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(54) A METHOD OF AND AN APPARATUS FOR PRODUCING AND REGULATING ELECTRICAL POWER

METHODE UND VORRICHTUNG ZUR ERZEUGUNG UND REGULIERUNG VON STROM

PROCÉDÉ ET DISPOSITIF POUR LA PRODUCTION DE L'ÉLECTRICITÉ

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(56) References cited:
EP-A- 1 102 187
SU-A1- 1 260 641
US-A- 4 057 736

- **MAKANSI J: "THROUGH THE IT LOOKING GLASS APPEARS A NEW KIND OF COMPANY" POWER, HILL PUB. CO., NEW YORK, NY, US, vol. 143, no. 5, September 1999 (1999-09), pages 22-24,26, XP000860784 ISSN: 0032-5929**

EP 1 815 109 B1

Description

[0001] The present invention relates to systems and methods concerning supply and regulation of electrical power.

[0002] EP 1,102,187 discloses a process for the prediction and optimization of the output of a plant producing products from incoming materials.

[0003] SU 1 260 641 discloses a system for controlling pulverized-coal preparation units of boiler sets.

[0004] US 4,057,736 discloses systems for producing high voltage electrical power from fossil fuels or other non-electrical energy resources and provides an electrical power production system and a distribution system with which it is practically and economically feasible to locate power production facilities near fuel resource sites or other primary energy sources that may be remote from the areas in which the power is consumed.

[0005] The present invention differs from the known processes in that the invention provides a method of producing and regulating electrical power for delivery on an electrical power supply grid, in particular by determining the need for electrical power on the electrical power supply grid and delivering the needed electrical power on the grid, and at the same time delivering any excess electrical power to the fuel-producing plant.

[0006] Accordingly, the present invention provides a process and a system, which permits optimization of energy production.

[0007] In a first aspect, the present invention relates to a method of producing and regulating electrical power for delivery on an electrical power supply grid. The method according to the first aspect comprises:

providing at least one combined heat and power plant generating heat and electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof,
providing a fuel producing plant for generating carbon or nitrogen-based fuels using electrical power from the at least one combined heat and power plant and a combination of carbon dioxide and hydrogen and/or carbonaceous gasses, and/or carbonaceous liquids and/or nitrogen,
determining the need for electrical power on the electrical power supply grid and delivering the needed electrical power on the grid, and
delivering any excess electrical power to the fuel producing plant.

[0008] The combined heat and power plant generates heat and electrical power for delivery to a multitude of households. The need for electrical power and the need for heat fluctuate over time.

[0009] When production of a specific electrical power is required, the yield of the combined heat and power plant may be reduced. There is an optimal range wherein the combined heat and power plant has the highest yield, however, excess electrical power and/or excess heat may be produced. The excess electrical power and/or the excess heat may be converted to a form that may be stored. In the presently preferred embodiment of the present invention, the excess electrical power and/or the excess heat is guided or led to a fuel producing plant producing carbon and/or nitrogen-based fuels from a combination of carbon dioxide and hydrogen and/or carbonaceous gasses and/or carbonaceous liquids and/or nitrogen and electrical power. In the present context, yield and efficiency is construed as terms describing the level or rate of conversion of fuel or the like, into electrical power.

[0010] The combined heat and power plant generating heat and electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof. The biomass is preferably fermented or broken down or decomposed so that the biomass may be utilised in a combustion process for the generation of heat and/or electrical power and/or synthesis gas, as corrosive water-soluble inorganic substances is removed.

[0011] The biomass is preferably treated by acid hydrolysis, basic or alkaline hydrolysis or enzymatic hydrolysis, followed by fermentation to ethanol and other fermented products, such as higher alcohols, methane or hydrogen. Alternatively, the enzymatic hydrolysis is followed by thermo-chemical transformation.

[0012] The need for electrical power on the electrical power supply grid is determined by a monitoring unit or system.

[0013] Specifically, the excess electrical power may be produced due to requirements for production of heat, as a high demand for heat requires the plant to operate at a level or the plant for other reasons is not able to down-regulate where the corresponding production of electrical energy exceeds the need in the electrical power supply grid.

[0014] Also, at least one electrical power plant generating electrical power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy may be provided and electrically connected to the electrical power supply grid.

[0015] A second aspect of the present invention relates to a method of producing and regulating electrical power for delivery on an electrical power supply grid. The method according to the second aspect comprises:

providing at least one electrical power plant generating electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof,
providing at least one electrical power plant generating electrical power from renewable energy, such as wind power,

hydro power, solar energy, tidal energy or wave energy,
providing a fuel producing plant for generating carbon and/or nitrogen-based fuels using electrical power, and a combination of carbon dioxide and hydrogen and/or carbonaceous gasses and/or carbonaceous liquids and/or nitrogen,
determining the need for electrical power on the electrical power supply grid and delivering the needed electrical power on the grid, and
delivering any excess electrical power to the fuel producing plant.

[0016] In the presently preferred embodiment of the present invention according to the second aspect, at least one electrical power plant generates electrical power from renewable energy. As the electrical energy provided or generated by such a plant varies as the wind blow, so to speak, the total amount of electrical energy generated by the at least one electrical energy plant generating electrical power from renewable energy and the at least one electrical power plant generating electrical power from other sources, may vary a lot in a short or long period of time, and it is desirable to run the plant not producing electrical energy from renewable energy at a level where the yield of the plant is maximal, some excess electrical energy may be produced.

[0017] Instead of e.g. selling the excess electrical energy at the global, local or regional energy market, possibly at prices lower than the cost of producing the energy, it is preferably to store the excess energy for periods of time where the demand for electrical energy is low. Therefore, at least a part of the excess electrical power may originate from the uneven production of electrical power generated from the renewable energy.

[0018] Alternatively, an electrical power plant generating electrical power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy, and
a fuel producing plant for generating carbon and/or nitrogen-based fuels using electrical power, and a combination of carbon dioxide and hydrogen and/or carbonaceous gasses and/or carbonaceous liquids and/or nitrogen, is used for generating the carbon and/or nitrogen-based fuels for later or almost immediate use in a plant for generating electrical power from the carbon and/or nitrogen-based fuels.

[0019] It is an advantage of the present invention that in the method according to the second aspect at least one of the at least one electrical power plant may be a combined heat and power plant. Also, the excess electrical power may be produced due to requirements for production of heat, as discussed earlier.

[0020] A third aspect of the present invention relates to a method of producing and regulating electrical power for delivery on an electrical power supply grid comprising:

providing a plurality of electrical power generating units each capable of producing a specific electrical power rating where the unit generates power at an optimal efficiency,
providing a plant for producing carbon and/or nitrogen-based fuels using electrical power from the plurality of electrical power generation units and a combination of carbon dioxide and hydrogen and/or carbonaceous gasses and/or carbonaceous liquids and/or nitrogen,
determining the need for electrical power on the electrical power supply grid and delivering the needed electrical power on the grid, enabling a specific number of power generating units generating electrical power at the optimal efficiency, and
delivering any excess electrical power to the fuel producing plant.

[0021] Each of the power generating plants has an optimal setting for utilising the amount of fuel driving the unit.

[0022] At least one of the electrical power generating units may be an electrical power plant generating electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof, or an electrical power plant generating electrical power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy or a combined heat and electrical power generating unit, or a combination thereof.

