1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).

2. This REPORT consists of a total of 14 sheets, including this cover sheet.

In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- Box No. I Basis of the report
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).

Date of issuance of this report
05 May 2015 (05.05.2015)

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Form PCT/IB/373 (January 2004)
PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA210 (second sheet)

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/HU2013/000023

International filing date (day/month/year)
04.03.2013

Priority date (day/month/year)
05.11.2012

International Patent Classification (IPC) or both national classification and IPC
INV. F23G5/00 C10J3/00 ADD. F02C3/28 F01K13/00

Applicant
INT-ENERGIA KFT

1. This opinion contains indications relating to the following items:

☒ Box No. I Basis of the opinion
☐ Box No. II Priority
☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐ Box No. IV Lack of unity of invention
☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
☐ Box No. VI Certain documents cited
☐ Box No. VII Certain defects in the international application
☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority (“IPEA”) except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA220.

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Date of completion of this opinion
see form PCT/ISA210

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Form PCT/ISA237 (Cover Sheet) (July 2009)
Box No. I  Basis of the opinion

1. With regard to the language, this opinion has been established on the basis of:
   ☑ the international application in the language in which it was filed
   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
   a. (means)
      ☐ on paper
      ☑ in electronic form
   b. (time)
      ☐ in the international application as filed
      ☑ together with the international application in electronic form
      ☑ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V  Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

   Novelty (N)                      Yes: Claims  1-14
                                   No: Claims

   Inventive step (IS)             Yes: Claims  2, 3
                                   No: Claims  1, 4-14

   Industrial applicability (IA)   Yes: Claims  1-14
                                   No: Claims

2. Citations and explanations

   see separate sheet
Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet


Re Item VIII

Certain observations on the international application

1 The application does not meet the requirements of Article 6 PCT, because claim 1 is not clear.

1.1 The expression "external power consumers in the configuration" used in claim 1 is vague and unclear, as it not clear whether or not the external power consumers are part of the configuration. This expression therefore leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear, Article 6 PCT.

For the further assessment of claim 1, the external consumers not considered as a part of the configuration.

1.2 The expression "having two-way communications with other units in the configuration" used in claim 1 is vague and unclear, as it not clear what these other units are. This expression therefore leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear, Article 6 PCT.

1.3 The expression "the third output of the algae biodiesel and biomass production unit is connected to the first output of a steam and gas turbine unit" used in claim 1 is not supported by the figures. This expression therefore leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear, Article 6 PCT.

For the further assessment the expression is interpreted as "the third output of the algae biodiesel and biomass production unit is connected to the first input of a steam and gas turbine unit".

1.4 In claim 1 many technical features are introduced for the first time with the expression "the ..." while this should be done with the expression "a ...", e.g. the first solid municipal and industrial waste treatment input, the second biomass treatment input, the first gasholder, the second output, ...

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:
**Independent claim 1: Inventive step**

The present application does not meet the criteria of Article 33(3) PCT, because the subject-matter of claim 1 does not involve an inventive step.

1.1 Document D1 (figure 1; pages 4-6) is regarded as being the prior art closest to the subject-matter of claim 1, and shows a structural configuration of environmentally safe waste and biomass processing to increase the efficiency of electric power and heat generation which comprises a plasma waste and
biomass processing unit comprising the first solid municipal and industrial waste treatment input (input of waste/biomass in figure 1) and the second biomass treatment input (return of algae in figure 1) which are also the first and second inputs for waste and biomass loading and shredding system (implicit); plasma waste and biomass processing unit also comprises, at least, one plasma converter ((112) figure 1), one pyrolysis gas cleaning system ((120) figure 1), first compression system (implicit), and the first gasholder (implicit); at least, one output of the waste loading and shredding system is connected to the first input of, at least, one plasma converter (figure 1); the second output of, at least, one plasma converter is connected to the input of a basalt-like slag processing unit ((114) figure 1); output of the first compression system is connected to the first input of the first gasholder (implicit); the first output of a carbon dioxide distribution and dosing system ((126) figure 1) is connected to the second input of a plasma converter (return of CO2 in figure 1); the third output of a carbon dioxide distribution and dosing system is also the fourth output of a plasma waste and biomass processing unit which is connected to the first input of the algae biomass production unit (130 figure 1); the third output of the algae and biomass production unit is connected to the first input of a steam & gas turbine unit;

