# SYSTEM AND METHOD FOR BIOMASS GROWTH AND PROCESSING

## FIELD

[0001] The present disclosure relates to the field of private, public or municipal infrastructure and utility services and fields of renewable energy, biofuels, water treatment and environmental conservation and remediation.

[0002] Many different power generation and industrial systems involving the use of heat may be in use worldwide. These systems may use fuels of many types to produce power through a variety of processes. Combustion-based thermal power plants may also discharge carbon dioxide and other gases into the environment. It is generally recognized that carbon dioxide is a gas that produces an atmospheric greenhouse-effect, the excess production of which has a detrimental effect on climate worldwide. Also, power plants may discharge waste heat in ways which produce environmental damage. Other industrial systems discharge pollution in ways that may be destructive to the environment.

[0003] Thus, there may be a need to provide thermal energy production and other industrial processes that minimize the production and discharge of excess, or waste, carbon dioxide, heat, and other byproducts.

## BRIEF SUMMARY

[0004] The present disclosure provides a means of abating carbon dioxide and other gases generated by thermal plants through the growth of biomass, which uses these normally harmful emissions to produce biofuels and other useful products. Biofuels and/or biomass generated may also become a source of fuel for a thermal plant where appropriate. Water treatment methods and heat, water, and other byproduct abatement and resource conservation technologies may be incorporated e.g., as described herein.

[0004a] In one aspect, the present disclosure provides a method of using and reclaiming heat and/or cooling from a thermal plant module, the thermal plant module either a) being: a fossil fuel-fired plant, a nuclear plant, a solar thermal plant, a steel plant, a cement plant, a paper mill, a textile mill, a metal manufacturing plant, an incinerator, and/or a rotary kiln incinerator, and/or b) comprising: a cellulosic ethanol/ isobutanol/butanol module, a hydrothermal processing module, a gasification module, a waste-to-energy

module, a plasma gasification unit, and/or a desorber/condenser module, the method comprising: generating heat and/or cooling at the thermal plant module; transmitting heat and/or cooling to a biomass growth module (BGM); and using all or a portion of the heat and/or cooling in the thermal plant module and/or in the BGM, wherein the BGM does not include, nor is operatively connected to, an anaerobic bioreactor.

[0004b] In another aspect, the present disclosure provides a system configured to use and reclaim heat and/or cooling from a thermal plant module, the thermal plant module either a) being: a fossil fuel-fired plant, a nuclear plant, a solar thermal plant, a steel plant, a cement plant, a paper mill, a textile mill, a metal manufacturing plant, an incinerator, and/or a rotary kiln incinerator, and/or b) comprising: a cellulosic ethanol/ isobutanol/butanol module, a hydrothermal processing module, a gasification module, a waste-to-energy module, a plasma gasification unit, and/or a desorber/condenser module, using the method of claim 1, wherein the reclaimed heat and/or cooling is provided in whole or in part to a biomass growth module (BGM) that grows biomass, wherein the BGM does not include, nor is operatively connected to, an anaerobic bioreactor.

[0004c] In another aspect, the present disclosure provides a method of using and reclaiming heat and/or cooling from a thermal plant module, the method comprising: generating heat and/or cooling at the thermal plant module; transmitting heat and/or cooling to a biomass growth module (BGM); and using all or a portion of the heat and/or cooling in the thermal plant module and/or in the BGM, wherein heat and/or cooling is further provided to and/or reclaimed from: a. a refinery module; b. a BPP module; c. an air conditioning/heating module; d. a recycling module; e. a BBPP module; f. a products storage module; g. a desalination module; h. a waste to energy module; i. a biogas storage module; j. a heat/cooling storage module; k. a heat/cooling recovery module; l. heating/cooling external to or apart from the method; m. heating/cooling for discharge; n. biomass products; o. a gasification module; p. processing of biofuel; and/or q. systems optionally comprised by the thermal plant module selected from: i. a pyrolysis processes module; ii. a hydrothermal processing module; iii. a cellulosic ethanol/butanol/isobutanol module; and/or a desorber/condenser module, wherein any two or more of components a-q are collocated and wherein outputs of heat and/or

cooling from any one of components a-q share heating and/or cooling transmission modules and/or technologies, and/or heat and/or cooling storage module(s) and/or unit(s).

[0004d] In another aspect, the present disclosure provides a method of using and reclaiming heat and/or cooling from a thermal plant module, the method comprising: generating cooling at the thermal plant module by cogenerating cooling using heat from the thermal plant module; transmitting the cogenerated cooling to a biomass growth module (BGM); and using all or a portion of the cogenerated cooling in the BGM.

[0005] In an ~~embodiment~~example, the present disclosure relates to a biomass growth module optionally fuelable by an exhaust gas comprising carbon dioxide from a thermal plant; wherein the thermal plant may be optionally fuelable by a biomass and/or biofuel outflow fluid from the biomass growth module and wherein the biomass and/or biofuel outflow fluid may be optionally refined by the thermal plant and wherein the exhaust gas may

provide a substantial portion of the carbon content of the biomass and/or biofuel outflow fluid.

[0006] In certain ~~embodiment~~examples, e.g., those represented by FIG. 2, FIGs 7A, 7B, 11, 12A, 12B, 12C, 12D, 12E, 15A, 15B, 16, 17, 18, 19, 20A, 20B, 20C, 20D and/or other figures and ~~embodiment~~examples regarding heat capture and/or transfer, the present disclosure relates to a method of providing a cooling fluid, e.g., a necessary cooling water, to a thermal plant, while concurrently making productive use of the waste heat energy generated by the thermal plant, which waste heat may otherwise be simply discharged unproductively, and at times, destructively, into the environment. The waste heat may be used productively, e.g., to regulate bioreactor temperature and/or in a process to refine water, fuels, and/or biomass produced in a biomass growth module into useful products. In certain ~~embodiment~~examples, e.g., those represented by FIG. 3, FIG. 4 and/or other ~~embodiment~~examples regarding the use of water and/or carbon dioxide e.g., in the Plan, the present disclosure relates to an integrated approach to minimization of $CO_2$ emissions, power generation, biofuel production, efficient use of heat and water, as well as production of biomass-derived non-fuel products, and treatment of wastewater and waste-to-energy in some ~~embodiment~~examples. Various ~~embodiment~~examples provide for a wide variety of other water sources or combinations to be used to provide a medium for biomass and/or biofuel production and $CO_2$ abatement, with conservation of water and heat energy.

[0007] In an ~~embodiment~~example, one or more water sources may be provided for biomass growth, wherein the water may be wastewater, salt water, brackish water, purified water, potable water, non-potable water, and/or brine. The amount of carbon in the water may be from less than 0.1% to 15% by weight, or about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15 percent by weight or from one integer to another in the preceding array of numbers, e.g., from about 3% to about 8%

## BRIEF DESCRIPTION OF THE FIGURES

[0008] FIG. 1 is a schematic representation of a design according to the present disclosure.

[0009] FIG. 2 is a schematic representation of heat flow within the Plan according to the present disclosure.

~~1. A system comprising: A biomass growth module (BGM) and optionally:~~

~~a. a thermal plant module optionally producing an exhaust gas comprising carbon dioxide optionally fueling the BGM;~~

~~b. wherein the thermal plant module is optionally fuelable by a BGM outflow fluid from the BGM;~~

~~c. wherein the BGM outflow fluid is optionally refined in whole or in part optionally by heat from the thermal plant module; and/or~~

~~d. wherein the exhaust gas optionally may provide a substantial portion of the carbon content of the BGM outflow fluid.~~

~~2. The system of claim 1 wherein the BGM is configured to be supplied by BGM feed water which is optionally pretreated and comprising:~~

~~a. salt water;~~

~~b. fresh water;~~

~~c. high salinity water;~~

~~d. wastewater;~~

~~e. any source of water;~~

~~f. another water type(s); and/or~~

~~g. a combination thereof.~~

~~3. The system of claim 2, wherein the BGM feed water is optionally processed through a primary treatment process, also referred to as "primary treatment", before being supplied to the BGM.~~

~~4. The system of claim 3, wherein the primary treatment process comprises:~~

~~a. screening;~~

~~b. grit removal;~~

~~c. sedimentation;~~

~~d. addition of chemicals;~~

~~e. and/or other means to prepare water for introduction into a BGM.~~

~~5. The system of either of claims 3 or 4, wherein sludge from the primary treatment process is optionally supplied to a gasification module.~~

~~6. The system of any one of claims 1-5, wherein the BGM is configured to produce a biofuel, which biofuel supplies the thermal plant module either directly or after additional processing.~~

~~7. The system of any one of claims 1-6 wherein the BGM outflow fluid is optionally processed before optionally fueling the thermal plant module, and wherein the BGM outflow fluid is optionally being supplied to a gasification module, a BPP module and/or a BBPP module, wherein the BGM outflow fluid is processed by:~~

~~a. a tertiary treatment module;~~

~~b. a gravity thickener to concentrate, and separate the BGM outflow fluid;~~

~~c. a dilution module;~~

~~d. a refinery module;~~

~~e. processing; and/or~~

~~f. a heat recovery module.~~

~~8. The system of claim 7 wherein the tertiary treatment module is configured to supply a biomass/water slurry to the gravity thickener to concentrate, separate, and/or dilute the BGM outflow fluid.~~

~~9. The system of any one of claims 1-8, wherein the thermal plant module is configured to optionally provide heat and/or cooling to the following:~~

~~a. the refinery module;~~

~~b. a BPP module;~~

~~c. biomass products;~~

~~d. a BBPP module;~~

~~e. the BGM;~~

~~f. the gasification module;~~

g. processing of biofuel; and/or

h. a desalination module.

10. The system of any one of claims 7-9 wherein water that is the result of the tertiary treatment is routed for water reuse and/or optional recirculation to the BGM.

11. The system of any one of claims 7-10 wherein the gravity thickener to concentrate, separate, and/or dilute the BGM outflow fluid comprises:

a. a water, biomass and/or extract output;

b. a treated biomass/water slurry output (also defined as a BGM outflow fluid); and/or

c. a water output.

12. The system of claim 11 wherein any portion of the treated biomass/water slurry is directed to:

a. the refinery module; and/or

b. the gasification module.

13. The system of either of claims 11 or 12 wherein the water, biomass, and/or an extract thereof is supplied to the BPP module.

14. The system of any one of claims 11 – 13 wherein the water output from the gravity thickener to concentrate, separate, and/or dilute the BGM outflow fluid is routed for water reuse.

15. The system of any one of claims 7 – 14, wherein the BPP module comprises:

a. biomass products outputs which are optionally routed to a BBPP module;

b. heat, water, and/or carbon dioxide outputs which are optionally routed for reuse; and/or

c. residuals optionally routed to the refinery module.

16. The system of any of any one of claims 7 – 15, wherein the refinery module receives optional inputs selected from:

a. other biomass source(s);

b. other waste; and/or

c. pressure.

17. The system of any of any one of claims 7 - 16, wherein the refinery module has optional outputs selected from:

a. biocrude;

b. biofuel;

c. water; and/or

d. residuals.