[0023] The plurality of units may be a mixture of the above mentioned electrical power generating plants, but also embodiments where only one type of electrical power generating plants are present are also possible.

[0024] A further advantage of the present invention, relates to

providing an apparatus for performing hydrolysis using electrical power,
producing hydrogen and oxygen from water by hydrolysis of water, and
generating the carbon and/or nitrogen-based fuels using the hydrogen.

[0025] The carbon and/or nitrogen-based fuels may be produced using a combination of the hydrogen generated from hydrolysis of water and a carbonaceous and/or nitrogen containing source. The process is integrated with heat and power production resulting ion a high plant efficiency.

[0026] Providing an apparatus for performing hydrolysis using electrical power enable the production of hydrogen and

oxygen from water by hydrolysis of the water on or near the site where it is later to be used for producing the carbon and/or nitrogen-based fuels. Also, at least part of the oxygen may be used for gasification and/or using at least part of the oxygen as combustion air for generating heat and/or electrical power.

[0027] Furthermore, the carbon monoxide and/or carbon dioxide and/or nitrogen, or at least a part thereof, may be provided from the at least one combined heat and power plant or the at least one electrical power plant from the burning of biomass and/or fossil fuel.

[0028] The collection or containment of carbon monoxide and/or dioxide is also contemplated to improve, i.e. lower, the release of these unwanted gasses into the atmosphere. The collection or containment and use of the gasses including nitrogen is also contemplated to improve, i.e. lower, the need to buy or collect these gasses.

[0029] A feature of the present invention relates to either of the methods according to the first or second aspects further comprising:

providing at least one second apparatus for production of carbon monoxide or carbon dioxide by gasification of biomass, natural gas, coal, by reforming of natural gas or biogas or a combination thereof,
producing the carbon monoxide or carbon dioxide, and
generating said carbon and/or nitrogen-based fuels using the carbon monoxide and/or carbon dioxide.

[0030] A further feature relates to the method according to any of the aspects one, two, or three wherein at least one electrical power plant generates electrical power from biomass, the methods may further comprise:

processing any excess or remaining biomass into animal feed and/or fodder and/or organic fibre and/or carbon dioxide or any combinations thereof.

[0031] A special feature of the present invention relates to the carbon and/or nitrogen-based fuels being used for cars, trucks, air planes, any combustion engine, heating system, fuel cell system or any combinations thereof, or at least mixed into fuel for the above mentioned engines and/or systems.

[0032] The method according to the first aspect may incorporate any of the features mentioned in connection to the method according to the second or third aspect of the present invention, the method according to the second aspect may incorporate any of the features mentioned in connection to the method according to the first or third aspects of the present invention and the method according to the third aspect may incorporate any of the features mentioned in connection to the method according to the first or second aspects of the present invention

[0033] A fourth aspect of the present invention relates to a system for producing and regulating electrical power for delivery on an electrical power supply grid that comprises:

at least one power plant generating electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof, the at least one power plant electrically connected to the electrical power supply grid,
a fuel producing plant for generating carbon and/or nitrogen-based fuels using electrical power and a combination of carbon dioxide, nitrogen and hydrogen or synthesis gas, the fuel producing plant electrically connected to the electrical power supply grid and/or the at least one power plant,
an apparatus/system for determining the need for electrical power on the electrical power supply grid and determining the amount of excess electrical power,
a control/regulation system for controlling the fuel producing plant so as to control consumption of the excess electrical power in the fuel producing plant.

[0034] The discussion in relation to the first and/or second and/or third aspect of the present invention is also applicable in relation with the fourth aspect of the present invention.

[0035] The synthesis gas is preferably a mixture of carbon monoxide, carbon dioxide and hydrogen. For the nitrogen-based fuels, the synthesis gas is preferably hydrogen and nitrogen.

[0036] In the system according to the fourth aspect at least one of the at least one electrical power plant may be a combined heat and electrical power plant. The generation of heat, e.g. in the form of steam or water with an elevated temperature, requires or results in a specific amount of electrical power, hence, if the requirement for heat rises, and the plant produces more heat, more electrical energy is produced. The excess electrical power may be sold on the local, regional or global energy market, but may also be used as discussed in relation to the first and second aspect of the present invention on or in a plant or system in accordance with the fourth aspect of the present invention.

[0037] Also, the system according may further comprise:

at least one additional electrical power plant producing electrical power from renewable energy, such as from wind power, hydraulic power, water power, tidal energy or wave energy, the at least one additional electrical power plant

electrically connected to the fuel producing plant and/or the at least one power plant and/or the electrical power supply grid.

[0038] As discussed earlier, a system comprising at least one electrical power plant producing electrical power from renewable energy and a fuel producing plant for generating carbon and/or nitrogen-based fuels using electrical power and a combination of carbon dioxide, nitrogen and hydrogen or synthesis gas, wherein the two are electrically connected, may be envisioned.

[0039] The fuel producing plant in the system according to the fourth aspect may generate methanol, ethanol, higher alcohols, dimethanolether, RME, DME, methylated, ethylated plant oils, ammonia, or any other carbon and/or nitrogen-based fuel or any combinations thereof.

[0040] The carbon and/or nitrogen-based fuels may be used alone as a fuel for e.g. combustion engines or fuel cell systems or other applications wherein a carbon and/or nitrogen-based fuel is to be used.

[0041] The system may include in the fuel producing plant an apparatus for performing hydrolysis using electrical power, also, a supply of water, in the form of a pipeline to a tank or a reservoir, or the like, is advantageous for the plant to be able to perform the hydrolysis at any time it is required.

[0042] Also, the fuel producing plant may further comprise at least one second apparatus for production of carbon monoxide and/or carbon dioxide by partial oxidation of biomass, natural gas, coal, by steam reforming of natural gas, by dry reforming of natural gas or any combinations thereof. The carbon monoxide and/or dioxide may then be used in the production of the carbon and/or nitrogen-based fuels.

[0043] The system according to the fourth aspect may incorporate any of the features derivable from the methods according to the first and/or second aspect of the present invention.

[0044] A fifth aspect of the present invention relates to a system for producing and regulating electrical power for delivery on an electrical power supply grid comprising:

a plurality of electrical power generating units each capable of producing a specific electrical power rating where the unit generates power at an optimal efficiency,
a plant for producing carbon and/or nitrogen-based fuels using electrical power from the plurality of electrical power generation units and a combination of carbon dioxide, nitrogen and hydrogen and/or carbonaceous gasses, the plant receiving electrical power from at least one of the units,
determining the need for electrical power on the electrical power supply grid and delivering the needed electrical power on the grid, enabling a specific number of power generating units generating electrical power at the optimal efficiency, and
delivering any excess electrical power to the fuel producing plant.

[0045] As the units have an optimal point, the electrical power generated on a specific number of plants may exceed the requirements of the electrical power grid. This excess energy may be utilised in a plant for generating carbon and/or nitrogen-based fuels. The requirements for electrical power on the electrical power grid fluctuates over time, even over short periods of time. The electrical power may be delivered to households, factories, office buildings, streetlights or the like, alternatively any combination of these.

[0046] For environmental reasons, each of the plant preferably operates an optimal efficiency for reducing the waste or loss of energy.

[0047] At least one of the plurality of electrical power generation units may be a combined heat and power generation plant and/or at least one of the plurality of electrical power generation units is a power generation plant producing power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy and/or at least one of the plurality of electrical power generation units is a power generation plant producing power from biomass, fossil fuel, nuclear fuel or combinations thereof.

