combined cycle solutions with CO_2 capture used on shore are extremely bulky and heavy (in particular due to the size of the recovery boilers, of the steam turbine and of the condenser), because they aim above all to maximize yield and are not well suited to the constraints of offshore. In addition, the "light" combined cycles without capture proposed today for the offshore remain rather heavy and bulky, and raise some questions for their conversion into a solution with capture, in particular for the impact of the consequent extraction of steam, necessary for the CO_2 capture process, on the design and operation. Thus, it is not at all certain that such cycles with capture will ultimately offer better performance while their weight and footprint will be much greater.

[0023] In addition, the decarbonization of power generation installation also poses the problem of optimizing production and investment costs. The combined cycle with absorption capture is a common solution today, but the weight criterion is not as critical as for offshore, and the impact of the cooling system, usually air, on the size of the installation makes the search less relevant. The boilers used are usually heavier, the steam cycle at 2 pressures to increase efficiency and mitigate the difficulties related to the steam turbine mentioned above, and the cost constraints are little or not optimized with regard to the production need.

[0024] Hence, there is a need for solutions capable of generating power while reducing greenhouse gas emissions and which are suitable for small-scale installations without compromising their efficiency, and while reducing the costs associated with these installations.

Summary of the invention

[0025] The following sets forth a simplified summary of selected embodiments and examples of the present invention for the purpose of providing a basic understanding of the claimed invention. However, the summary does not constitute an extensive overview of all the embodiments and examples of the claimed invention. The sole purpose of the summary is to present selected embodiments and examples of the claimed invention in a concise form as an introduction to the more detailed description of the embodiments and examples of the claimed invention that follow the summary.

[0026] The claimed invention aims to overcome the disadvantages of the prior art. According to a first aspect of the present invention, there is provided **a system for generating power** with a combined cycle for an installation, the system comprising:

- at least one supply pipe, at least one gas turbine,
- at least one transport pipe, at least one heat recovery steam generator, at least one conveying pipe, at least one back pressure steam turbine, wherein:
- the at least one supply pipe is configured to supply a working fluid to the at least one gas turbine,
- the at least one transport pipe is configured to guide an exhaust gas from a proximal end to a distal end of the at least one transport pipe, said proximal end being configured to cooperate fluidically with the at least one gas turbine and the distal end being configured to cooperate fluidically with the at least one compact heat recovery steam generator, said distal end being at a height less than or equal to a height of the proximal end relative to a base of said installation, and
- the at least one conveying pipe is configured to direct a steam from the at least one compact heat recovery steam generator to the at least one back-pressure steam turbine configured to generate power from the steam.

[0027] The advantage of this system is that it improves overall efficiency, which reduces fuel costs. The system allows improving the weight/power ratio and thus to increase the efficiency of the installation. In addition, the system is compact and allows to be adapted to the installation with reduced space.

[0028] Hence, the claimed invention allows a significant increase in efficiency compared to "open cycle" operation, and therefore a reduction in fuel consumption while minimizing the amount of space and materials required for power generation. The layout and arrangement of each system element is considered to facilitate its implementation and to improve the performance of the installation.

[0029] The claimed invention thus allows for a reduction in costs, an increase in efficiency, a reduction in fuel consumption, in particular compared to a direct capture installation, and thus an improvement in the overall size of the installation.

[0030] In addition, the claimed invention allows to be adaptable to several types of installations.

[0031] According to other optional features of the system according to the claimed invention, it can optionally include one or more of the following characteristics alone or in combination:

- the generated power is an electric, thermal power and/or mechanical power,
- the installation is an onshore installation or an offshore installation,
- the at least one gas turbine comprises an exhaust gas recirculation means,
- the system and/or the at least one compact heat recovery steam generator comprise at least one duct firing,

[0032] According to a second aspect of the present invention, there is provided **a system for capturing CO_2** from exhaust gas comprising:

- at least one power generation system as defined in the first aspect,
- at least one cooling module configured to cool the exhaust gas from the at least one compact heat recovery steam generator,
- at least one absorption module configured to contact cooled exhaust gas with a lean solvent capable of absorbing CO_2 from the exhaust gas to generate an enriched solvent, and
- at least one solvent regeneration module fluidically coupled to at least one reboiler, said solvent regeneration module being configured to treat the enriched solvent to release absorbed CO_2 and form a lean solvent, and
- wherein the back pressure steam turbine is configured to supply steam to the reboiler of the solvent regeneration module.

[0033] The claimed invention allows increasing efficiency compared to "open cycle" operation, and thus reduced fuel consumption and residual CO_2 emissions, while minimizing the space and amount of material required to provide CO_2 capture by absorption on a power generation installation and thus reducing CO_2 emissions.

[0034] The claimed invention allows a power generation system with a specific layout and arrangement to be judiciously combined with a CO_2 capture system also having a particular layout and arrangement in order to improve and decrease the weight/power ratio of the installation and to adapt to space constraints.

