Response to reviewers' comments for Journal of Power Technologies article 1127:

(0080) Gas turbine selection for hot windbox repowering on 200 MW fossil fuel power plant.

The authors would like to thank the reviewers for valuable comments and suggestions which have helped them to improve the paper. All comments are greatly appreciated. Below is a detailed reply to each comment:

Reviewer A:

The paper is clearly presented, brings a new and original contribution to the field, but before publication there is need to make minor revisions, listed below:

1. The steam turbine in power plant after repowering using chosen gas turbine (GE MS9001E) achieve over 36% more electric power than before repowering. Is this possible for presented power plant (steam turbine, fossil boiler and generator) to work with load over 36% higher than nominal power, for which it was designed? There is no comment in the paper about technical limitations in that field or if the modernization is necessary.

The comment regarding increasing steam turbine power effect has been added in section 4, in Ad. 1.

"Actually after repowering (after adding a new gas turbine in the existing steam cycle) there is available the effect of increasing heat energy provided to the steam turbine, because of increasing the amount of heat energy provided to the steam boiler from gas turbine side.

There are two versions to use this effect:

- To stay stable with the fuel mass flow to the steam boiler and then to modernized the equipment of steam boiler and steam turbine. It means for example to enlarge the surface of heat exchange, to change the installation of steam turbine electrical generator and so on. In the result of this the power of steam turbine will be increased and therefore the power of combined cycle will be increased too.

- To decrease value of fuel provided to the steam boiler till the level in which case the power of steam turbine will be the equal to the previous one before repowering. In the result of this there is available the economy of fuel value to the steam boiler and increase the efficiency of combined cycle power plant.

In this paper the first version has been presented. As mentioned above the authors wanted to show the effect of repowering on the power of steam turbine for academic case only".

2. In chapter 4, figure 10 and text above - the CO2 emissions are decreased by 0.18 to 0.29%. This is an obvious error, the real values should be 18 to 29%. E.g. for the chosen gas turbine MS9001E the CO2 emissions are 40.12% higher and the total power of the power plant after repowering is 97.69% higher. That gives the CO2 emissions equal to

(1.4012/1.9769) = 0.7087, which is (1-0.7087) = 0.2913*100% = 29.13% lower CO2 emission than before repowering. Figure 10 and text referring to this Figure need corrections.

In chapter 4, in figure 10 and in the corresponding text the values of CO2 emissions have been corrected.

There are several typographical and grammatical errors:

a) Chapter 1.2. column is narrower than other chapters. In chapter 1.2. the size of column has been corrected.

b) In chapter 2. in sentence "(...) software GateCycle [10]. is used (...)" - there is unexpected dot after [10]. In chapter 2. the unexpected dot, after [10], has been deleted.

c) In chapter 3. the ambient air parameters are presented in table 1. There are only 3 parameters, thus, presenting them in the table is not necessary, it would be simplifier and more clearly to show the ambient air parameters within the text. In chapter 3. Table 1. has been deleted and then ambient air parameters have been added in the text.

d) In chapter 3. Table 2 is wider than the column. In chapter 3. the size of Table 2 has been corrected corresponding to the column size.

e) In chapter 4., below equation (1) the sentence "The subscripts SCPP and BR symbolize steam cycle power plant and before repowering, respectively" - There should be "The subscripts SCPP and BR symbolize steam cycle power plant after and before repowering, respectively" In chapter 4., below equation (1) the sentence have been corrected accordingly the reviewer's comment.

f) In chapter 4. in sentence "In that case the burner section has not be upgraded (...)" – There should be "(...) not been upgraded (...)". The mentioned sentence has been corrected.

g) In chapter 4. in sentence "(...) the temperature of mixture is lower than 56 °C in comparison (...)" - There should be "(...) is over 56 °C lower than in the ninth case (...)". The mentioned sentence has been corrected.

h) In chapter 4., ad. 2. in sentence "(...) in part loads before and after repowering.." - There are 2 dots. The second superfluous dot has been deleted.

i) In Figure 12 the Load of Fossil Boiler is in (KJ/sec)x105. It should be kJ, not KJ. In Figure 12 the unit of Load of Fossil Boiler has been corrected from KJ to kJ.

<u>Reviewer C:</u>

EDITORIAL REMARKS

1. Page 2; lines 5 & 8; The authors write as the temperature unit "^{0}C" - should be "°C".

The same goes for:

- **Page 5; line 6, In Table 1, In Table 2.**
- **Page 6; In Table 3.**
- **Page 11; lines 20, 22 i 24.**
- **Page 12; Fig. 9; Vertical axis.**
- **Page 13; line 18.**

Additionally the temperature record expressed in "0C" Authors once write without space between the temperature value and its unit and once with space (eg Page 2; lines 5 & 8 - write with a space; Page 11; line 24 - write without space). It is generally accepted that the temperature record expressed in degrees (eg °C, °F etc.) is written without space between the value and the unit. Please standardize text. In the text all temperature unit signs have been corrected according to the reviewer's comment and then the text has been standardized writing the spaces between the value and the unit.