[0048] The system according to the fifth aspect may incorporate any of the features derivable from the methods according to the first and/or second and/or third aspect of the present invention.

[0049] The system according to the fifth aspect may incorporate any of the features mentioned in connection with the system according to the fourth aspect of the present invention.

[0050] The present invention is now to be discussed in greater detail with non-limiting reference to the drawing, in which:

Fig. 1 is a schematic view block diagram illustrating a process for producing carbon and/or nitrogen- based fuels.

[0051] Fig. 1 schematically illustrates a process for producing carbon and/or nitrogen-based fuels, preferably being methanol and/or ethanol, from biomass in the form of straw, woods waste, leftovers from foodstuff industry or other biomass resources. The biomass or waste is introduced as illustrated by the arrow 1 into a biomass pre-treatment apparatus or facility 2, wherein the biomass is decomposed, broken down, or biodegraded by hydrological and/or en-

zymatic processes into monosaccharoses that may be fermented along with a leftover part returned for use for the purposes in the process. The leftover part is returned as indicated by the arrow.

[0052] In the pre-treatment process of the biomass or the organic waste, the bulk of the water soluble alkali compounds are removed as these may give rise to corrosion and/or fouling or deposit problems during the energy reforming processes such as the combustion, incineration and/or gasification.

[0053] The monosaccharoses produced in the pre-treatment process 2 are transferred into ethanol fermentation 4 as indicated by the arrow 3. The fermentation may be a conventional fermentation using yeast or alternatively by use of thermophile bacteria. The ethanol solution produced in this process is transported for ethanol distillation in a distillation plant or apparatus 6 as indicated by the arrow 5.

[0054] The unused part of the biomass 1 returned to a biomass storage is used as additional fuel along with other fuel, such as coal, oil, gas, biomass, waste or the like in a separate boiler 7. The boiler 7 is used for the production of steam 8 used for heating processes, district heating or production of electricity in a steam turbine 9.

[0055] The combustion process in the boiler 7 also produces a flue or waste gas, also including carbon dioxide. The gas is led to an absorption facility 11 where carbon dioxide and/or carbon monoxide are absorbed within an appropriate absorber such as monoethanoamin.

[0056] The absorbed carbon monoxide and carbon dioxide are transported 12 to be deabsorbed and stripped 13.

[0057] The carbon dioxide from the stripper is mixed with carbon dioxide from the fermentation process 4 and is compressed 15 and stored 17 or led to the autothermal reactor 34 or directly to syngas mixing station 36. The gas is compressed to a pressure level useful in the following processes. Typically, the carbon dioxide is compressed to approximately 30-150 bar. The compressor may be driven by a steam turbine or electricity.

[0058] The compressed carbon dioxide is led 16 to a storage tank from where the carbon dioxide is distributed to the other processes such as natural gas reforming 34 or to a synthesis tank 36.

[0059] If a large surplus of carbon dioxide exists the carbon dioxide may be used for reforming natural gas, thereby increasing the amount of carbon monoxide which in turn reduces the need for production of hydrogen. The autothermal reforming using carbon dioxide of natural gas is an endoderm process operating at high temperature in the range of 500-900° C. The heat for the process may be in the form of a burner or from other processes. The reformed gas is delivered to the synthesis gas mixture tank 36.

[0060] The reforming of natural gas follows the formula:

$$CO_2 + CH_4 \rightarrow 2CO + 2H_2$$

[0061] In the mixture tank 36 a mixture of three parts carbon monoxide, one part carbon dioxide and nine parts of hydrogen is preferable. However, divergent mixtures may also be used. The mixture in the mixing tank 36 receives additional hydrogen 22 from an electrolysis process where hydrogen is produced from electrical power and water in an electrolysis tank 19. The hydrogen is preferably produced at a high pressure, or may be compressed by a compressor compressing the produced hydrogen. The hydrogen is transferred 20 into a hydrogen tank 21 connected to the mixing tank 36 via 22.

[0062] The electrical power may be supplied from any source of electrical power. In the presently preferred embodiment of the present invention, the electrical power may be supplied from a source producing the electrical power from renewable energy such as wind power, hydro power, solar energy, tidal energy or wave energy or any combinations thereof. Also, at least one electrical power plant producing electrical power from carbon and/or nitrogen-based fuels may supply the electrical power for the hydrolysis process.

[0063] As the power plants produce electrical power based on the need of the electrical power supply grid and it is preferably to run these plants at a specific level for obtaining an optimal yield of the plants, there may be periods wherein the plants produce excess electrical power and in these periods it is possible to use this excess electrical power for electrolysis of water for the production of hydrogen. Alternatively, the excess electrical power may be sold on the international or local energy markets, possibly at prices lower than the costs of production of the electrical power.

[0064] The autothermal reformer or the mixing tank 36 also receives hydrogen and carbon monoxide 33 from the gasification of untreated waste/biomass 27, from coal 29 and from pre-treated biomass 31. The gasification processes produces heat that may be used for other processes or process steps (electricity, chemical processes and for heating)

[0065] It is preferable that the electrolysis process 19 uses electrical power that stems from electrical power plants producing electrical power from renewable energy. The use of electrical power stemming from renewable energy is preferable, as the methanol would have a higher share of renewable energy than if produced on electricity from fossil fuel. Also, the electrolysis could be used to balance varying electricity production from renewable energy sources. Further, it is preferable that the electrolysis is formed at high pressure thereby possibly avoiding additional compression.

[0066] From the mixing tank 36 the gas 37 produced in the mixing tank 36 is transferred into a methanol reactor 38 for producing methanol from the gas 37. The methanol synthesis is a catalytic process where typical Cu/Zn/Al are used as catalysts. The methanol synthesis typically runs at 200-300^0 C and at a pressure of 50-150 bar. The methanol

synthesis follows the formula:

$$CO + 2H_2 \rightarrow CH_3OH$$

[0067] Ethanol is produced using fermentation of biomass and/or waste and follows the formula:

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$

[0068] The methanol synthesis follows the formula:

$$CO_2 + 3H_2 \rightarrow CH_3OH + H_2O$$

[0069] The use of carbon dioxide as a basis of methanol production inevitably resolves in one third of the hydrogen bound in water, however, using carbon monoxide as a basis for methanol production or synthesis, a more balanced hydrogen use is contemplated. The methanol synthesis follows the formula:

$$CO + 2H_2 \rightarrow CH_3OH$$

[0070] The amount of carbon monoxide may be increased by using oxygen from the electrolysis for gasification of biomass or gasification of natural gas as illustrated in the two following formulas:

$$(C6H_{10}O_5)n^1 + n/202 \rightarrow 6nCO + 5nH_2$$

$$½O_2 + CH_4 \rightarrow CO + 2H_2$$

Claims

1. A method of producing electrical power for delivery on an electrical power supply grid comprising:

   providing at least one combined heat and power plant (7-10) generating heat(7,8) and electrical power (9,10) from biomass, fossil fuel, nuclear fuel or combinations thereof,
   characterized in providing a fuel producing plant (19-45) for generating carbon and/or nitrogen-based fuels using electrical power (19) from said at least one combined heat and power plant and a combination of carbon dioxide (23) and hydrogen (22) and/or carbonaceous gasses and/or carbonaceous liquids (35) and/or nitrogen,
   determining the need for electrical power on said electrical power supply grid and delivering said needed electrical power on said grid, and
   delivering any excess electrical power to said fuel producing plant.