[0035] The claimed invention also allows for a reduction in the cost of implementing CO_2 capture on an installation with an increase in efficiency, reduction in fuel consumption and CO_2 emissions compared to, for example, a direct capture installation, and thus in the overall size of the installation. This claimed invention allows the implementation of capture on a power generation installation at a significantly lower overall cost than that of an "open cycle" installation with direct capture, or of a "combined cycle" installation, lightened or not with capture. Moreover, the claimed invention can be adapted to installations with a reduced footprint.

[0036] In addition, the claimed invention allows to be adaptable to several types of installations.

[0037] According to other optional features of the system according to the claimed invention, it can optionally include one or more of the following characteristics alone or in combination:

- it comprises an auxiliary water extraction and re-injection system,

- it comprises a water storage means,
- it comprises a collector, preferably configured to be arranged downstream of the at least one compact heat recovery steam generator,
- the cooling module comprises a cooling fluid, said cooling module being configured to bring the exhaust gas and the cooling fluid into contact, said contact being direct or indirect,
- the cooling module and the absorption module are configured to be arranged in the lower part of the installation,
- the cooling module is configured to cooperate fluidically with the at least one compact heat recovery steam generator,
- it comprises a fan,
- the absorption module is configured to enable a counter-current flow absorption,
- the absorption module is configured to enable a crossflow absorption.

[0038] According to a third aspect of the present invention, there is provided **a method for capturing CO_2** comprising at least one system for capturing CO_2 as defined in the second aspect wherein the said method comprises a step of setting the at least one compact heat recovery steam generator to an inlet exhaust gas temperature ranging from 400 °C to 650 °C.

[0039] The claimed invention allows for increased efficiency over "open cycle" operation, thus reducing fuel consumption and residual CO_2 emissions, while minimizing the space and amount of material required to provide CO_2 capture by absorption on an installation. The claimed invention allows an optimization of the system parameters allowing an excellent compromise between performance and compactness, while allowing a thorough integration of the whole "power generation" and "CO_2 capture" functions in an optimized installation.

[0040] In addition, the claimed invention allows to be adaptable to several types of installations.

[0041] According to other optional features of the method according to the claimed invention, it can optionally include one or more of the following characteristics alone or in combination:

- It comprises a step of setting the at least one compact heat recovery steam generator to an outlet exhaust gas temperature ranging from 70 °C to 250 °C,

- It comprises a step of setting the at least one compact heat recovery steam generator to a steam outlet temperature ranging from 400 °C to 565°C,
- It comprises a step of setting the at least one compact heat recovery steam generator to a steam outlet pressure ranging from 25 bar to 170 bar,
- It comprises a step of setting the back pressure steam turbine to an inlet steam pressure ranging from 25 to 170 bar,
- It comprises a step of setting the back pressure steam turbine to an outlet steam pressure ranging from 1 to 20 bar,
- It comprises a step of setting the back pressure steam turbine to a steam inlet temperature ranging from 400 to 565 °C,
- It comprises a step of setting the back pressure steam turbine to a steam outlet temperature ranging from a saturation temperature to at most 50 °C superheating,
- It comprises a step of setting the reboiler to a steam inlet pressure in a range from 2 bar to 6 bar,
- It comprises a step of setting the reboiler to a steam inlet temperature in a range from 120 °C to 200 °C,
- It comprises a step of setting the reboiler to a steam outlet pressure in a range from 2 bar to 6 bar,
- It comprises a step of setting the reboiler to a steam outlet temperature in a range from 120 °C to 160 °C.

[0042] According to a fourth aspect of the present invention, there is provided a use of a CO_2 capture system as defined in the second aspect in electricity production, steam production, mechanical power production, thermal power production, in the treatment of CO_2, in the conditioning of CO_2, in the transport of CO_2, in the storage of CO_2, in the recovery of exhaust flue gas, in the treatment of exhaust flue gas, in gas production, in oil production and/or in marine transport.

[0043] The use of such a system allows to reduce CO_2 emissions, to optimize costs while being compatible with multiple installations and platform activities.

[0044] According to a fifth aspect of the present invention, there is provided a use of a power generation system as defined in the first aspect in the capture of CO_2, in electricity production, steam production, mechanical power production, thermal power production, in the treatment of CO_2, in the conditioning of CO_2, in the transport of CO_2, in the storage of CO_2, in the recovery of exhaust flue gas, in the treatment of exhaust flue gas, in gas production, in oil production and/or in marine transport.

[0045] The use of such a system allows generating power, to optimize costs while being compatible with multiple installations and platform activities.

[0046] According to a sixth aspect of the present invention, there is provided an offshore installation comprising a power generation system as defined in the first aspect.

[0047] According to a seventh aspect of the present invention, there is provided an onshore installation comprising a power generation system as defined in the first aspect.

[0048] According to an eighth aspect of the present invention, there is provided an offshore installation comprising a system for capturing CO_2 as defined in the second aspect.

[0049] According to a ninth aspect of the present invention, there is provided an onshore installation comprising a system for capturing CO_2 as defined in the second aspect.