18. The system of claim 17, wherein the biocrude and/or biofuel outputs from the refinery module serve in whole or in part as the BGM outflow fluid output which output optionally fuels the thermal plant module.

19. The system of claim 18, wherein the biocrude and/or biofuel outputs from the refinery module undergo additional steps selected from the following before optionally fueling the thermal plant module:

a. a heat recovery module; and/or

b. processing.

20. The system of either of claims 18 or 19, wherein the refinery module generates residuals which are optionally sent to a gasification module.

21. The system of any of any one of claims 5-20, wherein the gasification module produces a biogas output.

22. The system of claim 21, wherein the biogas output is optionally further processed.

23. The system of either of claims 21 or 22, wherein the biogas output optionally partially or fully fuels the thermal plant module.

~~24. The system of any of any one of claims 5-23, wherein the gasification module produces a residuals output.~~

~~25. The system of claim 24, wherein the residuals output is supplied to the BGM.~~

~~26. The system of any of any one of claims 17-25, wherein the refinery module's water output is directed to an optional heat and/or pressure recovery module.~~

~~27. The system of claim 26, wherein the heat and/or pressure recovery module produces a water output wherein the water is reused.~~

~~28. The system of any one of claims 1 – 27, wherein the thermal plant module optionally provides power to the Plan.~~

~~29. A system comprising a BPP module collocated with a BBPP module.~~

~~30. The system of claim 29, wherein the BPP module provides a biomass and/or biomass product output stream(s) to the BBPP module.~~

~~31. The system of either of claims 29 or 30, wherein the BPP module receives inputs of:~~

~~a. water;~~
~~b. biomass;~~
~~c. extract;~~
~~d. heat; and/or~~
~~e. any combination of the above.~~

~~32. The system of any one of claims 29 - 31, wherein the following are reclaimed from the BPP module:~~

~~a. heat;~~
~~b. carbon dioxide;~~

c. water; and/or

d. residuals.

33. The system of claim 32, wherein residuals may comprise any portion of material not used in a process or module, including optionally:

a. biomass;

b. water;

c. sediment;

d. sludge;

e. solvent(s); and/or

f. chemical residues.

34. The system of either of claim 32 or 33, wherein the residuals are sent to a refinery module.

35. The system of any one of claims 29 – 34, wherein the BBPP module receives an input of heat.

36. The system of any one of claims 35, wherein the heat is provided by a thermal plant module.

37. The system of claim 36, wherein the thermal plant module and the BBPP module are collocated.

38. A system wherein any two or more of the following are collocated:

a. a thermal plant module;

b. a BGM;

c. a refinery module;

d. a gasification module;

e. a BPP module;

f. a BBPP module; and/or

g. a desalination module

wherein the modules are operatively in communication with one another and may exchange heat, biomass, water, carbon dioxide, residuals and/or other resources and/or byproducts.

39. The system of claim 38 wherein any one or more of modules a-g is a retrofitted module.

40. The system of either of claims 38 or 39 wherein biomass from any source(s) may be processed by:

a. the refinery module;

b. the gasification module; and/or

c. the BPP module.

41. The system of any one of claims 38-40, wherein residuals may be directed from any of these modules to any other(s) for processing:

a. a thermal plant module;

b. a BGM;

c. a refinery module;

d. a gasification module;

e. a BPP module;

f. a BBPP module; and/or

g. a desalination module.

42. The system of either of claims 40 or 41, wherein fuels produced from processing may be provided as fuels to the thermal plant module either directly and/or with additional treatment, processing and/or heat recovery.

43. The system of any one of claims 9—42, wherein the desalination module generates a water and/or brine outputs.

~~44. The system of claim 43, wherein the water output is directed to a BBPP module for packaging.~~

~~45. The system of either of claims 43 or 44, wherein the brine output is discharged either with or without dilution from other water sources.~~

~~46. A method of integrating a thermal plant and a BGM comprising: providing the system of claim 1 and generating a biomass in the BGM.~~

~~47. The method of claim 46 further comprising refining the biomass to a biofuel.~~

~~48. The method of claim 46 further comprising delivering the biomass to the thermal plant.~~

~~49. The method of claim 47 further comprising delivering the biofuel to the thermal plant.~~

~~50. The method of claim 49 further comprising combusting the biofuel in the thermal plant.~~

~~51. The method of claim 46 further comprising delivering thermal plant exhaust gas to the BGM.~~

~~52. The method of claim 46 further comprising processing the biomass into non-fuel products.~~

~~53. The method of claim 46 further comprising removing pollutants from the thermal plant exhaust gas.~~

54. A method of integrating: a thermal plant module; a BGM; a refinery module; a gasification module; a BBP module; a BBPP module; and/or a desalination module; comprising providing the system of claim 38 wherein the one or more of: the thermal plant module; the BGM; the refinery module; the gasification module; the BBP module; the BBPP module; and/or the desalination module is a retrofitted module; and integrating the one or more retrofitted module into one or more grids which grids are in operative communication with one another.

55. The method of claim 54 wherein operative communication comprises exchanging: heat; biomass; water; carbon dioxide; residuals; and/or other resources and/or byproducts between the one or more retrofitted module and/or the one or more grids.

56. A system configured to use and reclaim heat and/or cooling from a thermal plant module and/or another module, wherein heat and/or cooling is provided to and/or reclaimed from:

a) a BGM;

b)a) a refinery module;

c)a) a BPP module;

d)a) an air conditioning/heating module;

e)a) a recycling module;

f)a) a BBPP module;

g)a) a products storage module;

h)a) a desalination module;

i)a) a waste to energy module;

j)a) a biogas storage module;

k)a) a heat/cooling storage module;

l)a) a heat/cooling recovery module;

m)a) offsite heating/cooling;

n)a) heating/cooling for discharge; and/or

o)a) some systems optionally comprised by the thermal plant module selected from:

1. a pyrolysis processes module;

2.1. a hydrothermal processing module;

3.1. a cellulosic ethanol/butanol/isobutanol module; and/or

4.1. a desorber/condenser module.

57. The system of claim 56 wherein heat and/or cooling reclaimed from any one or more of modules a – o as described in claim 1 is provided to any one or more of modules a – o as described in claim 1.

58. The system of either of claims 56 or 57, wherein any one or more of modules a-o as described in claim 1 are collocated.

59. The system of any one of claims 56-58 wherein the thermal plant module is configured to supply waste heat to heat the BGM.

60. The system of claim 59, wherein the thermal plant module is configured to discharge waste heat as a heated fluid.

61. The system of claim 60, wherein the heated fluid is fed directly or in part as a water source and/or gas source to the BGM, a BGU, and/or any subunit of a BGU.

62. The system of claim 61, wherein the heated fluid is configured to provide heat transfer to the BGM, a BGU, and/or any subunit of a BGU without direct interaction with the BGM.

63. The system of any one of claims 56-62 wherein offsite heating/cooling comprises a fresh water source and/or salt water intake.

64. The system of claim 63 wherein the fresh water source and/or salt water intake provide heat and/or cooling to any one or more of modules a – l, and o.

~~65. The system of any one of claims 56-64, wherein outputs of heat and/or cooling from any one of claim 1 modules a - o share heating and/or cooling transmission modules and/or technologies, and/or heat and/or cooling storage module(s) and/or unit(s).~~

~~66~~61. A method of using and reclaiming heat and/or cooling from a thermal plant module, the thermal plant module either a) being: a fossil fuel-fired plant, a nuclear plant, a solar thermal plant, a steel plant, a cement plant, a paper mill, a textile mill, a metal manufacturing plant, an incinerator, and/or a rotary kiln incinerator, and/or b) comprising: a cellulosic ethanol/ isobutanol/butanol module, a hydrothermal processing module, a gasification module, a waste-to-energy module, a plasma gasification unit, and/or a desorber/condenser module, the method ~~and/or another module~~ comprising:

generating heat and/or cooling at ~~a~~ the thermal plant module;

transmitting heat and/or cooling to ~~another module~~a biomass growth module (BGM); and

using all or a portion of the heat and/or cooling in the thermal plant module and/or in the ~~another module~~BGM~~;~~,

wherein the BGM does not include, nor is operatively connected to, an anaerobic bioreactor~~and optionally transmitting unused heat and/or cooling from the thermal plant module and/or in the another module to the module, wherein heat and/or cooling is provided to and/or reclaimed from:~~

~~a) a BGM;~~

~~b) a refinery module;~~

~~c) a BPP module;~~

~~d) an air conditioning/heating module;~~

~~e) a recycling module;~~

~~f) a BBPP module;~~

~~g) a products storage module;~~

~~h) a desalination module;~~

~~i) a waste to energy module;~~

~~j) a biogas storage module;~~

~~k) a heat/cooling storage module;~~

~~l) a heat/cooling recovery module;~~

~~m) heating/cooling external to or apart from the method;~~

~~n) heating/cooling for discharge; and/or~~

~~o) some systems optionally comprised by the thermal plant module selected from:~~

~~1. a pyrolysis processes module;~~

~~2. a hydrothermal processing module;~~

~~3. a cellulosic ethanol/butanol/isobutanol module; and/or~~

~~4. a desorber/condenser module;~~.

2. The method according to claim 1 wherein the method further comprises growing biomass in the BGM.

3. The method according to any one of claims 1 to 2 wherein heat and/or cooling is provided to and/or reclaimed from:

a) a refinery module;

b) a BPP module;

c) an air conditioning/heating module;

d) a recycling module;

e) a BBPP module;

f) a products storage module;

g) a desalination module;

h) a waste to energy module;

i) a biogas storage module;

j) a heat/cooling storage module;

k) a heat/cooling recovery module;

l) heating/cooling external to or apart from the method;

m) heating/cooling for discharge;

n) biomass products;

o) a gasification module;

p) processing of biofuel; and/or

q) systems optionally comprised by the thermal plant module selected from:

1. a pyrolysis processes module;

2. a hydrothermal processing module;

3. a cellulosic ethanol/butanol/isobutanol module; and/or

4. a desorber/condenser module~~;~~.

~~67~~4. The method of claim ~~66~~ 3 wherein heat and/or cooling reclaimed from any one or more of modules a – ~~o~~ q ~~as described in claim 66~~ is provided to any one or more of modules a – ~~o~~q.

5. The method of any one of claims 1 to 4 wherein the thermal plant module and the BGM are collocated.

~~68~~6. The method of ~~either of claims 66 or 67,~~ any one of claims 3 to 4 wherein any ~~one~~ two or more of ~~modules~~ components a-~~o~~ q are collocated.

7. The method of any one of claims 1 to 6 wherein the step of transmitting includes transmitting heat from the thermal plant module as a heated fluid.

8. The method of claim 7 wherein the heated fluid is fed directly or in part as a water source and/or gas source to the BGM, a BGU, and/or any subunit of a BGU.

9. The method of any one of claims 7 to 8 wherein the heated fluid is configured to provide heat transfer to the BGM, a BGU, and/or any subunit of a BGU without direct interaction with the BGM.

10. The method of any one of claims 1 to 9 wherein heat is reclaimed from exhaust gases generated by the thermal plant module and/or from cooling fluid output from the thermal plant module.

