comply with the emission limit values for nitrogen oxides set out in Part 1 of Annex V; and (d) the combustion plant has not been granted an exemption as referred to in Article 4(4) of Directive 2001/80/EC."* Hence, if Stanari PP is regarded as an "old" installation, it could operate under the above conditions; if it is regarded as a "new" one, it could not. The problem is, however, that application of this limited life time derogation is possible only upon an action by an EU member state, as described in Paragraph 2 of the same article: "*At the latest on 1 January 2016, each Member State shall communicate to the Commission a list of any combustion plants to which paragraph 1 applies, including their total rated thermal input, the fuel types used and the applicable emission limit values for sulphur dioxide, nitrogen oxides and dust. For plants subject to paragraph 1, Member States shall communicate annually to the Commission a record of the number of operating*

hours since 1 January 2016." – which is of course impossible as Bosnia and Herzegovina is nowadays not an EU member country.

Summing up, the parameters included in the Stanari PP Environmental Permit are not in accordance with the requirements of the IED.

Stanari PP environmental permit compliance with LCPD

The Stanari PP Environmental Permit must be compared to the *Large Combustion Plants Directive* (*Directive 2001/80/EC of the European Parliament and of the Council, of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants*), hereafter called the LCPD. According to Art. 15 read in conjunction with Art. 16 of the Energy Community Treaty which binds Bosnia and Herzegovina, the construction and operation of new generating plants shall comply with the LCPD.

According to Article 1 of the LCPD "*This Directive shall apply to combustion plants, the rated thermal input of which is equal to or greater than 50 MW, irrespective of the type of fuel used (solid, liquid or gaseous)*", so it can be applied to Stanari PP.

The LCPD also distinguishes two categories of combustion plants: these which were *the subject of a full request for a license before 27 November 2002, provided that the plant was put into operation no later than 27 November 2003* (Article 4 paragraph 1), and those which *were new plants, other than those covered by paragraph 1* (Article 4 paragraph 2). The former class corresponds to the oldest installations mentioned in the IED, thus has no meaning from the viewpoint of Stanari PP; the latter one includes both "old" and "new" installations mentioned in the IED, thus it concerns Stanari PP.

Thus, the allowed emission limit values applicable for Stanari PP are listed in Part B of Annexes III, VI and VII (*SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 6%) to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines; NO_x emission limit values expressed in mg/Nm^3 to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines; Dust emission limit values expressed in mg/Nm^3 to be applied by new plants, pursuant to Article 4(2) with the exception of gas turbines*), as follows:
SO_2: 850 mg/m^3 for 50-100 MW_t, 200 mg/m^3 for 100-300 MW_t, 200 mg/m^3 for > 300 MW_t;
NO_x: 400 mg/m^3 for 50-100 MW_t, 200 mg/m^3 for 100-300 MW_t, 200 mg/m^3 for > 300 MW_t;
Dust: 50 mg/m^3 for 50-100 MW_t, 30 mg/m^3 for > 100 MW_t
(with some exceptions for 100-300 MW_t installations in so-called "outermost regions", which has no meaning from viewpoint of Stanari PP due to its larger size).

Hence, taking into account that Stanari PP belongs to the class of large power plants with > 300 MW_t, the emission limit values allowed by LCPD are as follows: **SO_2**: 200 mg/m^3, **NO_x**: 200 mg/m^3, **Dust**: 30 mg/m^3.

However, the emission limit values included in the Stanari PP Environmental Permit are 2-3 times higher than those allowed by the LCPD:
SO_2: 400 mg/m^3 instead of 200 mg/m^3;
NO_x: 650 mg/m^3 instead of 200 mg/m^3;
Dust: 100 mg/m^3 instead of 30 mg/m^3.
At the same time the Environmental Permit states:
"3.2.8. Other obligations for the liable person in the plant:
The operation of the TPP Stanari must comply with existing European standards listed in the Directive 2001/80/EC and the best available techniques for this type of plant from July 2006"

As the details for the maximum allowed emissions limit values contradict this statement and are less strict, it cannot be claimed that writing such a note constitutes proper implementation of the LCPD Directive.

Summing up, the parameters included in the Stanari PP Environmental Permit are not in accordance with the requirements of the LCPD.

Stanari PP Environmental Permit compliance with IPPCD (BAT)

The Stanari PP Environmental Permit can be also compared to the requirements of *Best Available Techniques for Large Combustion Plants*, based on another old (but still valid; it will be replaced by IED on 7th January 2014) EU act, *i.e. the Integrated Pollution Prevention and Control Directive* (*Directive 2008/1/EC of the European Parliament and of the Council, of 15 January 2008)*, hereafter called the IPPCD, whose implementation is recommended by the Energy Community Treaty. The Best Available Techniques are listed in the respective reference document (BREF).

First of all, as already mentioned, the Stanari PP Environmental Permit does not describe the expected thermal efficiency of the plant. As explained on p. 4 of the present analysis, the gross thermal efficiency is given on the webpage of the investing company as 38.5%. Comparing the known electric gross power (300 MW_e) and electric net power (265 MW_e), one can calculate the net thermal efficiency as (265/300)*38.5% = *ca.* 34%.