Brief description of the drawings

[0050] Other features and advantages of the invention will be better understood by reading the following description with reference to the attached drawings, given for illustrative purposes and in no way limiting:

FIG. 1 is a schematic diagram of a power generation system according to an embodiment of the invention.

FIG. 2 is a schematic view of a power generation system according to an embodiment of the invention.

FIG. 3 is a schematic diagram of an arrangement of the compact HRSG and the GT and in particular the flow between the compact HRSG and the GT according to several embodiments of the invention, FIG.3A is a schematic diagram of a horizontal flow, FIG. 3B and FIG. 3C are a schematic diagram of a vertical

Claims

1. A system for generating power with a combined cycle for an installation, the system comprising at least one supply pipe, at least one gas turbine, at least one transport pipe, at least one heat recovery steam generator, at least one conveying pipe, at least one back pressure steam turbine, wherein:

- the at least one supply pipe is configured to supply a working fluid to the at least one gas turbine,

- the at least one transport pipe is configured to guide an exhaust gas from a proximal end to a distal end of the at least one transport pipe, said proximal end being configured to cooperate fluidically with the at least one gas turbine and the distal end being configured to cooperate fluidically with the at least one compact heat recovery steam generator, said distal end being at a height less than or equal to a height of the proximal end relative to a base of said installation, and

- the at least one conveying pipe is configured to direct a steam from the at least one compact heat recovery steam generator to the at least one back-pressure steam turbine configured to generate power from the steam.

2. The system for generating power according to the claim 1 wherein the generated power is an electric, thermal power and/or mechanical power.

3. The system for generating power according to the claim 1, wherein the at least one compact heat recovery steam generator is an inverted vertical compact heat recovery steam generator.

4. The system for generating power according to the claim 1, wherein the at least one compact heat recovery steam generator is configured to present a horizontal flow or a vertical downflow or vertical upward flow.

5. The system for generating power according to the claim 1, wherein the distal end of the transport pipe is configured to be at a height greater than or equal to a height of an inlet of the at least one compact heat recovery steam generator relative to a base of the installation.

6. The system for generating power according to the claim 1, wherein the distal end of the transport pipe is configured to be at a height greater than or equal to a height of an

outlet of the at least one compact heat recovery steam generator relative to a base of the installation.

7. The system for generating power according to the claim 1, wherein the at least one compact heat recovery steam generator is configured to be arranged below the gas turbine.

8. A system for capturing CO_2 from exhaust gas comprising:
   - at least one power generation system according to the claim 1,
   - at least one cooling module configured to cool the exhaust gas from the at least one compact heat recovery steam generator,
   - at least one absorption module configured to contact cooled exhaust gas with a lean solvent capable of absorbing CO_2 from the exhaust gas to generate an enriched solvent, and
   - at least one solvent regeneration module fluidically coupled to at least one reboiler, said solvent regeneration module being configured to treat the enriched solvent to release absorbed CO_2 and form a lean solvent, and
   - wherein the back pressure steam turbine is configured to supply steam to the reboiler of the solvent regeneration module.

9. The system for capturing CO_2 according to the claim 8, wherein the cooling module is configured to cooperate fluidically with the at least one compact heat recovery steam generator.

10. The system for capturing CO_2 according to the claim 8, wherein the absorption module is configured to enable a counter-current flow absorption.

11. The system for capturing CO_2 according to the claim 8, wherein the absorption module is configured to enable a crossflow absorption.

12. A method for capturing CO_2 comprising at least one system for capturing CO_2 according to the claim 8, wherein the said method comprises a step of setting the at least one compact heat recovery steam generator to an inlet exhaust gas temperature ranging from 400 °C to 650 °C.

13. The method for capturing CO_2 according to the claim 12, wherein the said method comprises a step of setting the at least one compact heat recovery steam generator to an outlet exhaust gas temperature ranging from 70 °C to 250 °C.

14. The method for capturing CO_2 according to the claim 12, wherein the said method comprises a step of setting the at least one compact heat recovery steam generator to a steam outlet temperature ranging from 400 °C to 565 °C.

15. Use of a CO_2 capture system according to the claim 8 in electricity production, steam production, mechanical power production, thermal power production, in the treatment of CO_2, in the conditioning of CO_2, in the transport of CO_2, in the storage of CO_2, in the recovery of exhaust flue gas, in the treatment of exhaust flue gas, in gas production, in oil production and/or in marine transport.

16. Use of a power generation system according to claim 1 in the capture of CO_2, in electricity production, steam production, mechanical power production, thermal power production, in the treatment of CO_2, in the conditioning of CO_2, in the transport of CO_2, in the storage of CO_2, in the recovery of exhaust flue gas, in the treatment of exhaust flue gas, in gas production, in oil production and/or in marine transport.

17. An offshore installation comprising a power generation system according to the claim 1.

18. An onshore installation comprising a power generation system according to the claim 1.

19. An offshore installation comprising a system for capturing CO_2 according to the claim 8.

20. An onshore installation comprising a system for capturing CO_2 according to the claim 8.