11. The method of claim 10 wherein heat is reclaimed from cooling fluid output from the thermal plant module and the cooling fluid is cooling a power cycle comprising one or more of:

a. a Rankine cycle;

b. a Simple cycle;

c. a Combined cycle; and/or

d. an Open Rankine cycle.

12. The method of claim any one of claims 1 to 11 wherein the method is performed in a system comprising the thermal plant module and the biomass growth module (BGM) that grows biomass.

~~69. The method of any one of claims 66-68, wherein outputs of heat and/or cooling from any one of modules a - o share heating and/or cooling transmission modules and/or technologies, and/or heat and/or cooling storage module(s) and/or unit(s).~~

13. A system configured to use and reclaim heat and/or cooling from a thermal plant module, the thermal plant module either a) being: a fossil fuel-fired plant, a nuclear plant, a solar thermal plant, a steel plant, a cement plant, a paper mill, a textile mill, a metal manufacturing plant, an incinerator, and/or a rotary kiln incinerator, and/or b) comprising: a cellulosic ethanol/ isobutanol/butanol module, a hydrothermal processing module, a gasification module, a waste-to-energy module, a plasma gasification unit, and/or a desorber/condenser module, using the method of claim 1, wherein the reclaimed heat and/or cooling is provided in whole or in part to a biomass growth module (BGM) that grows biomass, wherein the BGM does not include, nor is operatively connected to, an anaerobic bioreactor.

14. The system according to claim 13 wherein the system is further configured to provide heat and/or cooling to and/or to reclaim heat and/or cooling from:

a) a refinery module;

b) a BPP module;

c) an air conditioning/heating module;

d) a recycling module;

e) a BBPP module;

f) a products storage module;

g) a desalination module;

h) a waste to energy module;

i) a biogas storage module;

j) a heat/cooling storage module;

k) a heat/cooling recovery module;

l) offsite heating/cooling;

m) heating/cooling for discharge;

n) biomass products;

o) a gasification module;

p) processing of biofuel; and/or

q) systems optionally comprised by the thermal plant module selected from:

1. a pyrolysis processes module;

2. a hydrothermal processing module;

3. a cellulosic ethanol/butanol/isobutanol module; and/or

4. a desorber/condenser module.

15. The system of claim 14 wherein heat and/or cooling reclaimed from any one or more of components a –q as described is provided to any one or more of modules a –q.

16. The system of any one of claims 14 to 15, wherein any two or more of modules a-q are collocated.

17. The system of any one of claims 14 to 16, wherein outputs of heat and/or cooling from any one of components a - q share heating and/or cooling transmission modules and/or technologies, and/or heat and/or cooling storage module(s) and/or unit(s).

18. The system of any one of claims 14 to 17, wherein the thermal plant module is configured to discharge waste heat as a heated fluid to heat the BGM.

19. The system of claim 18, wherein the heated fluid is fed directly or in part as a water source and/or gas source to the BGM, a BGU, and/or any subunit of a BGU and/or any of the other components a – q.

20. The system of claim of any one of claims 18 to 19, wherein the heated fluid is configured to provide heat transfer to the BGM, a BGU, and/or any subunit of a BGU without direct interaction with the BGM and/or any of the other components a – q.

21. The system of any one of claims 14 to 20 in which cooling is provided to the BGM, wherein the cooling is provided by a cogenerated cooling module which uses heat from the thermal plant module to provide cooling to the BGM and/or the other components a – q.

22. The system of any one of claims 13 to 21 wherein the thermal plant module and the BGM are collocated.

23. The system of any one of claims 13 to 22 wherein the thermal plant module is configured to supply waste heat to heat the BGM.

24. The system of claim 23 wherein the thermal plant module is configured to discharge waste heat as a heated fluid.

25. The system of claim 24 wherein the heated fluid is fed directly or in part as a water source and/or gas source to the BGM, a BGU, and/or any subunit of a BGU.

26. The system of any one of claims 24 to 25 wherein the heated fluid is configured to provide heat transfer to the BGM, a BGU, and/or any subunit of a BGU without direct interaction with the BGM.

27. The system of any one of claims 13 to 26 in which cooling is provided to the BGM, wherein the cooling is provided by a cogenerated cooling module which uses heat from the thermal plant module to provide cooling to the BGM.

28. The system of any one of claims 13 to 27 wherein heat is reclaimed from either exhaust gases generated by the thermal plant module and/or from cooling fluid output from the thermal plant module.

29. The system of claim 28 wherein heat is reclaimed from cooling fluid output from the thermal plant module and the cooling fluid is cooling a power cycle comprising one or more of:

a. a Rankine cycle;

b. a Simple cycle;

c. a Combined cycle; and/or

d. an Open Rankine cycle.

30. A method of using and reclaiming heat and/or cooling from a thermal plant module, the method comprising: generating heat and/or cooling at the thermal plant module; transmitting heat and/or cooling to a biomass growth module (BGM);

and

using all or a portion of the heat and/or cooling in the thermal plant module and/or in the BGM,

wherein heat and/or cooling is further provided to and/or reclaimed from:

a. a refinery module;

b. a BPP module;

c. an air conditioning/heating module;

d. a recycling module;

e. a BBPP module;

f. a products storage module;

g. a desalination module;

h. a waste to energy module;

i. a biogas storage module;

j. a heat/cooling storage module;

k. a heat/cooling recovery module;

l. heating/cooling external to or apart from the method;

m. heating/cooling for discharge;

n. biomass products;

o. a gasification module;

p. processing of biofuel; and/or

q. systems optionally comprised by the thermal plant module selected from:

i. a pyrolysis processes module;

ii. a hydrothermal processing module;

iii. a cellulosic ethanol/butanol/isobutanol module; and/or

a desorber/condenser module,

wherein any two or more of components a.-q. are collocated and wherein outputs of heat and/or cooling from any one of components a.-q. share heating and/or cooling transmission modules and/or technologies, and/or heat and/or cooling storage module(s) and/or unit(s).

31. A method of using and reclaiming heat and/or cooling from a thermal plant module, the method comprising: generating cooling at the thermal plant module by cogenerating cooling using heat from the thermal plant module; transmitting the cogenerated cooling to a biomass growth module (BGM); and using all or a portion of the cogenerated cooling in the BGM.

~~70. A system configured to use and reclaim water used by one or more modules configured for water use wherein such water is provided to and/or reclaimed from:~~

~~a) a fresh water source;~~

~~b) a fresh water pretreatment module;~~

~~c) a salt water intake;~~

~~d) a salt water pretreatment module;~~

~~e) a preheating/cooling module;~~

~~f) a water storage module;~~

~~g) irrigation;~~

~~h) firefighting;~~

~~i) fountains;~~

~~j) lakes;~~

~~k) cleaning;~~

~~l) a BGM;~~

~~m) a traditional WWTP module;~~

~~n) a refinery module;~~

~~o) a BPP module;~~

~~p) heating and/or cooling;~~

~~q) a recycling module;~~

~~r) a waste receiving module;~~

~~s) a BBPP module;~~

~~t) a desalination module;~~

~~u) water for discharge/export;~~

~~v) a processing and/or treatment module; and/or~~

~~w) a thermal plant module.~~

~~71. The system of claim 70, wherein the water provided to and/or water reclaimed from any one or more of modules a – w as described in claim 1 is mixed with water from any one or more of modules a-w as described in claim 1 and/or with any other water source at any stage of any process depicted.~~

~~72. The system of either of claims 70 or 71, wherein the water is provided to and/or reclaimed from claim 1 modules a – w using a conduit wherein the water conduit is shared by two or more water lines wherein the water is salt water, brine water, brackish water, fresh water, wastewater, grey water, and/or potable water.~~

~~73. The system of claim 72, wherein the conduit is in operative communication with a salt water intake, a salt water BGU, a desalination module, a salt water cooling system(s), a discharge/export module, and/or another saltwater module for use in the system.~~

~~74. The system of claim 72, wherein the conduit has one or more separate water lines for salt water, brackish water, and/or brine water.~~

~~75. The system of any one of claims 70-74, wherein the conduit is in operative communication with a fresh water source, a fresh water BGU, a WWTBGU, a WWTP module, a fresh water cooling system(s), a discharge/export module, and/or another fresh water module for use in the system.~~

~~76. The system of claim 75, wherein the conduit has one or more separate water lines for fresh water, potable water, wastewater, and/or brackish water.~~

~~77. A method of using and reclaiming water comprising: transmitting water from a module to another module; using all or a portion of the water in the another module for work; and optionally transmitting water unused for the work from the another module to the module, wherein such water is provided to and/or reclaimed from:~~

~~a) a fresh water source;~~

~~b) a fresh water pretreatment module;~~

~~c) a salt water intake;~~

~~d) a salt water pretreatment module;~~

~~e) a preheating/cooling module;~~

~~f) a water storage module;~~

~~g) irrigation;~~

~~h) firefighting;~~

~~i) fountains;~~

~~j) lakes;~~

~~k) cleaning;~~

~~l) a BGM;~~

~~m) a traditional WWTP module;~~

~~n) a refinery module;~~

~~o) a BPP module;~~

~~p) heating and/or cooling;~~

~~q) a recycling module;~~

~~r) a waste receiving module;~~

s) a BBPP module;

t) a desalination module;

u) water for discharge/export;

v) a processing and/or treatment module; and/or

w) a thermal plant module.

78. The method of claim 77, wherein the water provided to and/or water reclaimed from any one or more of modules a – w as described in claim 8, is mixed with water from any one or more of modules a-w as described in claim 8 and/or with any other water source.

79. The system of either of claims 77 or 78, wherein the water is provided to and/or reclaimed from claim 1 modules a – w using a conduit wherein the water conduit is shared by two or more water lines wherein the water is salt water, brine water, brackish water, fresh water, wastewater, grey water, and/or potable water.

80. The method of claim 79, wherein the conduit is in operative communication with a salt water intake, a salt water BGU, a desalination module, a salt water cooling system(s), a discharge/export module, and/or another saltwater module for use in the system.

81. The method of claim 80, wherein the conduit has one or more separate water lines for salt water, brackish water, and/or brine water.

82. The method of any one of claims 77-81, wherein the conduit is in operative communication with a fresh water source, a fresh water BGU, a WWTBGU, a WWTP module, a fresh water cooling system(s), a discharge/export module, and/or another fresh water module for use in the system.

83. The method of claim 82, wherein the conduit has one or more separate water lines for fresh water, potable water, wastewater, and/or brackish water.

84. A system configured to use and reclaim carbon dioxide wherein the carbon dioxide is provided by:

a) a thermal plant module;

b) a sludge processing module;

c) a traditional WWTP module;

d) a carbon dioxide storage module;

e) an ambient carbon dioxide source(s);

f) a purification module;

g) a refinery module;

h) a BPP module;

i) a supercritical fluids extraction module;

j) a gasification module;

k) a BGM;

l) a cellulosic ethanol/butanol/isobutanol module;

m) a landfill module; and/or

n) a source outside the system (offsite) .

85. The system of claim 84 wherein carbon dioxide from any one or more of modules a – n is optionally provided to:

a) a BGM;

b) a refinery module;

c) a BPP module;

d) a purification/processing module;

e) a carbon dioxide storage module;

f) a BBPP module;

g) a desalination module; and/or

h) a discharge and/or export module.

