Claims

[Claim 1]

A gas turbine cogeneration system comprising:

a gas turbine comprising a combustor;

a heat recovery steam generator configured to produce boiler steam by using exhaust gas discharged from the gas turbine as a heat source;

a water recovery device configured to recover moisture from the exhaust gas discharged from the heat recovery steam generator by heat exchange between the exhaust gas and refrigerant water; and

a fuel gas production facility configured to produce gas turbine fuel gas to be supplied to the combustor by using industrial water containing recovered water recovered by the water recovery device as at least one of feedstock materials.

[Claim 2]

The gas turbine cogeneration system according to claim 1, wherein the fuel gas production facility further comprises a water-splitting device configured to produce hydrogen gas by performing a water-splitting treatment on the industrial water.

[Claim 3]

The gas turbine cogeneration system according to claim 2, wherein the fuel gas production facility further comprises:

a carbon dioxide recovery device configured to recover carbon dioxide from the exhaust gas discharged from the water recovery device by using the boiler steam discharged from the heat recovery steam generator;

a methane production device configured to produce methane gas from the hydrogen gas produced by the water-splitting device and the carbon dioxide recovered by the carbon dioxide recovery device; and

a methane fuel gas supply line configured to supply the methane gas to the combustor as the gas turbine fuel gas.

[Claim 4]

The gas turbine cogeneration system according to claim 2 or 3, wherein the fuel gas production facility further comprises a hydrogen fuel gas supply line configured to supply the hydrogen gas produced by the water-splitting device to the combustor as the gas turbine fuel gas.

[Claim 5]

The gas turbine cogeneration system according to any one of claims 2 to 4, wherein the fuel gas production facility further comprises:

a nitrogen gas extraction device configured to extract nitrogen gas from an atmosphere; and

a first ammonia production device configured to produce ammonia from the hydrogen gas produced by the water-splitting device and the nitrogen gas extracted by the nitrogen gas extraction device.

[Claim 6]

The gas turbine cogeneration system according to claim 5, wherein the fuel gas production facility further comprises a first ammonia fuel gas supply line configured to supply ammonia gas discharged from the first ammonia production device to the combustor as the gas turbine fuel gas.

[Claim 7]

The gas turbine cogeneration system according to claim 5, wherein the fuel gas production facility further comprises:

a first hydrogen gas production device configured to produce hydrogen gas from ammonia gas discharged from the first ammonia production device by using the boiler steam discharged from the heat recovery steam generator as a heat source; and

a first hydrogen fuel gas supply line configured to supply the hydrogen gas produced by the first hydrogen gas production device to the combustor as the gas turbine fuel gas.

[Claim 8]

The gas turbine cogeneration system according to any one of claims 2 to 7, further comprising an oxygen gas supply line configured to supply oxygen gas generated in a process of producing the hydrogen gas in the water-splitting device to the combustor.

[Claim 9]

The gas turbine cogeneration system according to claim 1, wherein the fuel gas production facility further comprises:

a nitrogen gas extraction device configured to extract nitrogen gas from an atmosphere; and

a second ammonia production device configured to produce ammonia through electrolytic synthesis from the industrial water and the nitrogen gas extracted by the nitrogen gas extraction device.

[Claim 10]

The gas turbine cogeneration system according to claim 9, further comprising an oxygen gas supply line configured to supply oxygen gas generated in a process of producing the ammonia in the second ammonia production device to the combustor.

[Claim 11]

The gas turbine cogeneration system according to claim 9 or 10, wherein the fuel gas production facility further comprises a second ammonia fuel gas supply line configured to supply ammonia gas discharged from the second ammonia production device to the combustor as the gas turbine fuel gas.

[Claim 12]

The gas turbine cogeneration system according to any one of claims 9 to 11, wherein the fuel gas production facility further comprises:

a second hydrogen gas production device configured to produce hydrogen gas from ammonia gas discharged from the second ammonia production device by using the boiler steam discharged from the heat recovery steam generator as a heat source; and

a second hydrogen fuel gas supply line configured to supply the hydrogen gas produced by the second hydrogen gas production device to the combustor as the gas turbine fuel gas.

[Claim 13]

The gas turbine cogeneration system according to any one of claims 1 to 12,

wherein the fuel gas production facility comprises:

a gas mixing device configured to mix the gas turbine fuel gas and fossil fuel gas to produce mixed fuel gas; and

a mixed fuel gas supply line configured to supply the mixed fuel gas to the combustor.

[Claim 14]

The gas turbine cogeneration system according to any one of claims 1 to 13, further comprising a head end-side steam supply pipe configured to supply the boiler steam discharged from the heat recovery steam generator to a head end side of the combustor.

[Claim 15]

A modification method for a gas turbine cogeneration system comprising a gas turbine comprising a combustor, and a heat recovery steam generator, the modification method comprising:

a water recovery device addition step of adding a water recovery device configured to recover moisture from exhaust gas discharged from the heat recovery steam generator by heat exchange between the exhaust gas and refrigerant water; and

a fuel gas production facility addition step of adding a fuel gas production facility configured to produce gas turbine fuel gas to be supplied to the combustor by using industrial water containing recovered water recovered by the water recovery device as at least one of feedstock materials.

[Claim 16]

An add-on unit for a gas turbine cogeneration system, comprising:

a water recovery device configured to recover moisture from exhaust gas discharged from a heat recovery steam generator by heat exchange between the exhaust gas and refrigerant water; and

a fuel gas production facility configured to produce gas turbine fuel gas to be supplied to a combustor of a gas turbine by using industrial water containing recovered water recovered by the water recovery device as at least one of feedstock materials.