2. The method according to claim 1, wherein said excess electrical power is produced due to requirements for production of heat (7-10).

3. The method according to claims 1 or 2, further comprising:

   providing at least one electrical power plant generating electrical power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy or any combination thereof.

4. A method of producing electrical power for delivery on an electrical power supply grid comprising:

   providing at least one electrical power plant (9,10) generating electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof,
   providing at least one electrical power plant generating electrical power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy,
   characterized in providing a fuel producing plant (19-45) for generating carbon and/or nitrogen- based fuels (40-45) using electrical power (19), and a combination of carbon dioxide (23) and hydrogen (22) and/or carbonaceous gasses, and/or carbonaceous liquids (35) and/or nitrogen,
   determining the need for electrical power on said electrical power supply grid and delivering said needed electrical power on said grid, and

delivering any excess electrical power to said fuel producing plant (19).

5. The method according to claim 4, wherein at least a part of said excess electrical power originates from the uneven production of electrical power generated from said renewable energy.

6. The method according to any of the claims 4 or 5, wherein at least one of said at least one electrical power plant is a combined heat and power plant (7-10).

7. The method according to claim 6, wherein said excess electrical power is produced due to requirements for production of heat (7-10).

8. A method of producing electrical power for delivery on an electrical power supply grid comprising:

providing a plurality of electrical power generating units each capable of producing a specific electrical power rating where said unit generates power at an optimal efficiency,
characterized in providing a plant for producing carbon and/or nitrogen-based fuels using electrical power from said plurality of electrical power generation units and a combination of carbon dioxide and hydrogen and/or carbonaceous gasses and/or carbonaceous liquids and/or nitrogen,
determining the need for electrical power on said electrical power supply grid and delivering said needed electrical power on said grid, enabling a specific number of power generating units generating electrical power at said optimal efficiency, and
delivering any excess electrical power to said fuel producing plant.

9. The method according to claim 8, wherein at least one of said electrical power generating units is a electrical power plant generating electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof, or an electrical power plant generating electrical power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy or a combined heat and electrical power generating unit, or a combination thereof.

10. The method according to any of the claims 1-9, further comprising:

providing an apparatus for performing hydrolysis using electrical power (10),
producing hydrogen (20) and oxygen (24) from water by hydrolysis of water, and
generating said carbon and/or nitrogen-based fuels using said hydrogen (36-45).

11. The method according to claim 10, further comprising:

using at least part of said oxygen (26) for gasification (27, 29 & 31) and/or using at least part of said oxygen (26) as combustion air for generating heat (7) and/or power (9).

12. The method according to any of the claims 1-11, wherein said carbon monoxide, carbon dioxide or nitrogen, or at least a part thereof, is provided from said at least one combined heat and power plant (7-10) or said at least one electrical power plant from the burning of biomass and/or fossil fuel (11).

13. The method according to any of the claims 1-12, further comprising:

providing at least one second apparatus for production of carbon monoxide or carbon dioxide by gasification of biomass (27), natural gas (31), coal (29), by reforming of natural gas or biogas (34) or a combination thereof, producing said carbon monoxide or carbon dioxide (34-35), and
generating said carbon and/or nitrogen-based fuels using said carbon monoxide and/or carbon dioxide (35-45).

14. The method according to any of the claims 1-13, wherein at least one electrical power plant generates electrical power from biomass (7-10), said method further comprises:

processing any excess or remaining biomass into animal feed and/or fodder and/or organic fibre and/or carbon dioxide or any combinations thereof (4).

15. The method according to any of the claims 1-14, wherein said carbon and/or nitrogen-based fuels are used for cars, trucks, air planes, any combustion engine, heating system, fuel cell system or any combinations thereof.

16. A system for producing electrical power for delivery on an electrical power supply grid comprising:

at least one power plant (9,10) generating electrical power from biomass, fossil fuel, nuclear fuel or combinations thereof, said at least one power plant electrically connected to said electrical power supply grid,
characterized in that a fuel producing plant (19-45) for generating carbon and/or nitrogen-based fuels using electrical power (19) and a combination of carbon dioxide (23), nitrogen and hydrogen (22) or synthesis gas (35), said fuel producing plant electrically connected to said electrical power supply grid and/or said at least one power plant (9,10),
an apparatus for determining the need for electrical power on said electrical power supply grid and determining the amount of excess electrical power,
a control system for controlling said fuel producing plant so as to control consumption of said excess electrical power in said fuel producing plant.

17. The system according to claim 16, wherein at least one of said at least one electrical power plant is a combined heat and electrical power plant (7-10).

18. A system according to claim 16 or 17, further comprising:

at least one additional electrical power plant producing electrical power from renewable energy, such as from wind power, hydro power, solar energy, tidal energy or wave energy, said at least one additional electrical power plant electrically connected to said fuel producing plant (10,19) and/or said at least one power plant and/or said electrical power supply grid.

19. The system according to any of the claims 16-18, wherein said fuel producing plant (19-45) generates methanol, ethanol, higher alcohols, dimethanolether, methylated, ethylated plant oils ammonia or ammonia derivates as e.g. ammonia salts or any combinations thereof.

20. The system according to any of the claims 16-19, wherein said fuel producing plant (19-45) further comprises apparatus for performing hydrolysis using electrical power (19).

21. The system according to any of the claims 16-20, wherein said fuel producing plant further comprises at least one second apparatus (27-34) for production of carbon monoxide or carbon dioxide by partial oxidation of biomass (27), natural gas(31), coal (31), by steam reforming of natural gas (34), by dry reforming of natural gas or any combinations thereof.

22. A system for producing electrical power for delivery on an electrical power supply grid comprising:

a plurality of electrical power generating units each capable of producing a specific electrical power rating where said unit generates power at an optimal efficiency,
characterized in that, a plant (19-45) for producing carbon and/or nitrogen-based fuels using electrical power from said plurality of electrical power generation units and a combination of carbon dioxide (23) and hydrogen (22) and/or carbonaceous gasses, and/or carbonaceous liquids (35) and/or nitrogen said plant receiving electrical power from at least one of said units,
an apparatus for determining the need for electrical power on said electrical power supply grid and means for delivering said needed electrical power on said grid, enabling a specific number of power generating units generating electrical power at said optimal efficiency, and
means for delivering any excess electrical power to said fuel producing plant.

23. The system according to claim 22, wherein at least one of said plurality of electrical power generation units is a combined heat and power generation plant (7-10) and/or at least one of said plurality of electrical power generation units is a power generation plant producing power from renewable energy, such as wind power, hydro power, solar energy, tidal energy or wave energy and/or at least one of said plurality of electrical power generation units is a power generation plant (7-10) producing power from biomass, fossil fuel, nuclear fuel or combinations thereof.

Patentansprüche

1. Verfahren zur Erzeugung von elektrischem Strom zur Einspeisung in ein Stromversorgungsnetz, umfassend:

Bereitstellen mindestens eines Wärmekraftwerks (7-10) zur Erzeugung von Wärme (7, 8) und elektrischem Strom (9, 10) aus Biomasse, fossilem Brennstoff, Kernbrennstoff oder Kombinationen davon,
gekennzeichnet durch Bereitstellen eines Brennstoff erzeugenden Werks (19-45) zur Erzeugung von Brennstoffen auf Kohlenstoff- und/oder Stickstoffbasis unter Verwendung von elektrischem Strom (19) aus dem mindestens einen Wärmekraftwerk und einer Kombination aus Kohlendioxid (23) und Wasserstoff (22) und/oder kohlenstoffhaltigen Gasen und/oder kohlenstoffhaltigen Flüssigkeiten (35) und/oder Stickstoff,
Bestimmen des Bedarfs an elektrischem Strom für das Stromversorgungsnetz und Einspeisen des erforderlichen elektrischen Stroms in das Netz und
Einspeisen von überschüssigem elektrischem Strom in das Brennstoff erzeugende Werk.

