CLAIMS

1. A method for providing a frequency response for a combined cycle power plant (1) connected to an electric grid (21), wherein

the combined cycle power plant (1) comprises a gas turbine engine (2) and a steam turbine engine (3),

the steam turbine engine (3) comprises a boiler (11), a steam turbine (12), a pump (14), a condenser (13), a bypass (15) for the steam turbine (12), a steam admission control valve (12a),

the steam turbine engine (3) operates with the bypass (15) closed or at least partly open to supply steam from the boiler (11) to the condenser (13) bypassing the steam turbine (12), and/or with the steam admission control valve (12a) at least partly open,

the method comprising regulating the output load of the steam turbine engine (3) in response to a frequency change of the electric grid (21):

by regulating the steam admission control valve (12a), and/or

by regulating the steam flow through the bypass (15).

2. The method of claim 1, characterised in that also the gas turbine engine output load is adjusted.

3. The method of claim 2, characterised in that

the boiler (11) is supplied with exhaust gas discharged from the gas turbine engine (2), and

the gas turbine engine output load is adjusted such that the amount of steam generated by the boiler (11) is sufficient to achieve the target load of the steam turbine.

4. The method of claim 1, characterised in that the regulation of the output load of the steam turbine engine (3) includes at least
a transient load variation phase (A)
a stabilisation phase (B)
an normalization phase (C).

5. The method of claim 2 and 4, characterised in that during the transient load variation phase (A) the regulation of the output load of the steam turbine engine (3) is faster than the regulation of the output load of the gas turbine engine (2).

6. The method of claim 2 and 4, characterised in that at the end of the normalization phase (C) the output load of the gas turbine engine (2) and the output load of the steam turbine engine (3) is the same as the output load of the gas turbine engine (2) and the output load of the steam turbine engine (3) before regulation.

7. The method of claim 2, characterised in that the adjustment of the output load of the gas turbine engine (2) includes at least
a transient load variation phase (D)

an stabilisation phase (E)

an normalization phase (F).

8. The method of claim 4 and 7, characterised in that the transient load variation phase (A) for the regulation of the output load of the steam turbine engine (3) is shorter than the transient load variation phase (D) for the adjustment of the output load of the gas turbine engine (2).

9. The method of claim 4 and 7, characterised in that the normalisation phase (C) for the regulation of the output load of the steam turbine engine (3) is shorter than the normalisation phase (F) for the adjustment of the output load of the gas turbine engine (2).

10. The method of claim 2, characterised in that the gas turbine engine output load is adjusted simultaneously or with a time lag with respect to the steam turbine engine output load regulation.

11. The method of claim 1, characterised in that the power output of the combined cycle power plant (1) prior to the frequency disturbance is zero and a frequency increase above the nominal value causes the steam turbine and/or gas turbine to reduce load and yield to an import of active power by the combined cycle power plant (1).

CLAIMS

1. A method for providing a frequency response for a combined cycle power plant (1) connected to an electric grid (21), wherein the combined cycle power plant (1) comprises a gas turbine engine (2) and a steam turbine engine (3),

the steam turbine engine (3) comprises a boiler (11), a steam turbine (12), a pump (14), a condenser (13), a bypass (15) for the steam turbine (12), a steam admission control valve (12a),

the steam turbine engine (3) operates with the bypass (15) closed or at least partly open to supply steam from the boiler (11) to the condenser (13) bypassing the steam turbine (12), and/or with the steam admission control valve (12a) at least partly open,

the method comprising regulating the output load of the steam turbine engine (3) in response to a frequency change of the electric grid (21) by increasing steam flow through the bypass when the frequency of the electric grid increases:

by regulating the steam admission control valve (12a), and/or

by regulating the steam flow through the bypass (15).

2. The method of claim 1, wherein further regulation of the output load of the steam turbine engine (3) in response to a frequency change of the electric grid (21) is carried out by decreasing steam flow through the bypass when the frequency of the electric grid decreases.

3. The method of claim 1, characterised in that also the gas turbine engine output load is adjusted.

4. The method of claim 3, characterised in that the boiler (11) is supplied with exhaust gas discharged from the gas turbine engine (2), and the gas turbine engine output load is adjusted such that the amount of steam generated by the boiler (11) is sufficient to achieve the target load of the steam turbine.

5. The method of claim 1, characterised in that the regulation of the output load of the

steam turbine engine (3) includes at least:

a transient load variation phase (A);

a stabilisation phase (B); and

an normalization phase (C).

6. The method of claim 3 and 5, characterised in that during the transient load variation phase (A) the regulation of the output load of the steam turbine engine (3) is faster than the regulation of the output load of the gas turbine engine (2).

7. The method of claim 3 and 5, characterised in that at the end of the normalization phase (C) the output load of the gas turbine engine (2) and the output load of the steam turbine engine (3) is the same as the output load of the gas turbine engine (2) and the output load of the steam turbine engine (3) before regulation.

8. The method of claim 3, characterised in that the adjustment of the output load of the gas turbine engine (2) includes at least:

a transient load variation phase (D);

an stabilisation phase (E); and

an normalization phase (F).

9. The method of claim 5 and 8, characterised in that the transient load variation phase (A) for the regulation of the output load of the steam turbine engine (3) is shorter than the transient load variation phase (D) for the adjustment of the output load of the gas turbine engine (2).

10. The method of claim 5 and 8, characterised in that the normalisation phase (C) for the regulation of the output load of the steam turbine engine (3) is shorter than the normalisation phase (F) for the adjustment of the output load of the gas turbine engine (2).

11. The method of claim 3, characterised in that the gas turbine engine output load is adjusted simultaneously or with a time lag with respect to the steam turbine engine

output load regulation.

12. The method of claim 1, characterised in that the power output of the combined cycle power plant (1) prior to the frequency disturbance is zero and a frequency increase above the nominal value causes the steam turbine, or both the steam turbine and the gas turbine engine to reduce load and yield to an import of active power by the combined cycle power plant (1).

13. The method of claim 12, characterised in that a frequency increase above the nominal value additionally causes the gas turbine to reduce load and yield to an import of active power by the combined cycle power plant (1).