1.2 The subject-matter of claim 1 therefore differs from this known structural configuration in that

1. the algae and biomass production unit can also produce biodiesel

2. the output of the first gasholder is also the second output of the plasma waste and biomass processing unit which is connected to the second input of a dual-fuel regulator of the steam & gas turbine unit which is also the second input of the steam & gas turbine unit; steam & gas turbine unit comprises, at least, one gas turbine comprising a compressor, dual-fuel combustion chamber, and turbine; in addition, it comprises, at least, one electrical generator, at least, one heat recovery steam generator, steam turbine, second electrical generator, water treatment system, and, at least, one exhaust stack; compressor output is connected to the third input of a dual-fuel combustion chamber; the first input of a dual-fuel combustion chamber is connected to the first output of a fuel regulator and the second output of the fuel regulator is connected to the second input of the dual-fuel combustion chamber; dual-fuel combustion chamber output is connected to the turbine input; the first output of the turbine is connected to the first electrical generator which output is also the first connection output for external power consumers in the configuration; the
second turbine output is connected to the first input of a heat recovery steam generator; the second input of a heat recovery steam generator is connected to the water treatment system; the first output of a heat recovery steam generator connected to the first output of a steam turbine is also the third connection output for external heat consumers in the configuration; the second output of the heat recovery steam generator is connected to the steam turbine input; second output of the steam turbine is connected to the input of the second electrical generator which output is also the second connection output for external power consumers in the configuration;

3. the output of the exhaust stack is connected to the input of a process control and monitoring unit having two-way communications with other units in the configuration and consisting of a process control and monitoring system and, at least, one environmental emission control system;

4. the first output of, at least, one plasma converter of the plasma waste and biomass processing unit is connected to the input of a heat recovery hot water generator; the first output of a heat recovery hot water generator is also the first heat output (A) of the plasma waste and biomass processing unit which is connected to the third input of a steam & gas turbine unit which is also the third input of a heat recovery steam generator of the steam & gas turbine unit; output of the heat recovery hot water generator is connected through pyrolysis gas cleaning system to the input of the first carbon dioxide capture system; the first output of the first carbon dioxide capture system is connected to the input of the first compression system; the second output of the first carbon dioxide capture system is connected through the second compression system to, at least, one of the inputs of the second gasholder; output of the second gasholder is connected to the input of a carbon dioxide distribution and dosing system;

5. the second output of the carbon dioxide distribution and dosing system is also the third output of a plasma waste and biomass processing unit which is connected to the input of a carbon dioxide marketable product production unit; output of the carbon dioxide marketable product production unit, is also the carbon dioxide marketable product output (D) in the configuration;

6. the second input of the algae biodiesel and biomass production unit is connected to the third connection output of a steam & gas turbine unit and the second input of a coal syngas generator unit;
7. the third output of a heat recovery steam generator of a steam & gas turbine unit is connected to the input of the second carbon dioxide capture system; the first output of the second carbon dioxide capture system is connected to the input of, at least, one exhaust stack;

8. the second output of the second carbon dioxide capture system is also the fourth output of a steam & gas turbine unit which is connected to the fourth input of a plasma waste and biomass processing unit which is also the input of the third compression system which output is connected to, at least, one of the inputs of the second gasholder;

9. the first input of, at least, one dual-fuel regulator of the steam & gas turbine unit is connected to the output of a gas turbine fuel preparation system which input is also the first input of the steam & gas turbine unit;

10. the third input of a plasma waste and biomass processing unit is also the input of the fourth compression system which is connected to the output of a coal syngas generator unit comprising a coal dust treatment input; output of the fourth compression system, in its turn, is connected to, at least, one of the inputs of the first gasholder.

11. the third output of the algae biodiesel and biomass production unit is connected to the first output of a steam & gas turbine unit;

1.3 The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

1.4 It is customary practice to make biodiesel out of algae (e.g. see D5, paragraph 55) and to use it as a fuel for a gas turbine.

1.5 It is customary practice to burn the pyrolysis gas produced by a gasifier in a combined cycle power plant with recovery heat boiler and CO2 capturing and sending the waste steam to external consumers (see e.g. D6 figures 1 and 5 or D7 figure 1).