2. Verfahren nach Anspruch 1, wobei der überschüssige elektrische Strom aufgrund der Anforderungen für die Wärmeerzeugung (7-10) erzeugt wird.

3. Verfahren nach Anspruch 1 oder 2, weiterhin umfassend:

Bereitstellen mindestens eines Kraftwerks zur Erzeugung von elektrischem Strom aus erneuerbarer Energie, wie Windkraft, Wasserkraft, Solarkraft, Gezeitenkraft oder Wellenkraft oder jeder Kombination davon.

4. Verfahren zur Erzeugung von elektrischem Strom zur Einspeisung in ein Stromversorgungsnetz, umfassend:

Bereitstellen mindestens eines Kraftwerks (9, 10) zur Erzeugung von elektrischem Strom aus Biomasse, fossilem Brennstoff, Kernbrennstoff oder Kombinationen davon,
Bereitstellen mindestens eines Kraftwerks zur Erzeugung von elektrischem Strom aus erneuerbarer Energie, wie Windkraft, Wasserkraft, Solarkraft, Gezeitenkraft oder Wellenkraft oder jeder Kombination davon,
gekennzeichnet durch Bereitstellen eines Brennstoff erzeugenden Werks (19-45) zur Erzeugung von Brennstoffen (40-45) auf Kohlenstoff- und/oder Stickstoffbasis unter Verwendung von elektrischem Strom (19) und einer Kombination aus Kohlendioxid (23) und Wasserstoff (22) und/oder kohlenstoffhaltigen Gasen und/oder kohlenstoffhaltigen Flüssigkeiten (35) und/oder Stickstoff,
Bestimmen des Bedarfs an elektrischem Strom für das Stromversorgungsnetz und Einspeisen des erforderlichen elektrischen Stroms in das Netz und
Einspeisen von überschüssigem elektrischem Strom in das Brennstoff erzeugende Werk (19).

5. Verfahren nach Anspruch 4, wobei mindestens ein Teil des überschüssigen elektrischen Stroms aus der unregelmäßigen Erzeugung von elektrischem Strom aus der erneuerbaren Energie stammt.

6. Verfahren nach einem der Ansprüche 4 oder 5, wobei mindestens eines der mindestens einen Kraftwerke ein Wärmekraftwerk (7-10) ist.

7. Verfahren nach Anspruch 6, wobei der überschüssige elektrische Strom aufgrund der Anforderungen für die Wärmeerzeugung (7-10) erzeugt wird.

8. Verfahren zur Erzeugung von elektrischem Strom zur Einspeisung in ein Stromversorgungsnetz, umfassend:

Bereitstellen einer Mehrzahl von elektrischen Strom erzeugenden Einheiten, die jeweils in der Lage sind, eine bestimmte elektrische Nennleistung zu erzeugen, wobei die Einheit elektrischen Strom mit optimalem Wirkungsgrad erzeugt.
gekennzeichnet durch Bereitstellen eines Werks zur Erzeugung von Brennstoffen auf Kohlenstoff- und/oder Stickstoffbasis unter Verwendung von elektrischem Strom aus der Mehrzahl elektrischen Strom erzeugender Einheiten und einer Kombination aus Kohlendioxid und Wasserstoff und/oder kohlenstoffhaltigen Gasen und/oder kohlenstoffhaltigen Flüssigkeiten und/oder Stickstoff,
Bestimmen des Bedarfs an elektrischem Strom für das Stromversorgungsnetz und Einspeisen des erforderlichen elektrischen Stroms in das Netz, wobei eine bestimmte Anzahl von elektrischen Strom erzeugenden Einheiten zur Erzeugung von elektrischem Strom mit dem optimalen Wirkungsgrad aktiviert wird, und
Einspeisen von überschüssigem elektrischem Strom in das Brennstoff erzeugende Werk.

9. Verfahren nach Anspruch 8, wobei mindestens eine der elektrischen Strom erzeugenden Einheiten ein Kraftwerk zur Erzeugung von elektrischem Strom aus Biomasse, fossilem Brennstoff, Kernbrennstoff oder Kombinationen davon oder ein Kraftwerk zur Erzeugung von elektrischem Strom aus erneuerbarer Energie, wie Windkraft, Was-

serkraft, Solarkraft, Gezeitenkraft oder Wellenkraft oder eine Wärmekraftwerkeinheit oder eine Kombination davon ist.

10. Verfahren nach einem der Ansprüche 1-9, weiterhin umfassend:

Bereitstellen einer Vorrichtung zur Durchführung einer Hydrolyse unter Verwendung von elektrischem Strom (10),
Erzeugen von Wasserstoff (20) und Sauerstoff (24) aus Wasser mittels Hydrolyse von Wasser und
Erzeugen der Brennstoffe auf Kohlenstoff- und/oder Stickstoffbasis unter Verwendung des Wasserstoffs (36-45).

11. Verfahren nach Anspruch 10, weiterhin umfassend:

Verwenden mindestens eines Teils des Sauerstoffs (26) zur Vergasung (27, 29 und 31) und/oder Verwenden mindestens eines Teils des Sauerstoffs (26) als Verbrennungsluft zur Erzeugung von Wärme (7) und/oder elektrischem Strom (9).

12. Verfahren nach einem der Ansprüche 1-11, wobei das Kohlenmonoxid, das Kohlendioxid oder der Stickstoff oder mindestens ein Teil davon von dem mindestens einen Wärmekraftwerk (7-10) oder dem mindestens einen Kraftwerk aus der Verbrennung von Biomasse und/oder fossilem Brennstoff (11) bereitgestellt wird.

13. Verfahren nach einem der Ansprüche 1-12, weiterhin umfassend:

Bereitstellen mindestens einer zweiten Vorrichtung zur Erzeugung von Kohlenmonoxid oder Kohlendioxid durch Vergasung von Biomasse (47), Erdgas (31), Kohle (29), durch Reformieren von Erdgas oder Biogas (34) oder eine Kombination davon,
Erzeugen des Kohlenmonoxids oder Kohlendioxids (34-35) und
Erzeugen der Brennstoffe auf Kohlenstoff- und/oder Stickstoffbasis unter Verwendung des Kohlenmonoxids und/oder Kohlendioxids (35-45).

14. Verfahren nach einem der Ansprüche 1-13, wobei mindestens ein Kraftwerk elektrischen Strom aus Biomasse (7-10) erzeugt, wobei das Verfahren weiterhin umfasst:

Verarbeiten jedes Überschusses an Biomasse oder Restbiomasse zu Tiernahrung und/oder Viehfutter und/oder organischen Fasern und/oder Kohlendioxid oder jeder Kombination davon (4).

15. Verfahren nach einem der Ansprüche 1-14, wobei die Brennstoffe auf Kohlenstoff- und/oder Stickstoffbasis für Pkws, Lkws, Flugzeuge, jeden Verbrennungsmotor, jedes Wärmesystem, jedes Brennstoffzellensystem oder jede Kombination davon verwendet werden.