86. The system of either of claims 84 or 85, wherein oxygen generated in the BGM is directed to the traditional WWTP module.

~~87. A method of using and reclaiming carbon dioxide comprising generating carbon dioxide at one or more modules a-n, using the carbon dioxide in the generating module, and reclaiming any unused carbon dioxide for further use or discharge, wherein the carbon dioxide is generated or provided by:~~

~~a) a thermal plant module;~~

~~b) a sludge processing module;~~

~~c) a traditional WWTP module;~~

~~d) a carbon dioxide storage module;~~

~~e) an ambient carbon dioxide source;~~

~~f) a purification module;~~

~~g) a refinery module;~~

~~h) a BPP module;~~

~~i) a supercritical fluids extraction module;~~

~~j) a gasification module;~~

~~k) a BGM;~~

~~l) a cellulosic ethanol/butanol/isobutanol module;~~

~~m) a landfill module; and/or~~

~~n) an offsite source.~~

~~88. The method of claim 87 wherein carbon dioxide from any one or more of modules a – n is optionally provided to:~~

~~a) a BGM;~~

~~b) a refinery module;~~

~~c) a BPP module;~~

~~d) a purification/processing module;~~

~~e) a carbon dioxide storage module;~~

~~f) a BBPP module;~~

~~g) a desalination module; and/or~~

~~h) a discharge and/or export module.~~

~~89. The method of either of claims 87 or 88, comprising directing oxygen generated in the BGM to the traditional WWTP module.~~

~~90. A system configured for biomass growth comprising a biomass growth module (BGM) wherein the BGM comprises one or more biomass growth units (BGUs) selected from the following configurations:~~

~~a) Single;~~

~~b) dual serial;~~

~~c) dual parallel;~~

~~d) dual parallel connected;~~

~~e) serial simple networked; and/or~~

~~f) complex networked.~~

~~91. The system of claim 90 wherein any one or more of the BGUs is:~~

~~a) an autotrophic BGU;~~

~~b) a heterotrophic BGU; and/or~~

~~c) a mixotrophic BGU.~~

~~92. The system of claim 91 wherein any of the BGUs may share and/or exchange inputs and/or outputs optionally comprising:~~

~~a) carbon dioxide;~~

~~b) oxygen;~~

~~c) water;~~

~~d) nutrients;~~

~~e) biomass;~~

~~f) growth medium;~~

~~g) solvent;~~

~~h) carbon source;~~

~~i) nitrogen or other gases; and/or~~

~~j) light source(s).~~

93. A method for growing biomass comprising networking a set of biomass growth units in a biomass growth module (BGM) wherein the set comprises a biomass growth unit which is:

a) a single biomass growth unit;

b) a dual serial biomass growth unit;

c) a dual parallel biomass growth unit;

d) dual parallel connected biomass growth unit;

e) serial simple networked biomass growth unit; and/or

f) complex networked biomass growth unit.

94. The method of claim 93, wherein any one or more of the BGUs is operating:

a) autotrophically;

b) heterotrophically; and/or

c) mixotrophically.

95. The method of claim 94 wherein any of the BGUs is sharing and/or exchanging inputs and/or outputs optionally comprising:

k) carbon dioxide;

l) oxygen;

m) water;

n) nutrients;

o) biomass;

p) growth medium;

q) solvent;

r) carbon source;

s) nitrogen or other gases; and/or

t) light source(s).

96. A system configured to grow and process biomass comprising a biomass growing subunit selected from:

a. an autotrophic growing subunit;

b. a heterotrophic subunit; and/or

c. a mixotrophic subunit.

97. The system of claim 96, wherein the growing subunit is configured to receive inputs selected from:

a. water from any source selected from:

1. salt water;

2. fresh water;

3. high salinity salt water;

4. wastewater; and/or

5. mixtures of the above.

b. carbon dioxide;

c. oxygen in any form;

d. other gases;

e. a nitrogen source;

f. a carbon source selected from:

1. glucose;

2. acetic acid;

3. glycerol;

4. sugarcane;

5. corn stover;

6. miscanthus;

7. switchgrass;

8. forest residue;

9. waste streams; and/or

10. sugars;

g. biomass and water;

h. fresh medium; and/or

i. a daytime biomass culture.

~~98. The system of either of claim 96 or 97, wherein the growing subunit is configured to optionally discharge:~~

~~a. biomass and water;~~

~~b. a biofuel;~~

~~c. gases;~~

~~d. a nighttime biomass culture; and/or~~

~~e. an excess and/or old medium.~~

~~99. The system of either of claim 97 or 98, wherein the fresh medium is supplied to the growing subunit by an optional nutrient storage subunit.~~

~~100. The system of claim 99, wherein the nutrient storage subunit is configured to receive optional inputs selected from:~~

~~a. fresh nutrients;~~

~~b. feed water; and/or~~

~~c. filtered old medium.~~

~~101. The system of any one of claims 97-100, wherein the daytime biomass culture is supplied by an optional nighttime holding subunit(s).~~

~~102. The system of claim 101, wherein the nighttime holding subunit(s) is optionally configured to receive inputs selected from:~~

~~a. fresh medium; and/or~~

~~b. a nighttime biomass culture from one or more different inputs.~~

~~103. The system of either of claims 101 or 102, wherein the nutrient storage subunit is configured to provide a fresh medium to the nighttime holding subunit(s).~~

~~104. The system of any one of claims 101-103, wherein a nighttime biomass culture is provided to the nighttime holding subunit(s) by:~~

~~a. the growing subunit; and/or~~

b. a stressing and milking subunit(s).

105. The system of any one of claims 97-104, wherein the growing subunit is configured to provide and optionally receive biomass and water to and/or from:

a) a BPP module;

b) a refinery module;

c) a stressing subunit(s); and/or

d) the stressing and milking subunit(s).

106. The system of either of claims 104 or 105, wherein the stressing subunit(s) is optionally configured to provide and receive biomass and water to and/or from the stressing and milking subunit(s).

107. The system of either of claims 105 or 106, wherein the stressing subunit(s) is configured to provide biomass and water to the BPP module and/or the refinery module.

108. The system of any one of claims 104-107, wherein the stressing and milking subunit(s) is configured to receive a daytime biomass culture from an optional nighttime holding subunit(s).

109. The system of any one of claims 104-108, wherein the stressing and milking subunit(s) is optionally configured to provide biomass and water to the growing subunit.

110. The system of any one of claims 104-109, wherein the stressing and milking subunit(s) is configured to receive an input of solvent(s) for milking biomass.

111. The system of any one of claims 104-110, wherein the stressing and milking subunit(s) is configured to supply solvent containing extracted biomass to the BPP module and/or the refinery module.

~~112. The system of any one of claims 98-111, wherein any portion of the biofuel is supplied to a vapor compression steam stripping and/or other separation technologies subunit.~~

~~113. The system of claim 112, wherein the vapor compression steam stripping and/or other separation technologies subunit is configured to supply a purified biofuel stream to the BPP module and/or the refinery module.~~

~~114. The system of any one of claims 98-113, wherein the growing subunit is configured to supply gases to a subunit for storage/use/reuse/marketing wherein the gases are optionally:~~

~~a) stored;~~

~~b) reused in the growing subunit;~~

~~c) reused in a different growing subunit; and/or~~

~~d) reused in the Plan;~~

~~115. The system of any one of claims 98-114, wherein the excess and/or old medium is provided to an optional cross-flow filtration subunit.~~

~~116. The system of claim 115, wherein old medium delivered from the cross-flow filtration subunit is provided to the nutrient storage subunit.~~

~~117. The system of any one of claims 96-116, wherein a subunit is configured to receive a stream of resources optionally selected from:~~

~~a. heat and/or cooling;~~

~~b. water from any source;~~

~~c. carbon dioxide;~~

~~d. exhaust gases;~~

~~e. oxygen;~~

~~f. other gases; and/or~~

~~g. lighting – natural and/or artificial, full spectrum and/or selected wavelengths.~~

~~118. The system of any one of claims 104-117, wherein the stressing subunit(s) and/or the stressing and milking subunit(s) are configured to receive inputs optionally selected from:~~

~~a. high intensity light;~~

~~b. blue light;~~

~~c. temperature fluctuations;~~

~~d. nitrogen starvation/depletion; and/or~~

~~e. salt content;~~

~~119. A method of producing biomass comprising growing a biomass in a system according to claim 96.~~

~~120. A system comprising: A thermal plant module comprising a source of exhaust gases; wherein the exhaust gases comprise carbon dioxide; and wherein a conveyance carries the exhaust gases away from the source; wherein a diversion therefrom carries any portion of the exhaust gases from the conveyance into an exhaust gas recovery module comprising:~~

~~a. one or more valves;~~

~~b. one or more motive devices;~~

~~c. a heat recovery module; and/or~~

~~d. a pollution entrainment module.~~

~~121. The system of claim 120 wherein a discharge section of the conveyance is configured to convey any portion of the exhaust gases for discharge.~~

~~122. The system of either of claims 120 or 121 wherein one or more valves are positioned on the discharge section to control the flow of exhaust gases through the discharge section.~~

~~123. The system of any one of claims 120-122 wherein a pollution control module, pollution entrainment module, and/or heat recovery module are provided on the discharge section.~~

~~124. The system of any one of claims 120-123, wherein the pollution control module, pollution entrainment module, and/or either or both of the heat recovery modules are configured to optionally provide heat, water, gases, carbon dioxide, or other fluid(s), and/or pollutants to a BGM, either directly from the thermal plant, or optionally after pollution control treatment, chemical treatment, and/or combination with water from other sources.~~

~~125. The system of claim 124 wherein the pollution control module, pollution entrainment module, and/or either or both of the heat recovery modules are configured to store or hold the heat, water, gases, carbon dioxide, or other fluid(s), and/or pollutants before providing the heat, water, gases, carbon dioxide, or other fluid(s), and/or pollutants to a BGM optionally after pollution control treatment, chemical treatment, and/or combination with water from other sources.~~

~~126. The system of any one of claims 120-125, wherein the pollution control module, pollution entrainment module, and/or heat recovery module utilize(s) a heat exchanger.~~

~~127. The system of any one of claims 120-126 wherein the pollution control module, pollution entrainment module and/or heat recovery module utilize:~~

~~activated carbon;~~

~~hearth furnace cokes;~~

~~zeolites;~~

~~lime;~~

~~chlorine;~~

~~sprayers;~~

~~sorbents;~~

~~filtration;~~

~~photochemical methods;~~

~~selective catalytic reduction;~~

~~dry scrubber;~~

~~wet scrubber, e.g., spray tower, tray tower, packed bed tower, two-pass wet scrubber, and/or other wet scrubber; and/or~~

~~any of the above in any sequence or combination.~~

~~128. The system of any one of claims 121-127, wherein the discharge section is configured to optionally discharge any portion of the exhaust gases.~~

~~129. The system of any one of claims 120-128, wherein an optional valve at or near the beginning of the diversion is configured to control the flow of exhaust gases from the conveyance through the exhaust gas recovery module.~~