1.6 It is customary practice to control a plant based on emissions.

1.7 It is customary practice to recover heat from the pyrolysis gas coming out of the plasma gasifier, clean the gas and remove the CO2 from the gas. (see e.g. D2 figure 1)

1.8 It is customary practice to couple the heat recovery water generator from the gasifying part with the recovery heat boiler of the power generating part of the plant (see e.g. D11, (208) and (215) figure 2; paragraph 29)

1.9 It is customary practice to gather CO2 from different sources in one place and distribute it from there to other places in the plant where it is needed.
1.10 It is customary practice to use captured CO2 for producing a carbon dioxide marketable product.

1.11 The addition of a coal syngas generator unit is merely a juxtaposition and it is customary practice to mix pyrolysis from biomass gasification with syngas produced from coal dust, and burn this mix in a gas turbine (see D7, figure 1; paragraph 25).

1.12 It is customary practice to use waste streams (heat, CO2) and use them in other places of the plant where they are considered to be a resource (see e.g. D5).

1.13 All these differentiating features are thus all making the waste processing plant more efficient, however they do not have a synergetic effect as they all independently contribute to a more efficient plant.

1.14 Thus when designing a waste processing plant configuration to be as environmentally as possible the skilled person would look at the all the waste streams (heat, CO2) and look for ways to use them as resources in other processes. This way, the skilled person would consider different configurations and arrive in an obvious manner at the structural configuration of claim 1.

1.15 Hence, the subject-matter of claim 1 is not inventive in view D1 and the customary practice of the skilled person.

2 **Independent claim 6: Inventive step**

The present application does not meet the criteria of Article 33(3) PCT, because the subject-matter of claim 6 does not involve an inventive step.

2.1 Document D1 is regarded as being the prior art closest to the subject-matter of claim 6, and discloses a method for environmentally safe waste and biomass processing (abstract; page 4, lines 1-4) to increase the efficiency of electric power and heat generation during which waste and biomass are loaded ((110) figure 1; page) an milled (implicit) and afterwards they are subject to pyrolysis and gasification (page 5, lines 19-22); produced pyrolysis gas is cooled and cleaned (page 6, lines 1-3); pyrolysis gas is compressed (implicit) and accumulated together with syngas (implicit: part of the pyrolysis gas is syngas, so it is always together the syngas); and they are used for electric power and heat generation ((124) figure 1; page 6, line 2-5); this generated electric power and heat are supplied to external consumers (implicit); during pyrolysis and gasification melting occurs and basalt-like slag
is formed ((114) figure 1; page 5, lines 23-27) which is processed and used for production of a heat-insulation material or granulated slag wherein from heat occurred during pyrolysis gas cooling, additional electric energy is generated ((116) and (120) figure 1), in its turn; carbon dioxide captured from the exhaust gases occurred as a result of electric energy and heat generation, is compressed (implicit) is fed as nutrient to cultivate algae ((126) and (130) figure 1; page 4, lines 25-29), herewith, seed material is loaded (implicit) and algae is cultivated using heat source (implicit) and carbon dioxide ((126) and (130) figure 1; page 4, lines 25-29)

2.2 The subject-matter of claim 6 therefore differs from this known method of performing distributed combustion in that it also comprises the following steps:

1. CO2 is captured from the pyrolysis gas.

2. the exhaust gases occurred as a result of electric energy and heat generation, is compressed (implicit) and accumulated together with carbon dioxide captured from pyrolysis gas

3. after distribution and dosing, the CO2 is sent to plasma torches as plasma-forming gas, and it is used for production of carbon dioxide marketable products for external consumers

4. algae biodiesel and biomass production is provided starting from the algae; produced biodiesel is cleaned, accumulated and used to generate electric power and heat and biomass extraction is returned to the beginning of the process; biomass and algae oil produced during liquid biofuel production is supplied to the external consumers;

5. coal dust is loaded simultaneously at the beginning of the process, syngas is generated using heat then it is compressed and together with pyrolysis gas it is accumulated and used for generation of electric power and heat.