16. System zur Erzeugung von elektrischem Strom zur Einspeisung in ein Stromversorgungsnetz, umfassend:

mindestens ein Kraftwerk (9, 10) zur Erzeugung von elektrischem Strom aus Biomasse, fossilem Brennstoff, Kernbrennstoff oder Kombinationen davon, wobei das mindestens eine Kraftwerk elektrisch mit dem Stromversorgungsnetz verbunden ist,
gekennzeichnet durch ein Brennstoff erzeugendes Werk (19-45) zur Erzeugung von Brennstoffen auf Kohlenstoff- und/oder Stickstoffbasis unter Verwendung von elektrischem Strom (19) und einer Kombination aus Kohlendioxid (23), Stickstoff und Wasserstoff (22) oder Synthesegas, wobei das Brennstoff erzeugende Werk elektrisch mit dem Stromversorgungsnetz und/oder dem mindestens einem Kraftwerk (9,10) verbunden ist,
eine Vorrichtung zum Bestimmen des Bedarfs an elektrischem Strom für das Stromversorgungsnetz und Bestimmen der Menge an überschüssigem elektrischem Strom,
ein Steuersystem zur Steuerung des Brennstoff erzeugenden Werks, um so das Einspeisen von überschüssigem elektrischem Strom in das Brennstoff erzeugende Werk zu steuern.

17. System nach Anspruch 16, wobei mindestens eines der mindestens einen Kraftwerke ein Wärmekraftwerk (7-10) ist.

18. System nach Anspruch 16 oder 17, weiterhin umfassend:

mindestens ein zusätzliches Kraftwerk zur Erzeugung von elektrischem Strom aus erneuerbarer Energie, wie

Windkraft, Wasserkraft, Solarkraft, Gezeitenkraft oder Wellenkraft, wobei das mindestens eine zusätzliche Kraftwerk elektrisch mit dem Brennstoff erzeugenden Werk (10, 19) und/oder dem mindestens einen Kraftwerk und/oder dem Stromversorgungsnetz verbunden ist.

19. System nach einem der Ansprüche 16-18, wobei das Brennstoff erzeugende Werk (19-45) Methanol, Ethanol, höhere Alkohole, Dimethanolether, methylierte, ethylierte Pflanzenöle, Ammoniak oder Ammoniakderivate wie beispielsweise Ammoniaksalze oder jede Kombination davon erzeugt.

20. System nach einem der Ansprüche 16-19, wobei das Brennstoff erzeugende Werk (19-45) weiterhin eine Vorrichtung zur Durchführung einer Hydrolyse unter Verwendung von elektrischem Strom (19) umfasst.

21. System nach einem der Ansprüche 16-20, wobei das Brennstoff erzeugende Werk weiterhin mindestens eine zweite Vorrichtung (27-34) zur Erzeugung von Kohlenmonoxid oder Kohlendioxid durch partielle Oxidation von Biomasse (27), Erdgas (31), Kohle (31), durch Dampfreformation von Erdgas (34), durch Trockenreformation von Erdgas oder jede Kombination davon umfasst.

22. System zur Erzeugung von elektrischem Strom zur Einspeisung in ein Stromversorgungsnetz, umfassend:

eine Mehrzahl von elektrischen Strom erzeugenden Einheiten, die jeweils in der Lage sind, eine bestimmte elektrische Nennleistung zu erzeugen, wenn die Einheit elektrischen Strom mit optimalem Wirkungsgrad erzeugt.
gekennzeichnet durch ein Werk (19-45) zur Erzeugung von Brennstoffen auf Kohlenstoff- und/oder Stickstoffbasis unter Verwendung von elektrischem Strom aus der Mehrzahl elektrischen Strom erzeugender Einheiten und einer Kombination aus Kohlendioxid (23) und Wasserstoff (42) und/oder kohlenstoffhaltigen Gasen und/oder kohlenstoffhaltigen Flüssigkeiten (35) und/oder Stickstoff, wobei das Werk elektrischen Strom von mindestens einer der Einheiten erhält,
eine Vorrichtung zum Bestimmen des Bedarfs an elektrischem Strom für das Stromversorgungsnetz und Mittel zum Einspeisen des erforderlichen elektrischen Stroms in das Netz, wobei eine bestimmte Anzahl von Strom erzeugenden Einheiten zur Erzeugung von elektrischem Strom mit dem optimalen Wirkungsgrad aktiviert wird, und
Mittel zum Einspeisen von überschüssigem elektrischem Strom in das Brennstoff erzeugende Werk.

23. System nach Anspruch 22, wobei mindestens eine der Mehrzahl von elektrischen Strom erzeugenden Einheiten ein Wärmekraftwerk (7-10) und/oder mindestens eine der Mehrzahl von elektrischen Strom erzeugenden Einheiten ein Kraftwerk zur Erzeugung von elektrischem Strom aus erneuerbarer Energie, wie Windkraft, Wasserkraft, Solarkraft, Gezeitenkraft oder Wellenkraft und/oder mindestens eine der Mehrzahl von elektrischen Strom erzeugenden Einheiten ein Kraftwerk (7-10) zur Erzeugung von elektrischem Strom aus Biomasse, fossilem Brennstoff, Kernbrennstoff oder Kombinationen davon ist.

Revendications

1. Procédé de production d'énergie électrique devant être livrée à un réseau de fourniture d'énergie électrique comprenant :

l'apport d'au moins une centrale de production combinée de chaleur et d'énergie (7-10) produisant de la chaleur (7, 8) et de l'énergie électrique (9, 10) à partir de biomasse, de combustible fossile, de combustible nucléaire ou de combinaisons de ceux-ci,
caractérisé par l'apport d'une usine de production de combustible (19-45) pour produire des combustibles à base de carbone et/ou d'azote en utilisant de l'énergie électrique (19) provenant de ladite au moins une centrale de production combinée de chaleur et d'énergie et une combinaison de dioxyde de carbone (23) et d'hydrogène (22) et/ou de gaz carbonés et/ou de liquides carbonés (35) et/ou d'azote,
la détermination des besoins en énergie électrique dudit réseau de fourniture d'énergie électrique et la livraison de ladite énergie électrique nécessaire au dit réseau, et
la livraison de toute énergie électrique excédentaire à ladite usine de production de combustible.

2. Le procédé selon la revendication 1, dans lequel ladite énergie électrique excédentaire est produite en raison d'exigences de production de chaleur (7-10).

3. Le procédé selon les revendications 1 ou 2, comprenant également :

l'apport d'au moins une centrale de production d'énergie électrique produisant de l'énergie électrique à partir d'énergie renouvelable, telle que l'énergie éolienne, l'énergie hydraulique, l'énergie solaire, l'énergie marémotrice ou l'énergie houlomotrice ou toute combinaison de celles-ci.