Such a value is much lower than the respective BREF limit of 40% for lignite-fired, new combustion plants using fluidised bed combustion (FBC; Table 2. *Levels of thermal efficiency associated with the application of BAT measures for coal and lignite fired combustion plants*). In consequence, Stanari PP will emit relatively large amounts of CO_2 and other pollutants per unit of electric power.

Furthermore, the Environmental Permit does in fact stipulate, as we have seen above, the following:

"3.2.8. Other obligations for the liable person in the plant:
The operation of the TPP Stanari must comply with existing European standards listed in the Directive 2001/80/EC and the best available techniques for this type of plant from July 2006"

Given that the Best Available Techniques stipulate 40% and the net thermal efficiency, according to the company's website, will be around 34%, the plant also does not appear to be in compliance with its Environmental Permit.

For comparison, the planned lignite-fired block 11 in Turow PP in Poland will have, according to its EIA report, the net thermal efficiency of *ca.* 42%, which is the lower limit in case of installations using pulverised lignite combustion (applied in this Polish power plant).

Moreover, the emission limit values of gaseous-dusty pollutions, described in the Stanari PP Environmental Permit, are much higher than the respective BREF values:

Dust: 100 mg/m^3 instead of 5-10 mg/m^3 in BREF (for coal- and lignite-fired, new combustion plants with thermal power > 300 MW_t; Table 5: *BAT for the reduction of particulate emissions from some combustion plants*);

SO_2: 400 mg/m^3 instead of 100-200 mg/m^3 in BREF (for coal- and lignite-fired, new combustion plants with thermal power > 300 MW_t and circulating fluidised bed combustion; Table 6: *BAT for the reduction of SO_2 emissions from some combustion plants*)

NO_x: 650 mg/m^3 comparing to 50-150 mg/m^3 in BREF (for coal- and lignite-fired, new installations with thermal power > 300 MW_t and circulating fluidised bed combustion; Table 7: *BAT for the reduction of NO_x emissions from coal-and lignite-fired combustion plants*)

Summing up, in respect to thermal efficiency and emissions of key atmospheric pollutions, the parameters included in the Stanari PP Environmental Permit are not in accordance with the BAT requirements of IPPCD.

Stanari PP environmental permit compliance with EIAD

The Environmental Impact Assessment Directive (*Directive 2011/92/EU of the European Parliament and of the Council, of 13 December 2011, on the assessment of the effects of certain public and private projects on the environment*) and its older version (Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, as amended by Council Directive 97/11/EC of 3 March 1997 and Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003) should have been implemented by Bosnia and Herzegovina according to the Energy Community Treaty. The Directive, hereafter called the EIAD, says in Article 3: "*The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 12, the direct and indirect effects of a project on the following factors: (a) human beings, fauna and flora; (b) soil, water, air, climate and the landscape; (c) material assets and the cultural heritage; (d) the interaction between the factors referred to in points (a), (b) and (c).*"

The present analysis refers to the Stanari PP Environmental Permit and not to the respective EIA report, however, one can expect that the principal statements of the latter document should have been transferred into the former. Nevertheless, in the Stanari PP Environmental Permit there are only data on emission limit values of some pollutants emitted to atmosphere, *i.e.* SO_2, NO_x, dust and CO. The other data are unavailable, although they are crucial for evaluation of the environmental impact of the planned facility in the meaning of Article 3 of EIAD.

In particular, the lacking data are as follows:

a) annual amounts of gaseous-dusty pollutants emitted to air, *i.e.* the masses of SO_2, NO_x, dust and CO introduced to the atmosphere every year;

b) emission concentrations and annual amounts of such pollutants as chlorides, sulfates and heavy metals (Zn, Cd, Hg, Pb, Cu, Ni), emitted to waste waters;

c) annual amounts of solid waste.

Without this information, the correct assessment of environmental impact for a lignite-fired power plant is impossible. For comparison, such data have been listed in details in the respective EIA reports and/or environmental permits for the recently planned Turow, Opole, Polnoc, Kozienice and Leczna power plants (the former using lignite, and the four latter using black coal) in Poland.

Moreover, according to Article 5(3) the investor should provide "*an outline of the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into account the environmental effects*". In the case of Stanari PP project, the investor should discuss both alternative combustion technologies, *i.e.* pulverised coal and supercritical steam parameters versus subcritical steam parameters in a circulating fluidised boiler, and evaluate which is better for the environment and why.

After the issuance of the Stanari PP Environmental Permit, the project of this power plant was changed. There is a question whether it will result in sufficient changes of the environmental impact to require a new EIA report. It is worth adding that according to Art. 5 and Annex IV of the EIA Directive ''*Member States shall adopt the necessary measures to ensure that the developer supplies the information including a description of the project comprising information on the site, design and size of the project and an estimate, by type and quantity, of expected residues and emissions*.''. However, one cannot deduce from the Stanari PP Environmental Permit that such information was delivered by the investor.