~~130. The system of any one of claims 120-129, optionally comprising one or more motive devices to control flow of the exhaust gases from the conveyance, through discharge section, through the diversion, and the through the exhaust gas recovery module.~~

~~131. The system of any one of claims 120-130, wherein an optional heat recovery module is provided either upstream or downstream from the pollution entrainment module.~~

~~132. The system of any one of claims 120-131, wherein water from any source optionally pretreated may be used in:~~

~~the pollution entrainment module;~~

~~the pollution control module; and/or~~

~~either of the heat recovery modules.~~

~~133. The system of any one of claims 120-132, wherein water from any source or other fluids optionally pretreated may be used in the heat recovery modules.~~

~~134. The system of any one of claims 120-133, wherein the gases comprising carbon dioxide and/or remaining heat after the above process as in the exhaust gas recovery module are provided to a BGM and/or other heat and/or carbon dioxide use either directly or after mixing with other gases, and/or are stored for later use in the BGM and/or for discharge.~~

~~135. The system of claims 120-134, wherein the motive device(s) are selected from a damper, a blower, and a combination thereof.~~

~~136. The system of claims 120-135, further comprising controlling pressure at the diversion, the outlet of the discharge section, and/or or the conveyance by controlling the valves and/or operation of the motive device(s).~~

~~137. The system of any one of claims 120-136, wherein the pollution entrainment module, exhaust gas recovery module, pollution control and/or heat recovery module(s) are configured to remove pollutants from the exhaust gases into water and transfer the pollutants to the BGM via the water, and wherein the BGM is configured to remove and/or utilize in the pollutants:~~

~~any portion of organic compounds contained therein;~~

~~any portion of the sulfur compounds contained therein;~~

~~any portion of the particulates contained therein;~~

~~any portion of the metals contained therein;~~

~~any portion of the heat contained therein with respect to ambient temperature;~~

~~any portion of the oxides of sulfur are converted into sulfurous acid;~~

~~any portion of sulfur oxide(s) wherein optionally salts are removed from the water by using sulfurous acid resulting from exhaust gas sulfur oxide(s) removal and conversion to sulfurous acid in the water; and/or~~

~~any portion of exhaust gas NOx emissions are retrieved from the exhaust gases into the water which may become biomass-available nitrogen compounds.~~

~~138. The system of any one of claims 124-137, configured such that a growth rate of the biomass in the BGM is regulated by:~~

~~Exposing the biomass to heat removed from the exhaust gases into the water used in the pollution entrainment module and/or other heat recovery modules and/or heat remaining in the exhaust gases;~~

~~Distributing thereto at least a portion of carbon dioxide from the exhaust gases;~~

~~Distributing compounds of nitrogen derived from the NOx in the exhaust gases and the water sprayed into the pollution entrainment module and/or the pollution control module;~~

~~Distributing other organic compounds from the exhaust gases which may be utilized by the biomass;~~

~~Distributing other inorganic compounds from the exhaust gases which may be utilized by the biomass; and/or~~

~~Exposing a greater surface area of the biomass to the exhaust gases and optionally to light, heat and/or nutrients by churning the water in which the biomass is growing by pulsing the flow of exhaust gases into the BGM and/or varying exhaust gas flow rates across a planar cross-section in a BGM's growing subunit to create a stirring action.~~

~~139. A system for biomass growth resource management comprising a pollution control module, a pollution entrainment module, and/or one or more heat recovery modules configured to optionally provide heat, water, gases, carbon dioxide, other fluid(s), and/or pollutants to a BGM and/or other heat or water use module or process in the system.~~

~~140. The system of claim 139 wherein the pollution control module, a pollution entrainment module, and/or one or more heat recovery modules are optionally configured to provide heat, water, gases, carbon dioxide, other fluid(s), and/or pollutants to a another module, design, component, and the like, either directly, after treatment, and/or after mixing with other fluids and/or for storage for later use in the BGM and/or for discharge.~~

~~141. The system of claim 140, wherein the pollution control module, pollution entrainment module, and/or heat recovery module(s) utilize a heat exchanger.~~

~~142. The system of any one of claims 139-141 wherein the pollution control module, pollution entrainment module, and/or heat recovery module(s) utilize:~~

~~a. activated carbon;~~

~~b. hearth furnace cokes;~~

~~c. zeolites;~~

~~d. lime;~~

e. chlorine;

f. sprayers;

g. sorbents;

h. filtration;

i. photochemical methods;

j. selective catalytic reduction;

k. dry scrubber;

l. wet scrubber, e.g., spray tower, tray tower, packed bed tower, two-pass wet scrubber, and/or other wet scrubber;

m. other pollution control/entrainment techniques known to those skilled in the art; and/or

n. any of the above in any sequence or combination.

143. A method of trapping exhaust gases within an integrated power generation, fuel generation, and waste treatment integrated system comprising:

a. capturing exhaust gas from a system thermal plant,

b. conveying the exhaust gas to a diversion operatively connected to the thermal plant;

c. diverting a portion of the exhaust gas to a gas recovery module as described in claim 120.

144. The method of claim 143 further comprising discharging a portion of the exhaust gas to a discharge section, a pollution control module, a pollution entrainment module, and/or heat recovery module are provided on the discharge section and extracting from the portion of exhaust gas heat, water, gases, carbon dioxide, or other fluid(s), and/or pollutants.

145. The method of claim 143 further comprising storing and/or delivering the heat, water, gases, carbon dioxide, or other fluid(s), and/or pollutants to a BGM or other system module.

~~146. A method of remediating an exhaust gas comprising treating the exhaust gas with the water and pollutants removed from exhaust gases defined in claim 137.~~

~~147. A method of remediating alkaline water and/or salty water and/or soil comprising treating the alkaline water and/or the salty water and/or the soil with the water and pollutants removed from exhaust gases defined in claim 137.~~

~~148. A system configured to provide selected wavelengths of light to a BGU or a component thereof comprising a hot mirror or other light-selective surface in operative communication with the BGU and which mirror or other surface is configured to selectively reflect, or direct, a wavelength or range of wavelengths of light to a BGU or a component thereof.~~

~~149. The system of claim 148 wherein selective wavelengths of light are allowed to pass through the hot mirror or other light-selective surface.~~

~~150. The system of claim 149 wherein the selective wavelengths of light are directed to a BGU or BGU component.~~

~~151. The system of claim 150 wherein the selected wavelengths of light are directed to a second hot mirror or other light-selective surface.~~

~~152. The system of claim 151 wherein selected wavelengths of light are reflected or directed from the second hot mirror or other light-selective surface into or onto a BGU or BGU component.~~

~~153. The system of either of claims 151 or 152 wherein selective wavelengths of light are allowed to pass through the hot mirror or other light-selective surface.~~

~~154. The system of claim 153 wherein the selective wavelengths of light are directed to a BGU or BGU component.~~

155. A method for providing selected wavelengths of light to one or more BGUs or BGU components comprising receiving light onto a hot mirror or other light-selective surface wherein the hot mirror or other light-selective surface is in operative communication with the BGU, and selectively reflecting or directing the wavelengths of light, and directing the selective wavelengths of light to a BGU or a BGU component.

156. The method of claim 155 further comprising allowing selected wavelengths of light to pass through the hot mirror or other light-selective surface.

157. The method of claim 156 wherein the selected wavelengths of light are directed to a BGU or BGU component.

158. The method of claim 157 further comprising directing the selected wavelengths of light to a second hot mirror or other light-selective surface, and selectively reflecting or directing the second selected wavelengths to a BGU or a BGU component.

159. The method of claim 158 comprising allowing selected wavelengths of light to pass through the hot mirror or other light-selective surface.

160. The method of claim 159 wherein the selected wavelengths of light are directed to a BGU or BGU component.

161. A system configured to provide resources to and/or receive resources from a thermal plant module comprising flows to and/or from a thermal plant module wherein the flows are selected from:

a. a treated biomass/water slurry;

b. biofuel;

c. biogas;

d. biocrude;

e. biomass;

f. waste;

g. other fuels;

h. air;

i. water;

j. anhydrous fluid(s);

k. mixture of water and anhydrous fluid(s);

l. a hot biomass and/or biofuel/water slurry;

m. hot biocrude and/or biofuel;

n. hot water or steam separated from biomass and/or biofuel;

o. hot water and/or steam from any water source;

p. unheated wastewater; and/or

q. heat and/or cooling from any one or more of a-p.

162. The system of claim 161, wherein optionally a portion of the biofuel is produced from a BGM outflow fluid that is optionally processed (termed a "treated biomass/water slurry").

163. The system of claim 162, wherein the BGM outflow fluid is the product of processing which optionally comprises:

a. tertiary treatment;

b. gravity thickener process and/or other methods to concentrate/separate biomass and water;

c. dilution;

d. treatment in a refinery and/or BPP module; and/or

e. treatment in a heat recovery module.

164. The system of claim 163, wherein optionally a portion of the treated biomass/water slurry is directed to a refinery and/or BPP module.

165. The system of either of claims 163 or 164, wherein biomass products and/or biofuel are sent from the refinery and/or BPP module to a BBPP module.

~~166. The system of any one of claims 162-165, wherein heat and/or cooling, water, steam, gases, pressure, and/or solvent(s) are recovered from the refinery and/or BPP module.~~

~~167. The system of any one of claims 163-166, wherein heat and/or cooling from the thermal plant module are optionally provided to the refinery and/or BPP module.~~

~~168. The system of any one of claims 163-167, wherein the hot biomass and/or biofuel/water slurry is processed in a refinery and/or a BPP module.~~

~~169. The system of any one of claims 163-168, wherein the hot biocrude and/or biofuel are processed in the refinery and/or BPP module.~~

~~170. The system of any one of claims 163-169, wherein the refinery and/or BPP module generates an output of:~~

~~a. biomass;~~

~~b. hot biomass, biocrude and/or other biofuels;~~

~~c. water;~~

~~d. steam;~~

~~e. heat and/or cooling;~~

~~f. pressure;~~

~~g. gases;~~

~~h. solvent(s); and/or~~

~~i. residuals.~~

~~171. The system of claim 170, wherein the hot biomass, biocrude and/or other biofuels are sent to an optional heat recovery module.~~

~~172. The system of claim 171, wherein the hot biomass, biocrude and/or other biofuels optionally processed in the heat recovery module are provided to the thermal plant module.~~

~~173. The system of any one of claims 170-172, wherein optionally biomass and/or residuals are sent from the refinery and/or BPP module to a gasification module, and/or are sent to and/or received from a BGM.~~

~~174. The system of claim 173, wherein the gasification module generates biogas and/or residuals from:~~

~~a. a CHG module; and/or~~

~~b. an anaerobic digestion module.~~

~~175. The system of claim 174, wherein the biogas is provided to the thermal plant module.~~

~~176. The system of either of claims 174 or 175, wherein the residuals are sent to a BGM or for other use.~~

~~177. The system of any one of claims 163-176 wherein optional additional heat and/or cooling is provided to the refinery and/or BPP module.~~

~~178. The system of claim 177, wherein the optional additional heat and/or cooling is provided by the thermal plant module.~~

~~179. The system of any one of claims 163-178 wherein additional pressure is provided to the refinery and/or BPP module.~~