4. Procédé de production d'énergie électrique devant être livrée à un réseau de fourniture d'énergie électrique comprenant :

l'apport d'au moins une centrale de production d'énergie électrique (9, 10) produisant de l'énergie électrique à partir de biomasse, de combustible fossile, de combustible nucléaire ou de combinaisons de ceux-ci,
l'apport d'au moins une centrale de production d'énergie électrique produisant de l'énergie électrique à partir d'énergie renouvelable, telle que l'énergie éolienne, l'énergie hydraulique, l'énergie solaire, l'énergie marémotrice ou l'énergie houlomotrice,
caractérisé par l'apport d'une usine de production de combustible (19-45) pour produire des combustibles à base de carbone et/ou d'azote (40-45) en utilisant de l'énergie électrique (19), et une combinaison de dioxyde de carbone (23) et d'hydrogène (22) et/ou de gaz carbonés et/ou de liquides carbonés (35) et/ou d'azote,
la détermination des besoins en énergie électrique dudit réseau de fourniture d'énergie électrique et la livraison de ladite énergie électrique nécessaire au dit réseau, et
la livraison de toute énergie électrique excédentaire à ladite usine de production de combustible (19).

5. Le procédé selon la revendication 4, dans lequel au moins une partie de ladite énergie électrique excédentaire provient de la production irrégulière d'énergie électrique produite à partir de ladite énergie renouvelable.

6. Le procédé selon l'une quelconque des revendications 4 ou 5, dans lequel au moins une desdites au moins une centrale de production d'énergie électrique est une centrale de production combinée de chaleur et d'énergie (7-10).

7. Le procédé selon la revendication 6, dans lequel ladite énergie électrique excédentaire est produite en raison d'exigences de production de chaleur (7-10).

8. Procédé de production d'énergie électrique devant être livrée à un réseau de fourniture d'énergie électrique comprenant :

l'apport d'une pluralité d'unités de production d'énergie électrique étant chacune capable de produire une puissance nominale électrique spécifique, ladite unité produisant de l'énergie avec un rendement optimal,
caractérisé par l'apport d'une usine pour produire des combustibles à base de carbone et/ou d'azote en utilisant de l'énergie électrique provenant de ladite pluralité d'unités de production d'énergie électrique et une combinaison de dioxyde de carbone et d'hydrogène et/ou de gaz carbonés et/ou de liquides carbonés et/ou d'azote,
la détermination des besoins en énergie électrique dudit réseau de fourniture d'énergie électrique et la livraison de ladite énergie électrique nécessaire au dit réseau, en activant un nombre spécifique d'unités de production d'énergie produisant de l'énergie électrique avec ledit rendement optimal, et
la livraison de toute énergie électrique excédentaire à ladite usine de production de combustible.

9. Le procédé selon la revendication 8, dans lequel au moins une desdites unités de production d'énergie électrique est une centrale de production d'énergie électrique produisant de l'énergie électrique à partir de biomasse, de combustible fossile, de combustible nucléaire ou de combinaisons de ceux-ci, ou une centrale de production d'énergie électrique produisant de l'énergie électrique à partir d'énergie renouvelable, telle que l'énergie éolienne, l'énergie hydraulique, l'énergie solaire, l'énergie marémotrice ou l'énergie houlomotrice, ou une unité de production combinée de chaleur et d'énergie électrique, ou une combinaison de celles-ci.

10. Le procédé selon l'une quelconque des revendications 1 à 9, comprenant également :

l'apport d'un dispositif pour réaliser une hydrolyse en utilisant de l'énergie électrique (10),
la production d'hydrogène (20) et d'oxygène (24) à partir d'eau par hydrolyse d'eau, et
la production desdits combustibles à base de carbone et/ou d'azote en utilisant ledit hydrogène (36-45).

11. Le procédé selon la revendication 10, comprenant également :

l'utilisation d'au moins une partie dudit oxygène (26) pour la gazéification (27, 29 & 31) et/ou l'utilisation d'au moins une partie dudit oxygène (26) comme air de combustion pour produire de la chaleur (7) et/ou de l'énergie (9).

12. Le procédé selon l'une quelconque des revendications 1 à 11, dans lequel ledit monoxyde de carbone, dioxyde de carbone ou azote, ou au moins une partie de celui-ci, est apporté par ladite au moins une centrale de production combinée de chaleur et d'énergie (7-10) ou par ladite au moins une centrale de production d'énergie électrique par combustion de biomasse et/ou de combustible fossile (11).

13. Le procédé selon l'une quelconque des revendications 1 à 12, comprenant également :

l'apport d'au moins un deuxième dispositif pour la production de monoxyde de carbone ou de dioxyde de carbone par gazéification de biomasse (27), de gaz naturel (31), de charbon (29), par reformage de gaz naturel ou de biogaz (34) ou une combinaison de ceux-ci,
la production dudit monoxyde de carbone ou dioxyde de carbone (34-35), et
la production desdits combustibles à base de carbone et/ou d'azote en utilisant ledit monoxyde de carbone et/ou dioxyde de carbone (35-45).

14. Le procédé selon l'une quelconque des revendications 1 à 13, dans lequel au moins une centrale de production d'énergie électrique produit de l'énergie électrique à partir de biomasse (7-10), ledit procédé comprenant également :

la transformation de toute biomasse excédentaire ou résiduelle en alimentation animale et/ou en fourrage et/ou en fibres organiques et/ou en dioxyde de carbone ou toute combinaison de ceux-ci (4).

15. Le procédé selon l'une quelconque des revendications 1 à 14, dans lequel lesdits combustibles à base de carbone et/ou d'azote sont utilisés pour des voitures, des camions, des avions, un moteur à combustion quel qu'il soit, un système de chauffage, un système de pile à combustible ou toute combinaison de ceux-ci.

16. Système de production d'énergie électrique devant être livrée à un réseau de fourniture d'énergie électrique comprenant :

au moins une centrale de production d'énergie (9, 10) produisant de l'énergie électrique à partir de biomasse, de combustible fossile, de combustible nucléaire ou de combinaisons de ceux-ci, ladite au moins une centrale de production d'énergie étant raccordée électriquement au dit réseau de fourniture d'énergie électrique,
caractérisé par une usine de production de combustible (19-45) pour produire des combustibles à base de carbone et/ou d'azote en utilisant de l'énergie électrique (19) et une combinaison de dioxyde de carbone (23), d'azote et d'hydrogène (22) ou de gaz de synthèse (35), ladite usine de production de combustible étant raccordée électriquement au dit réseau de fourniture d'énergie électrique et/ou à ladite au moins une centrale de production d'énergie (9,10),
un dispositif pour déterminer les besoins en énergie électrique dudit réseau de fourniture d'énergie électrique et déterminer la quantité d'énergie électrique excédentaire,
un système de contrôle pour contrôler ladite usine de production de combustible de manière à contrôler la consommation de ladite énergie électrique excédentaire dans ladite usine de production de combustible.

17. Le système selon la revendication 16, dans lequel au moins une desdites au moins une centrale de production d'énergie électrique est une centrale de production combinée de chaleur et d'énergie électrique (7-10).

18. Système selon la revendication 16 ou 17, comprenant également :

au moins une centrale de production d'énergie électrique supplémentaire produisant de l'énergie électrique à partir d'énergie renouvelable, telle que l'énergie éolienne, l'énergie hydraulique, l'énergie solaire, l'énergie marémotrice ou l'énergie houlomotrice, ladite au moins une centrale de production d'énergie électrique supplémentaire étant raccordée électriquement à ladite usine de production de combustible (10, 19) et/ou ladite au moins une centrale de production d'énergie et/ou ledit réseau de fourniture d'énergie électrique.