2.3 The technical effects connected to these differences are:

1. a syngas with a higher calorific value for the production of energy

2. having all the captured CO2 stored in one place

3. usefully use the CO2 that was captured

4. usefully use the algae which were used to convert to captured CO2

5. a bigger variety of waste products can be processed by the configuration
2.4 The problems to be solved by the present invention may therefore be regarded as how to modify the method of D1 in order to:

1. provide a syngas with a higher calorific value for the production of energy
2. have all the captured CO2 stored in one place
3. usefully use the CO2 that was captured
4. usefully use the algae which were used to convert to captured CO2
5. a bigger variety of waste products that can be processed by the same configuration

2.5 The five differentiating technical features do not have an synergetic effect as their problems are not interrelated.

2.6 The first differentiating technical feature "CO2 is captured from the pyrolysis gas" is not inventive, as it is customary practice for the skilled person to remove inert gases from a fuel gas in order to raise its calorific value (see e.g. D2, figure 1 or D3, figure 3)

2.7 The second differentiating technical feature "the exhaust gases occurred as a result of electric energy and heat generation, is accumulated together with carbon dioxide captured from pyrolysis gas " is not inventive, as it is customary practice for the skilled person to store the CO2, recovered from different sources, in one place.

2.8 The third differentiating technical feature "after distribution and dosing, the CO2 is sent to plasma torches as plasma-forming gas, and it is used for production of carbon dioxide marketable products for external consumers " is not inventive, as it is customary practice for the skilled person to recycle CO2 as plasma-forming gas (see e.g. D3, figure 3; paragraph 59) or to use the CO2 for external consumers.

2.9 The fourth differentiating technical feature "algae biodiesel and biomass production is provided starting from the algae; produced biodiesel is cleaned, accumulated and used to generate electric power and heat and biomass extraction is returned to the beginning of the process; biomass and algae oil produced during liquid biofuel production is supplied to the external consumers"," is not inventive, as it is customary practice for the skilled person to make biodiesel from algae ((D5, paragraphs 55 and 74)), use biodiesel to generate power and heat, return the biomass extraction to the gasifier (D5, paragraphs 55 and 74) and using part of the algae oil for external consumers (paragraphs 55 and 74).
2.10 The fifth differentiating technical feature "coal dust is loaded simultaneously at the beginning of the process, syngas is generated using heat then it is compressed and together with pyrolysis gas it is accumulated and used for generation of electric power and heat." is not inventive, as it is customary practice for the skilled person to mix different kinds of waste e.g., biomass and coal dust in the same gasifier (see e.g. D6, paragraph 36), which would lead to the syngas from the coal dust and the pyrolysis gas from the biomass being generated using heat (plasma from gasifier).

2.11 Hence, the subject-matter of claim 6 does not involve an inventive step in view of D1 and the customary practice of the skilled person.

3 Dependent claims 4, 5 and 7-14: Inventive step

Dependent claims 4, 5 and 7-14 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step, for the following reasons:

3.1 Claims 4-5: The additional features of claims 4 and 5 are part of the customary practice in the design of a baslat-like slag processing unit. Hence, the subject-matter of claims 7-8 is not inventive in view of D1 and the customary practice of the skilled person.

3.2 Claims 7-8: These are merely constructional details of plasma converter. Hence, the subject-matter of claims 7-8 is not inventive in view of D1 and the customary practice of the skilled person.

3.3 Claims 9 and 11-13: This is customary practice in the field of cultivating algae. Hence, the subject-matter of claims 9 and 11-13 is not inventive in view of D1 and the customary practice of the skilled person.

3.4 Claim 10: It is customary practice to use biodiesel in a gas turbine, recycle the biomass waste of the biodiesel production process in the plasma converter and use part of the algae oil to external users. Hence, the subject-matter of claim 10 is not inventive in view of D1 and the customary practice of the skilled person.

3.5 Claim 14: The addition of a coal syngas generator unit is merely a juxtaposition and it is customary practice to mix pyrolysis from biomass gasification with syngas produced from coal dust, and burn this mix in a gas
turbine (see D7, figure 1; paragraph 25).
Hence, the subject-matter of claim 14 is not inventive in view of D1 and the customary practice of the skilled person.

4 **Dependent claims 2 and 3: Positive assessment**

Dependent **claims 2 and 3** appear to be novel and inventive.