~~180. The system of any one of claims 160-179 further optionally configured to recover:~~

~~a. heat and/or cooling, pressure, water, steam and/or gases from the thermal plant module; and/or~~

~~b. heat and/or cooling, pressure, solvent(s), gases, water and/or steam from the refinery and/or BPP module.~~

~~181. The system of claim 180 wherein recovered heat and/or cooling, pressure, water, steam, gases and/or solvent(s) are provided to the refinery and/or BPP module.~~

~~182. A method of providing resources to and receiving resources from the thermal plant module of claim 160 comprising providing the system of claim 160 with one or more flows a-q and directing the flows to and from the thermal plant module.~~

~~183. A system configured to use ambient air and optionally reclaim, purify and deodorize used air wherein the ambient and/or used air is provided to and/or from:~~

~~a) a thermal plant module;~~

~~b) a sludge processing module;~~

~~c) a WWTP module;~~

~~d) a BGM (biomass growth module);~~

~~e) a gasification module;~~

~~f) a waste handling/recycling module;~~

~~g) a heat recovery module;~~

~~h) a refinery module;~~

~~i) a BPP module;~~

~~j) a BBPP module;~~

~~k) an air storage module; and/or~~

~~l) an optional air purification module.~~

~~184. The system of claim 183 wherein an ambient and/or used air outflow(s) from any one or more of the modules a – l as described in claim 1 is provided to the thermal plant module.~~

~~185. The system of claim 184, wherein the thermal plant module is configured to process the air outflow(s) using a combustion process.~~

~~186. The system of claim 185, wherein the combustion process comprises the combustion of fuels to generate heat and/or power.~~

~~187. The system of claim 185 or claim 186 wherein the air outflow(s) from the thermal plant module is provided to a heat recovery and/or pollution control module.~~

~~188. The system of claim 187 wherein the air outflow(s) from the heat recovery and/or pollution control module is optionally reused by any one or more of the modules a – l as described in claim 1and/or discharged external or outside the system.~~

~~189. A method for using ambient air and optionally reclaiming, purifying and deodorizing used air wherein the ambient and/or used air is provided within a system to and/or from:~~

~~a) a thermal plant module;~~
~~b) a sludge processing module;~~
~~c) a WWTP module;~~
~~d) a BGM (biomass growth module);~~
~~e) a gasification module;~~
~~f) a waste handling/recycling module;~~
~~g) a heat recovery module;~~
~~h) a refinery module;~~
~~i) a BPP module;~~
~~j) a BBPP module;~~
~~k) an air storage module; and/or~~
~~l) an optional air purification module,~~

~~comprising receiving ambient and/or used air from a module, optionally purifying the ambient and/or used air, and providing the ambient and/or used air to another module or discharging the ambient and/or used air.~~

~~190. The method of claim 189 further comprising providing an air outflow(s) from any one or more of the modules a – l to the thermal plant module wherein the air comprises ambient, reclaimed, purified, and/or deodorized air.~~

~~191. The method of claim 190 further comprising directing air to a thermal plant combustion unit or module.~~

~~192. The method of claim 191 further comprising directing air from a thermal plant combustion unit or module to a heat recovery and/or pollution control module.~~

~~193. The method of claim 194 further comprising directing air from the heat recovery and/or pollution control module to any one or more of the modules a – l and/or discharged.~~

~~FIG 14 claims start here.~~

~~194. A system for processing biomass comprising a separation module configured to receive biomass and water and wherein the separation module is configured to receive heat.~~

~~195. The system of claim 1 wherein the separation module comprises a biomass output and a water output and wherein the water output is optionally configured for reclamation of water use.~~

~~196. The system of claim 195 wherein optionally any portion of a second biomass output is processed by a whole cell products processing module.~~

~~197. The system of claim 196 wherein an output of whole cell products from the whole cell products processing module is provided to a BBPP module.~~

~~198. The system of any one of claims 195-197 wherein optionally any portion of the biomass output is processed by a cell disruption module.~~

~~199. The system of claim 198 wherein the cell disruption module comprises a cell disruption biomass output.~~

~~200. The system of claim 198 or 199 wherein optionally any portion of the biomass output and/or cell disruption biomass output is provided to a drying module.~~

~~201. The system of claim 200 wherein heat is optionally provided to the drying module.~~

~~202. The system of claim 200 or claim 201 configured to transfer air from an air treatment/odor control module to the drying module.~~

~~203. The system of any one of claims 200-202 configured to transfer air from the drying module to the air treatment/odor control module.~~

~~204. The system of any one of claims 200-203 wherein the drying module comprises a dried biomass output.~~

~~205. The system of claim 204 wherein the dried biomass output is transferred to a powdered product processing module.~~

~~206. The system of claim 205 wherein the powdered product processing module comprise a powdered products output.~~

~~207. The system of claim 206 wherein the powdered products output is transferred to a BBPP module.~~

~~208. The system of any one of claims 198-207 wherein the cell disruption module comprises a second biomass output.~~

~~209. The system of claim 208 wherein the second biomass output is transferred to one or more optional mixing module(s).~~

~~210. The system of claim 209 wherein the optional mixing module(s) further comprises an input of:~~

~~a. solvent(s) containing extracted biomass;~~

~~b. biomass;~~

~~c. solvent; and/or~~

~~d. recovered solvent.~~

~~211. The system of either of claims 209 or 210 wherein any of the mixing module(s) is configured to optionally receive heat.~~

~~212. The system of any one of claims 209-211 wherein the mixing module(s) comprise(s) a solvent and biomass output.~~

~~213. The system of claim 212, wherein the solvent and biomass is optionally provided to a separation module.~~

~~214. The system of claim 213 wherein the separation module comprises the following outputs:~~

~~a. solvent and biomass; and/or~~

~~b. residual biomass.~~

~~215. The system of claim 214 wherein the solvent and biomass output is provided to an evaporation module.~~

~~216. The system of claim 215 wherein heat, is optionally provided to the evaporation module.~~

~~217. The system of either of claims 215 or 216 wherein the evaporation module is optionally configured to evaporate solvent under a vacuum by an air flow.~~

~~218. The system of claim 217 wherein the air flow is directed to the air treatment/odor control module.~~

~~219. The system of any one of claims 216-218 wherein the evaporation module optionally comprises outputs optionally selected from:~~

~~a. formulated products in oil;~~

~~b. recovered solvent; and/or~~

~~c. solvent vapor.~~

~~220. The system of claim 219 wherein the recovered solvent output is optionally provided to the following:~~

~~a. the mixing module(s); and/or~~

~~b. a BGM.~~

~~221. The system of claim 372 wherein optionally cooling, is provided to the condensing module.~~

~~222. The system of either of claims 372 or 221 wherein an output of the condensing module comprises recovered solvent.~~

~~223. The system of claim 222 wherein the recovered solvent is optionally provided to the mixing module(s) and/or a BGM.~~

~~224. The system of any one of claims 219-223 and 372 wherein the formulated products in oil are provided to the BBPP module.~~

~~225. The system of any one of claims 214-224 and 372 wherein the residual biomass output is provided to:~~

~~a. a refinery module;~~

~~b. a gasification module; and/or~~

~~c. a BGM.~~

~~226. The system of claim 225 wherein the refinery module and/or the gasification module provide an output of biofuel.~~

~~227. The system of claim 226 wherein the biofuel output is optionally configured to fuel the thermal plant.~~

~~228. The system of any one of claims 194-227 and 372 wherein the biomass and water is supplied by a BGU.~~

~~229. The system of any one of claims 210-228 and 372 wherein the solvent containing extracted biomass is supplied by a BGU output.~~

~~230. A system configured to process solvent comprising a solvent and biomass input in operative communication with an evaporation module wherein heat is provided to the evaporation module.~~

~~231. The system of claim 230, wherein the evaporation module optionally comprises outputs selected from the following:~~

~~a. formulated products in oil;~~

~~b. recovered solvent;~~

~~c. solvent vapor; and/or~~

~~d. air.~~

~~232. A system configured to process solvent and biomass comprising a mixing module(s) wherein heat is provided to the mixing module(s).~~

~~233. The system of claim 232, wherein any of the mixing module(s) may receive inputs optionally selected from:~~

~~a. biomass;~~

~~b. solvent;~~

~~c. solvent containing extracted biomass; and/or~~

~~d. recovered solvent.~~

~~234. The system of either of claims 232 or 233, wherein an output of the mixing module(s) is solvent and biomass.~~

~~235. A system configured to dry biomass comprising a drying module wherein heat is provided to the drying module.~~

~~236. The system of claim 235, wherein the drying module is configured to receive inputs selected from:~~

~~a. biomass; and/or~~

~~b. air.~~

~~237. The system of either of claims 235 or 236, wherein the drying module comprises outputs selected from:~~

~~a. dried biomass; and/or~~

~~b. air.~~

~~238. A system configured to dry biomass comprising a drying module wherein ambient, reclaimed, purified and/or deodorized air from an air treatment/odor control module is configured to provide air to and/or receive air from the drying module.~~

~~239. The system of claim 238, wherein the drying module is configured to receive inputs selected from:~~

~~a. biomass; and/or~~

~~b. heat.~~

~~240. The system of either of claims 238 or 239, wherein the drying module is configured to provide an output of dried biomass.~~

~~241. A system configured to process solvent vapor comprising a solvent vapor input in operative communication with a condensing module wherein cooling is provided to the condensing module.~~

~~242. The system of claim 241, wherein the condensing module comprises an output of recovered solvent.~~

~~243. A system configured to grow biomass comprising a recovered solvent input configured to provide recovered solvent to a BGM.~~

~~244. The system of claim 243, wherein an evaporation module is in operative communication with the recovered solvent input.~~

~~245. A system configured to grow biomass comprising a recovered solvent input of a BGM wherein a condensing module is in operative communication with the recovered solvent input.~~

~~246. A system configured to reclaim residual biomass comprising a residual biomass input in operative communication with~~

~~a. a BGM;~~

~~b. a refinery module; and/or~~

~~c. a gasification module.~~

~~247. The system of claim 246, wherein a separation module is in operative communication with the residual biomass input.~~

~~248. The system of either of claims 246 or 247, wherein the refinery module and/or gasification module are configured to produce biofuel(s).~~

~~249. The system of claim 248, wherein the biofuel(s) are optionally used to fuel the thermal plant, for packaging, storage, and/or use in other combustion processes.~~

~~250. A system configured to bottle and/or package biomass comprising a BBPP module which receives inputs selected from:~~

~~a. formulated products in oil;~~

~~b. powdered products; and/or~~

~~c. whole cell products.~~

~~251. The system of claim 250, wherein the BBPP module is collocated with a BGM, and/or a BPP module.~~

~~252. The system of either of claims 250 or 251, wherein the BGM, and/or the BPP module provide inputs to the BBPP module.~~

~~253. A system to provide evacuation of air comprising an air input in operative communication with an air treatment/odor control module.~~

~~254. The system of claim 253, further comprising an evaporation module which provides the air input to the air treatment/odor control module optionally configured to create a vacuum.~~