19. Le système selon l'une quelconque des revendications 16 à 18, dans lequel ladite usine de production de combustible (19-45) produit du méthanol, de l'éthanol, des alcools supérieurs, du diméthanoléther, des huiles végétales éthylées, méthylées, de l'ammoniaque ou des dérivés de l'ammoniaque comme par exemple des sels d'ammoniaque ou

toute combinaison de ceux-ci.

20. Le système selon l'une quelconque des revendications 16 à 19, dans lequel ladite usine de production de combustible (19-45) comprend également un dispositif pour réaliser une hydrolyse en utilisant de l'énergie électrique (19).

21. Le système selon l'une quelconque des revendications 16 à 20, dans lequel ladite usine de production de combustible comprend également au moins un deuxième dispositif (27-34) pour la production de monoxyde de carbone ou de dioxyde de carbone par oxydation partielle de biomasse (27), de gaz naturel (31), de charbon (31), par reformage à la vapeur de gaz naturel (34), par reformage à sec de gaz naturel ou toute combinaison de ceux-ci.

22. Système de production d'énergie électrique devant être livrée à un réseau de fourniture d'énergie électrique comprenant :

une pluralité d'unités de production d'énergie électrique étant chacune capable de produire une puissance nominale électrique spécifique, ladite unité produisant de l'énergie avec un rendement optimal,
caractérisé par une usine (19-45) pour produire des combustibles à base de carbone et/ou d'azote en utilisant de l'énergie électrique provenant de ladite pluralité d'unités de production d'énergie électrique et une combinaison de dioxyde de carbone (23) et d'hydrogène (22) et/ou de gaz carbonés et/ou de liquides carbonés (35) et/ou d'azote, ladite usine recevant de l'énergie électrique provenant d'au moins une desdites unités,
un dispositif pour déterminer les besoins en énergie électrique dudit réseau de fourniture d'énergie électrique et des moyens pour livrer ladite énergie électrique nécessaire au dit réseau, en activant un nombre spécifique d'unités de production d'énergie produisant de l'énergie électrique avec ledit rendement optimal, et
des moyens pour livrer toute énergie électrique excédentaire à ladite usine de production de combustible.

23. Le système selon la revendication 22, dans lequel au moins une de ladite pluralité d'unités de production d'énergie électrique est une centrale de production combinée de chaleur et d'énergie (7-10) et/ou au moins une de ladite pluralité d'unités de production d'énergie électrique est une centrale de production d'énergie produisant de l'énergie à partir d'énergie renouvelable, telle que l'énergie éolienne, l'énergie hydraulique, l'énergie solaire, l'énergie marémotrice ou l'énergie houlomotrice et/ou au moins une de ladite pluralité d'unités de production d'énergie électrique est une centrale de production d'énergie (7-10) produisant de l'énergie à partir de biomasse, de combustible fossile, de combustible nucléaire ou de combinaisons de ceux-ci.

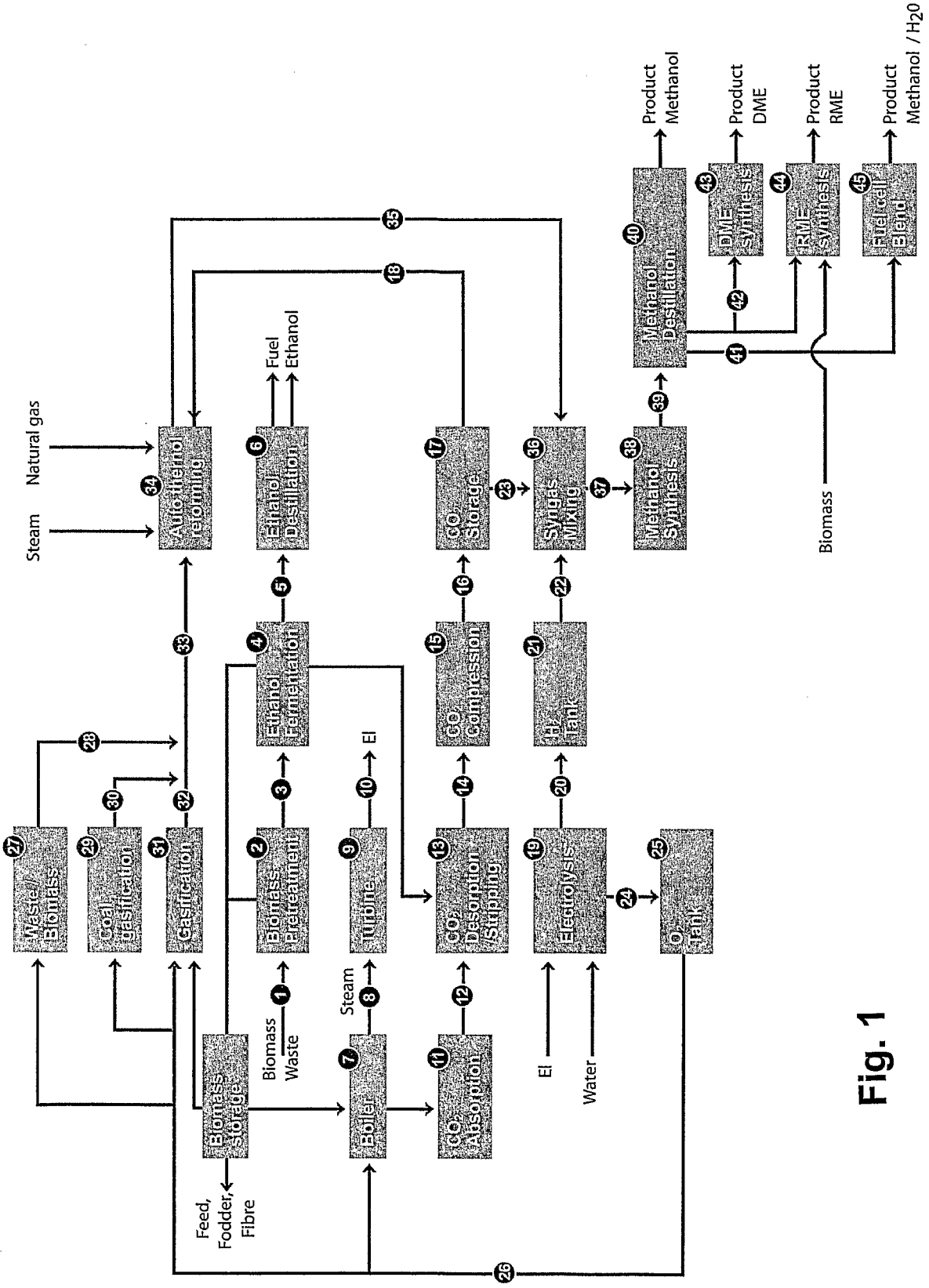
Natural gas
Steam
Fuel Ethanol
Product Methanol
Product DME
Product RME
Product Methanol / H20
Biomass
Waste
Steam
El
Water
Feed, Fodder, Fibre
Biomass Storage
Boiler
Turbine
Biomass Pretreatment
Ethanol Fermentation
Ethanol Destillation
Auto-thermal reforming
Gasification
Coal Gasification
Waste/ Biomass
CO2 Absorption
CO2 Desorption/ Stripping
CO2 Compression
CO2 Storage
Electrolysis
H2 Tank
O2 Tank
Syngas Mixing
Methanol Synthesis
Methanol Destillation
DME Synthesis
RME Synthesis
Fuel cell Blend

Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1102187 A **[0002]**
- SU 1260641 **[0003]**
- US 4057736 A **[0004]**