2. Pages 3 & 4; Fig. 1, 2 & 3; The generator on the gas turbine scheme should be located on the compressor side. In addition, in Fig. 1, no shortcuts are developed "FWP", "CND", "GEN", "CWP" etc. In Fig. 1, 2 and 3 the place of electrical generator on the gas turbine scheme has been changed from the expander to the compressor site. And also the descriptions have been added for the shortcuts.

3. Pages 5 & 6; Tables 1 & 3; The "Bar" pressure unit should be written in lowercase. Other units The authors wrote down from a lowercase letter. In Tables 1 and 3 the pressure unit "Bar" has been corrected, writing in lowercase.

4. Pages 8 - 10 & 12 - 15; Fig. 6 - 12; All values should be written with a dot (eg 61.14), not a comma (eg 61,14). Additionally there is no need for values on the vertical axes to be places with dots (just write "100" instead of "100.00" or "100,00"). This also applies to gas turbines in horizontal axes where their electric power is expressed using a comma instead of a dot. In Figures 6 - 12 all values have been corrected, writing with a dot instead of a comma. Also the values on the vertical axes of the figures have been written without decimal (It means: just "100" instead of "100.00" or "100,00").

5. Page 12; Fig. 9; In the drawing legend, the temperature has a unit "0C". In Fig. 9, in the drawing legend the temperature unit has been corrected.

6. Authors of values expressed in % also write without spaces or with spaces: (Page 13; line 9 & page 16; lines 10, 16 & 17 - write with a space; in other places the value of the article written without spaces). Please standardize text. The text has been standardized, al values expressed in % has been written with spaces.

7. Page 13; line 20; The authors wrote "rate of decrease in CO2", should be "rate of decrease in CO_2". The size of number “2” has been corrected, writing it in subscript.

8. Page 13; Fig. 10; In the description of the right vertical axis is "Mwel", should be "MWel". The size of the letter W in “Mwel” has been corrected, writing it as a capital letter.

9. Pages 12, 14 & 15; Fig. 9, 11 & 12; Unit of time Authors write as "sec". This unit also appears on page 10; line 15 and on page 14; line15. In other places, the authors write a unit of time as "s" eg "kg/s" (Page 14; line 24). Please standardize text. The text has been standardized for the case of the unit of time, writing it “s” instead of “sec”.

10. Page 16; line 10; The authors wrote "(6.67% higher than before repowering).", Would the writing "(6.67 p.p. higher than before repowering)." be maybe more accurate? The mentioned sentence has been changed according to the reviewer’s version.

11. The data series shown in Fig. 6 - 10, marked with the names of gas turbines at an angle, decrease the readability of the graphs. It is proposed in step 3 in the place where the article is presented analyzed gas turbines mark them accordingly, for example. (A, B, C, etc.), and so they also mean graphs. In section 3 in the list of selected gas turbines the letters have been added accordingly from A to I and then the same has been done in the graphs mentioned in the comment.

ESSENTIAL REMARKS

1. In point 3, the article does not have the basic parameters of the analyzed gas turbines - pressure ratio β and combustor outlet temperature (COT). In section 3, in Table 1 which shows Performance parameters for GTs, the values of pressure ratio (CPR) and combustor outlet temperature (COT) have been added. And then the descriptions of the shortcuts have been developed (CPR - compressor pressure ratio, COT - combustor outlet temperature).

2. There is no information on the fuel burned in the gas turbine. What is the calorific value? Figure 1 - 3 shows that the fuel is "Natural gas"? What is the composition of this gas? If 100% CH4 should be the information in the text. The fuel burned in the gas turbine is 100% CH4 and Lower Heating Value (LHV) is equal to 50044 kJ/kg. This information has been added in section 3, which comes next to the sentence about ambient air parameters.

3. The use of ready-made gas turbine models from the GateCycle library unfortunately causes some difficulties and uncertainties. First, it limits the possibility of interfering with the analyzed gas turbine model. Are the Authors confident of getting the correct gas turbine results? Unfortunately, the GateCycle gas turbine libraries do not take into

account their cooling model (expander and combustion chamber). The comment has been added in section 2. “Although using the ready - made gas turbine models from GateCycle library the results of calculation are not very closed to the real parameters, because of some details have not taken into account (expander and combustion chamber cooling models), the paper has been written for academic case only and the purpose of the paper is to show the selecting process of the right gas turbine for hot windbox repowering”.