~~255. The system of claim 254 wherein the air flow and/or vacuum is optionally used to evaporate solvents creating solvent vapor.~~

~~256. The system of claim 255, wherein the solvent vapor is optionally condensed in a condensing module.~~

~~257. A method of processing biomass comprising providing the system of claim 194 and introducing a biomass and water to the separation module.~~

~~258. A method of processing solvent comprising providing the system of claim 230 and providing heat to the evaporation module.~~

~~259. A method of processing solvent and biomass comprising providing the system of claim 232 and providing heat to the mixing module(s).~~

~~260. A method of drying biomass comprising providing the system of claim 235 and providing heat to the drying module.~~

~~261. A method of drying biomass comprising providing the system of claim 238 and conveying air to and from the drying module.~~

~~262. A method of processing solvent vapors comprising providing the system of claim 241 and providing cooling to the condensing module.~~

~~263. A method of growing biomass comprising providing the system of claim 243 and conveying a recovered solvent to a BGM.~~

~~264. A method of growing biomass comprising providing the system of claim 245 and conveying a recovered solvent to a BGM.~~

~~265. A method of reclaiming residual biomass comprising providing the system of claim 246 and conveying the reclaimed residual biomass to the BGM, the refinery module, and/or the gasification module.~~

~~266. A method of bottling and/or packaging biomass comprising providing the system of claim 250, and conveying the inputs to the BBPP module.~~

~~267. A method of evacuating air comprising providing the system of claim 253 and conveying air to the air treatment/odor control module.~~

~~268. A system for heat transfer comprising a heat transfer module configured to transfer heat from a thermal process to a system module and/or a treated biomass/water slurry.~~

~~269. A system for heat transfer comprising a heat transfer module configured to transfer heat from a thermal process to a system module by a heat exchanger.~~

~~270. The system of either of claims 268 or 269 wherein the heat transfer module comprises the biomass/water slurry (e.g., the treated biomass/water slurry) in operative communication with a heat exchanger.~~

~~271. The system of claim 270 wherein the biomass/water slurry is converted in whole or in part into a biocrude and/or a biofuel in the heat transfer module.~~

~~272. The system of either of claims 270 or 271 wherein the heat exchanger comprises an outflow comprising in liquid and/or gaseous state:~~

~~a. hot biomass;~~

~~b. hot biocrude;~~

~~c. hot biofuels; and/or~~

~~d. water / steam.~~

~~273. The system any one of claims of claim 270 - 272 wherein additional heat is provided to the heat transfer module by a separate heat source.~~

~~274. The system of claim 273 wherein the separate heat source is a burner.~~

~~275. The system of any one of claims 272 - 274 wherein the outflow is directed to another one or more heat exchange processes.~~

~~276. The system either of claims 272-275, wherein the outflow is directed to:~~

~~a. a refinery module;~~

~~b. a BPP module;~~

~~c. a BGM; and/or~~

~~d. a separation module.~~

277. The system of claim 276 wherein the separation module comprises outputs optionally comprising:

a. a hot biomass and/or biofuel and water slurry;

b. a hot biocrude and /or biofuel (gaseous and/or liquid); and/or

c. hot water and/or steam separated from biomass and/or biofuel.

278. The system of claim 277 wherein the hot biomass and/or biofuel and water slurry and/or the hot biocrude and /or biofuel (gaseous and/or liquid) are directed to a refinery module and/or a BPP module.

279. The system of any one of claims 276-278, wherein an outflow from the refinery module and/or the BPP module are optionally directed to modules for the recovery and reuse of heat, water, and/or pressure.

280. The system of any one of claims 277-279, wherein the hot water and/or steam separated from biomass and/or biofuel is optionally directed to modules for the recovery and reuse of heat, water, and/or pressure.

281. The system of any one of claims 272-280, wherein the outflow is directed to a BGM.

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282. The system of claim 269 configured such that a fluid is delivered to the heat exchanger via an optional pump.

283. The system of any one of claims 269 or claim 282, wherein water is used as a fluid for heat transfer.

284. The system of either of claims 282 or 283, wherein the heat exchanger has an outflow of heated fluid.

~~285. The system of claim 284, wherein any portion of the heated fluid is directed for use or to modules for the optional recovery and reuse of heat, water, fluid and/or pressure.~~

~~286. The system of either of claims 284 or 285 wherein any portion of the heated fluid is directed to the BGM for use in whole or in part as the BGM feedwater.~~

~~287. The system of claim 285 wherein the modules are configured to produce a reclaimed fluid output.~~

~~288. The system of claim 287 wherein any portion of the reclaimed fluid is directed to the BGM for use in whole or in part as the BGM feedwater.~~

~~289. The system of claim 287 wherein any portion of the reclaimed fluid is directed to a container for transferring heat.~~

~~290. The system of claim 289 wherein the container for transferring heat is configured to be in contact with a BGM.~~

~~291. The system of any one of claims 269-290 wherein any of the heat exchangers in any one or more of these systems is configured to cool one or more thermal processes and receives heat therefrom.~~

~~292. The system of claim 291 wherein a thermal process is a thermodynamic process.~~

~~293. The system of claim 292 wherein a thermodynamic process is a thermodynamic cycle.~~

~~294. The system of claim 292, wherein a thermodynamic cycle is a Rankine Cycle.~~

~~295. The system of claim 292, wherein the thermodynamic cycle is a Simple Cycle.~~

~~296. The system of claim 292, wherein the thermodynamic cycle is a Combined Cycle.~~

~~297. A method of transferring heat to a component or module comprising providing the system of claim 268 and generating heat, transferring the heat to a heat transfer module, and optionally transferring the heat to a system module and/or a treated biomass/water slurry.~~

~~298. The method of claim 297 wherein the heat transfer module comprises an outflow comprising in liquid and/or gaseous state: hot biomass; hot biocrude; hot biofuels; and/or water / steam.~~

~~299. A method of transferring heat to a component or module comprising providing the system of claim 269 and generating heat in a thermal process, transferring the heat to a heat exchanger, and transferring the heat to the system component or module.~~

~~300. A system configured to use a treated biomass/water slurry as a thermodynamic process working fluid.~~

~~301. The system of claim 300 further comprising a boiler comprising a first and second section wherein the first and second regions are adapted to process the slurry.~~

~~302. The system of claim 301 wherein the first section of the boiler is configured to receive the slurry.~~

~~303. The system of either of claims 301 or 302 further comprising a selective filtering division positioned between the first and second sections.~~

~~304. The system of claim 303 wherein the filtering division is configured to permit water to pass from the first section to the second section.~~

~~305. The system of either of claims 303 or 304 wherein the filtering division is configured to permit small molecules to pass from the first section to the second section.~~

306. The system of claim 305 wherein the small molecules have an average molecular weight of from 18 g/mol to 46 g/mol .

307. The system of any one of claims 301-306 further comprising a burner or other heat source configured to heat the first section and or the second section.

308. The system of claim 307 wherein the burner or other heat source is configured to receive an air supply from an air treatment/odor control system.

309. The system of either of claims 307 or 308 wherein the burner or other heat source is configured to send exhaust gas to an exhaust gas recovery system.

310. The system of any one of claims 300-309 configured to separate the treated biomass water slurry into one or more layers in the boiler.

311. The system of claim 310 wherein a layer comprises water, light oil/biomass, heavy oil/biomass and/or residuals.

312. The system of any one of claims 301-311, wherein the boiler comprises a drain in communication with the first section.

313. The system of any one of claims 301-312 wherein the boiler comprises a second drain in communication with the first section and positioned below the first drain.

314. The system of any one of claims 301-313 wherein the boiler comprises a third drain in communication with the first section and positioned below the second drain.

315. The system of any one of claims 312-314 wherein water is below the first drain.

316. The system of any one of claims 313-315 wherein the second drain is in communication with water.

317. The system of any one of claims 311-316 configured to drain the light oil/biomass layer and/or the optional heavy oil/biomass layer and/or residuals and/or optionally water, and a remaining water layer transferred to the second section and/or drained.

318. The system of any one of claims 304-317 wherein the second section is configured to vaporize the water and/or the small molecules.

319. The system of claim 318 wherein the vaporized water and/or small molecules are directed to drive a turbine to provide a downstream fluid.

320. The system of claim 319 wherein the downstream fluid is sent to:

a) a refinery module;

b) a BPP module; and/or

c) an optional condensing unit optionally configured to partially separate biofuel and water and recovers heat.

321. The system of claim 320 wherein the partially separated biofuel and water are sent to the refinery module and/or BPP module.

322. The system of any one of claims 311-320, configured to transfer the light oil/biomass layer and/or the optional heavy oil biomass/residuals layers and optionally water to a refinery module and/or BPP module.

323. The system of any one of claims 320-322 further comprising one or more outflows from the refinery module and/or BPP.

324. The system of claim 323 wherein the one or more outflows are optionally directed to modules for the recovery and reuse in the Plan of heat, water, and/or pressure.

325. The system of any one of claims 301-324 wherein the first and/or second boiler section shape comprises a cross-sectional shape selected from:

a) a cylinder;

b) an elliptical cylinder;

c) an elliptical cylinder with a longer half ellipse on one side and a shorter half ellipse on the opposite side; and/or

d) any vertical cross section of the above shapes wherein they are divided to comprise both boiler sections.

326. The system of any one of claims 301-325 wherein the boiler comprises one or more of the following features:

a) a treated biomass/water slurry entry point;

b) an optional lid, which may be movable or stationary;

c) a light oil/biomass drain;

d) a heavy oil/biomass drain;

e) a water layer drain;

f) an optional drain on the bottom of the second section;

g) a lip on the top of the second section that extends above the first section;

h) an optional inlet to section 2 for additional water supply to the second section of the boiler;

i) one or more agitation devices in the first section to stir the water in order to unclog the selective filtering division (e.g., remove biomass oil or other materials from the selective filtering division); and/or

aside from the features depicted, the boiler may also make use of any other accessories used in boilers that are known to those skilled in the art including but not limited to optionally: pressuretrols, safety valves, water level indicators, sight glass, water gauge or water column, bottom blowdown valves, continuous blowdown valves, flash tanks, automatic blowdown/continuous heat recovery system, hand holes, steam drum internals, low-water cutoffs, surface blowdown line, circulating

pump, feedwater check valve, clack valve, top feed, desuperheater tubes or bundles, and/or chemical injection lines.

327. The system of any one of claims 301-326, wherein the steam system used with the boiler may also optionally make use of steam system accessories known to those in the art.

328. A method for transferring heat from a boiler within the system of claim 300 to a module, unit, or subunit in the system comprising providing a treated biomass/water slurry, heating the slurry in the boiler to provide a working fluid, and transferring the working fluid to the module, unit or subunit in the system.

329. The boiler as described in claim 301.

330. A system configured to reduce NOx and SOx gaseous emissions of an exhaust gas, wherein said exhaust gas is optionally delivered to a BGM, the system comprising:

a. a conveyance or diversion configured to direct the exhaust gas to a wet scrubber;

b. a wet scrubber configured to utilize water from any source in the system, configured to capture SOx in the exhaust gas (a first pass); and

c. wherein the scrubber defines outflows of water, heat, and/or other pollutants and wherein the outflow water, heat, and/or other pollutants is or are used for subsequent scrubbing (the second pass), wherein the subsequent scrubbing is effective to remove NOx.