The two most principal changes in the Stanari PP Environmental Permit concern:
a) the technology of combustion (one with pulverised coal with supercritical steam parameters was replaced by that with subcritical steam parameters in a circulating fluidised boiler);
b) decrease of electric power - 300 MW_e instead of 410 MW_e;
c) although neither the previous version of the Stanari PP Environmental Permit nor the present one states anything about thermal efficiency, one can suppose that the decrease of thermal efficiency occurs simultaneously with the decrease of electric power.

The first change will have an ambiguous effect. Generally, one can expect that the replacement of pulverised coal combustion by circulating fluidised bed combustion will increase SO_2 emission and decrease NO_x emissions. This dependency can be exemplified by the analysis of allowed limits for these gases in the Industrial Emissions Directive, in case of new lignite-fired power plants with thermal power > 300 MW_t:
- for circulating or pressurised fluidised bed combustion higher SO_2 emissions are exceptionally allowed (200 mg/m^3 instead of 150 mg/m^3 in all other cases – Annex V, Part 2, paragraph 2 of IED);
- for pulverised lignite combustion higher NO_x emissions are exceptionally allowed (200 mg/m^3 instead of 150 mg/m^3 in all other cases – Annex V, Part 2, paragraph 4 of IED).

The above exceptions reflect the real possibilities and limitations of both techniques, giving the picture of their advantages and disadvantages.

Similarly, according to BREF, pressurised fluidised bed combustion is characterized by higher sulphur dioxide emission and lower nitrogen oxides emissions, comparing to pulverised combustion:
SO_2: 100-200 mg/m^3 *versus* 20-150 mg/m^3
NO_x: 50-150 mg/m^3 *versus* 50-200 mg/m^3
(for new plants firing lignite – Tables 6 and 7 of BREF).

Thus, according to the previous project (pulverised coal combustion), Stanari PP should emit a maximum of 150 mg/m^3 of SO_2 and 200 mg/m^3 of NO_x, while according to the present one (circulating fluidised bed combustion) – maximum 200 mg/m^3 of SO_2 and 150 mg/m^3 of NO_x.

The net environmental effect of such change is debatable, however, the fact of higher emissions of one crucial pollutant (SO_2) and lower emission of another one (NO_x), requires, in my opinion, a new environmental impact assessment.

The second change, *i.e.* the decrease of electric power from 410 MW_e to 300 MW_e, will only seemingly decrease the environmental impact of the whole power plant. In fact, this change is probably associated with a decrease of the net thermal efficiency, this phenomenon being generally typical for replacement of pulverized combustion by fluidized bed combustion (as exemplified by the respective BREF ranges: 43-47% → > 41% for coal, 42-45% → > 40% for lignite – Table 2).

In consequence, the annual emissions per unit of electric energy will be, most likely, higher than expected during the environmental permit issue. However, it must be kept in mind that a new power plant is not built for itself – the produced electric energy is to replace some other heat and electricity sources, usually more harmful for the environment (like old-fashioned local ovens *etc*), which is often used by investors as an argument for the investment. Thus, the full environmental effect of such an enterprise will be the difference of pollutant emissions from the new power plant and of those from the old sources, per unit of produced electricity. If thermal efficiency of the concerned power plant is decreased (*e.g.* when the thermal power remains the same while the electric power becomes smaller), the respective environmental balance becomes worse – although the same amount of pollutants is formed (it is determined by the thermal power, *i.e.* by the amount of fuel), much less electricity is produced. By other words, more tonnes of SO_2, NO_x and dust must be emitted to the atmosphere in order to produce 1 MWh of electricity (*i.e.* to replace the same amount of energy from other sources). In order to better understand this problem: one can imagine a hypothetical

modification of the power plant, when the thermal power decreases to 1/2 (for example) and the electric power decreases to 0 (thus, the thermal efficiency becomes 0); such installation would burn fuel but produce no electricity. Compared to the previous project, the emissions would be lower by half and one could say this installation is now more friendly to environment – however, it is obvious that, in reality, such facility would be a technical, economic and ecological nonsense.

In fact, the above described changes on Stanari PP are so large, from the viewpoint of their environmental impact, that this project can be regarded as a new one, compared to the time when the environmental decision was issued.

Summing up, the performed changes in the Stanari PP project require, in my opinion, a new Environmental Impact Assessment performance.

The question of which EU Directives should be finally applied for Stanari PP as an installation in Bosnia and Herzegovina, being a member state of the Energy Community, must be answered in detail by a lawyer specializing in international law and obligations of countries belonging to this organization. It is worth mentioning that the present internal regulations, particularly the Law on Environment Protection of the Republic of Srpska (*Zakon o zaštiti životne sredine Republike Srpske*), which require for Stanari PP much higher emission limits (according to http://www.eft-stanari.net/sr/tpp-ecology.html: 400 mg/m^3 for SO_2, 650 mg/m^3 for NO_x, 50 mg/m^3 for dust) are also not in accordance with the EU Directives discussed above, and should be probably changed.

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