331. The system of claim 330 wherein the outflow of water, heat, and/or pollutants from the first pass, optionally treated, is provided in whole or in part to:

a. a heat recovery and reuse module;

b. a BGM;

c. a storage module(s);

d. a module for other heat recovery and use; and/or

e. a module for water recovery and use.

~~332. The system of either of claim 330 or 331, wherein any portion of the outflow of water and/or pollutants is chemically treated for use in a scrubber.~~

~~333. The system of any one of claims 330-332, wherein optionally, any portion of the resulting optionally treated outflow of water and/or pollutants from the first pass is used in the scrubber's first pass after optionally mixing with a water source.~~

~~334. The system of any one of claims 330 - 333, wherein any portion of the optionally treated outflow of water and/or pollutants optionally mixed with another water source is directed for use in the second scrubber pass.~~

~~335. The system of claim 334, wherein one or more catalysts are used in a scrubber.~~

~~336. The system of either of claims 334 or 335, wherein the outflow of water, heat and/or pollutants from the second scrubber pass, optionally treated, is directed for use in:~~

~~a. a BGM;~~

~~b. a storage module(s)~~

~~c. a module for heat recovery and use; and/or~~

~~d. a module for water recovery and use.~~

~~337. The system of any one of claims 330-336, wherein optional treatment of the exhaust gas is performed:~~

~~a. before use in the first scrubber pass;~~

~~b. between the first scrubber pass and the second scrubber pass; and/or~~

~~c. after the second scrubber pass.~~

~~338. A system for managing and treating pollutants wherein water and/or pollutants from any source optionally treated are provided to:~~

~~a. a BGM;~~

~~b. a storage module(s);~~

~~c. a module for heat recovery and use; and/or~~

d. a module for water recovery and use.

339. The system of claim 338, wherein the water and/or pollutants are heated before being provided to any one or more of modules a – d as described in claim 338.

340. The system of claim 339, wherein the heat, water, and/or pollutants, are provided by the outflow of a wet scrubber.

341. A method of scrubbing a SOx and NOx pollutants from a stack gas comprising: directing an exhaust gas through a conveyance or diversion to a scrubber of claim 330, scrubbing the exhaust in the scrubber with a fluid configured to remove SOx pollutants from the exhaust gas, and scrubbing the exhaust in a second scrubber with the fluid.

342. The method of claim 341, wherein the second scrubber is the scrubber.

343. The method of claim 341, wherein the fluid is chemically treated before the exhaust is scrubbed in the scrubber and/or the second scrubber.

344. A system configured to use and reclaim pressure wherein such pressure is generated by and/or reclaimed from:

a. a desalination module;

b. a thermal plant heat and/or pressure-intensive processes module;

c. a BBPP module;

d. an HTP module(s) or processes;

e. a pressure generated to create movement of substances of any kind by turning a turbine, creating a vacuum, pressurizing a pump, and /or directing a pressurized substance into a conveyance;

f. a refinery module;

g. a BPP module; and/or

h. a power generation module - the system comprising: capturing fluid pressure from a module a-h and directing a portion of that fluid pressure to another module a-h.

345. The system of claim 344, wherein pressure reclaimed from any one or more of the modules a-h as described in claim 1 may be supplied to any one or more of modules a-h as described in claim 1. Maybe need a table.

346. A method of using and reclaiming pressure wherein such pressure is generated by and/or reclaimed from:

a. a desalination module;

a. a thermal plant heat and/or pressure-intensive processes module;

b. a BBPP module;

c. an HTP module(s) or processes;

d. a pressure generated to create movement of substances of any kind by turning a turbine, creating a vacuum, pressurizing a pump, and /or directing a pressurized substance into a conveyance;

e. a refinery module;

f. a BPP module; and/or

g. a power generation module - the method comprising: capturing fluid pressure from a module a-h and directing a portion of that fluid pressure to another module a-h.

347. The method of claim 346, wherein pressure reclaimed from any one or more of modules a-h may be supplied to any one or more of modules a-h.

348. A system for power generation and fuel production, configured to use and reclaim oxygen wherein the oxygen is provided to the system by:

a. an autotrophic BGU(s) configured to generate oxygen;

b. a mixotrophic BGU(s) configured to generate oxygen;

c. an offsite oxygen source(s); and/or

d. a module(s) for oxygen use, reuse, distribution, purification, and/or processing.

349. The system of claim 348 wherein oxygen is provided to:

a. a refinery module;

~~b. a BPP module;~~

~~c. a traditional WWTP module;~~

~~d. a mixotrophic BGU(s);~~

~~e. a heterotrophic BGU(s);~~

~~f. a BBPP module;~~

~~g. a sludge processing module;~~

~~h. a thermal plant module;~~

~~i. a module(s) for oxygen use, reuse, distribution, purification, and/or processing; and/or~~

~~j. a module(s) for oxygen export and/or discharge.~~

~~350. The system of claim 349 wherein oxygen is provided by an autotrophic BGU(s) configured to generate oxygen.~~

~~351. The system of either of claims 349 or 350 wherein oxygen is provided by a mixotrophic BGU(s) configured to generate oxygen.~~

~~352. The system of either of claims 350 or 351 wherein oxygen is supplied to one or more thermal plant oxy-fuel process module(s).~~

~~353. The system of any one of claims 350-352 wherein oxygen is supplied to a mixotrophic BGU(s).~~

~~354. The system of any one of claims 350-353 wherein oxygen is supplied to a heterotrophic BGU(s).~~

~~355. A method for using and reclaiming oxygen wherein the oxygen is provided by:~~

~~a. an autotrophic BGU(s);~~

~~b. a mixotrophic BGU(s);~~

~~c. an offsite oxygen source(s); and/or~~

~~d. a module(s) for oxygen use, reuse, distribution, purification, and/or processing, the method comprising capturing oxygen from a module a-d, and providing the oxygen to another module.~~

~~356. The method of claim 355 wherein oxygen is provided to:~~

~~a. a refinery module;~~

~~b. a BPP module;~~

~~c. a traditional WWTP module;~~

~~d. a mixotrophic BGU(s);~~

~~e. a heterotrophic BGU(s);~~

~~f. a BBPP module;~~

~~g. a sludge processing module;~~

~~h. a thermal plant module;~~

~~i. a module(s) for oxygen use, reuse, distribution, purification, and/or processing; and/or~~

~~j. a module(s) for oxygen export and/or discharge.~~

~~357. The method of claim 355 wherein oxygen is provided by an autotrophic BGU(s).~~

~~358. The method of either of claims 355 or 357 wherein oxygen is provided by a mixotrophic BGU(s).~~

~~359. The method of either of claims 357 or 358, wherein oxygen is supplied to one or more thermal plant oxy-fuel process module(s).~~

~~360. The method of any one of claims 357-359, wherein oxygen is supplied to a mixotrophic BGU(s).~~

~~361. The method of any one of claims 357-360, wherein oxygen is supplied to a heterotrophic BGU(s).~~

362. A method for growing biomass comprising:

a) delivering water optionally comprising a bioavailable carbon source to a biomass growth module; and/or

b) delivering carbon dioxide derived from exhaust gas of a thermal plant to said biomass growth module; and/or

c) growing a biomass from said carbon dioxide at an input rate commensurate with a carbon dioxide exhaust rate from the thermal plant and/or a carbon input rate from a water source.

363. The method of claim 362 wherein commensurate comprises from 0% to 100% of the $CO_2$ generated by the thermal plant; or from about 1% to about 100%; or from about 5% to about 100%; or from about 10% to about 100%; or from about 20% to about 90%; or from about 20% to about 80%; or from about 20% to about 70%; or from about 30% to about 80% or from about 30% to about 70%; or from about 40% to about 80%; or from about 50% to about 80%; or from about 50% to about 70%.

364. A method comprising: selecting a thermal plant optionally combusting a fuel and discharging stack gases therefrom; selecting an optional stack or other conveyance carrying the stack gases away from the thermal plant; optionally connecting a scrubber conducting the stack gases there through, from the stack; providing a motive device controlling flow of the stack gases from the stack through the scrubber removing into the water from the stack gases a significant portion of volatile organic compounds contained therein, substantially all the sulfur compounds contained therein, most particulates contained therein, and most, or a substantial portion, of heat contained therein with respect to ambient temperature, optionally feeding a biomass growth module by distributing the liquid and stack gases through it.

365. A system for growing biomass while simultaneously reducing carbon dioxide that would otherwise be available for discharge into the environment, comprising: a biomass growth module; a water source for feeding water to the biomass growth module; a thermal plant having a fuel combustion unit that emits an exhaust optionally comprising carbon dioxide gas; a gas delivery path from the thermal plant to the biomass growth module, whereby carbon dioxide

~~from the exhaust gas is introduced into the water feed into the biomass growth module either directly or after processing through a scrubber; a source of feed stock of said biomass; a feedstock delivery path into the biomass growth module; and a biofuel/biomass processor.~~

~~366. The system of any one of claims 139-142, wherein an optional heat recovery module is provided either upstream or downstream from the pollution entrainment module.~~

~~367. The system of any one of claims 139-142 and 366, wherein water from any source in the Plan optionally pretreated may be used in:~~

~~a. the pollution entrainment module;~~

~~b. the pollution control module; and/or~~

~~c. either of the heat recovery modules.~~

~~368. A system comprising an air supply and/or gas supply, a primary treatment module a secondary treatment module, a tertiary treatment module, ponds, and/or automation system with flow controls, wherein the an air supply and/or gas supply, a primary treatment module a secondary treatment module, a tertiary treatment module, ponds, and/or automation system with flow controls are in operative communication with:~~

~~a. a BGM~~

~~b. a BGU~~

~~c. a WWTP; and/or~~

~~d. a WWTP effective and/or modified to function as a BGU and/or to augment a BGU.~~

~~369. A system comprising shared infrastructure electrical power distribution to one or more modules, units, subunits, technologies, industrial control system, optionally adaptive controls, artificial intelligence module(s), connections/communications/components and/or features of the system.~~

~~370. A system comprising one or more collocated features which are stack of a thermal plant, one or more turbines, pollution control module(s), pollution entrainment~~

~~module(s), emission control module(s), computer controls or modules, exhaust gas conveyances, fuels, heat, water, power, carbon dioxide, methane, biogas, water/biomass slurry, biofuel, other fuel, chemical storage, piping for water, chemicals and/or other materials, fluid transportation and/or storage, oxygen or other gas transport lines and/or storage, cooling systems, and/or heat exchangers wherein one or more thermal plant technologies and/or one or more solar thermal technologies share one or more of said module(s) or technologies in the system.~~

~~371. The method of claim 143 further comprising managing a biomass growth resource comprising providing the system including a pollution control module, a pollution entrainment module and/or one or more heat recovery modules configured to optionally provide heat, water, gases, carbon dioxide, other fluid(s), and/or pollutants to a BGM and/or other heat or water use module or process in the system.~~

~~372. The system of either of claims 219 or 220 wherein the solvent vapor output is provided to a condensing module.~~