CLAIMS

1. Thermal energy storage system comprising an energy storage (2) having a vertical temperature gradient and an internal combined heating and cooling machine (15),
said internal combined heating and cooling machine (15) being adapted for retrieving energy having a first temperature from the energy storage, while simultaneously returning heated energy having a second higher temperature and cooled energy having a third lower temperature.

2. Thermal energy storage system according to claim 1, wherein said internal combined heating and cooling machine (15) comprises at least two heat pumps.

3. Thermal energy storage system according to claim 2, wherein each heat pump comprises at least two compressors.

4. Thermal energy storage system according to claim 3, wherein said internal combined heating and cooling machine (15) is adapted for alternating the connection between said at least two compressors between series connection and parallel connection.

5. Thermal energy storage system according to any previous claim, further comprising a pressurized electrical steam boiler arranged within said energy storage system such that surplus electricity in an electrical grid can be transformed into thermal energy as steam which can be directly injected into the thermal energy storage (2).

6. Thermal energy storage system according to any previous claim, further comprising at least one immersion heater arranged within said energy storage (2).

7. Thermal energy storage system according to any of the previous claims, further comprising at least one heat-absorbing system (3, 4).

8. Thermal energy storage system according to claim 7, wherein at least one of said heat-absorbing system (3) is a low temperature system.

9. Thermal energy storage system according to claim 7 or 8, wherein at least one of said heat-absorbing system (4) is a high temperature system.

10. Thermal energy storage system according to any of the previous claims, further comprising a heat-emitting system (7).

11. Thermal energy storage system according to claim 10, wherein said heat-emitting system (7) comprises a combined heat and power plant.

12. Thermal energy storage system according to claim 10 or 11, wherein said heat-emitting system (7) comprises an electrical hot water boiler and/or an electrical steam boiler.

13. Method for using a thermal energy storage system according to any of claims 1-12, comprising the steps of:
retrieving energy from a first level of temperature from the energy storage (2),
returning heated energy having a second, higher temperature to a corresponding level of said energy storage (2) or to a heat-emitting system (7), and
returning cooled energy having a third, lower temperature to a corresponding level of said energy storage (2) or to a heat-absorbing system (3, 4).

CLAIMS

1. Thermal energy storage system comprising an energy storage (2) having a vertical temperature gradient and an internal combined heating and cooling machine (15),
said internal combined heating and cooling machine (15) being adapted for retrieving fluid having a first temperature from the energy storage, while simultaneously returning heated fluid having a second higher temperature and cooled fluid having a third lower temperature, wherein said internal combined heating and cooling machine (15) comprises at least two heat pumps, wherein each heat pump comprises at least two compressors, and wherein said internal combined heating and cooling machine (15) is adapted for alternating the connection between said at least two compressors between series connection and parallel connection.

2. Thermal energy storage system according to claim 1, further comprising a pressurized electrical steam boiler arranged within said energy storage system such that surplus electricity in an electrical grid can be transformed into thermal energy as steam which can be directly injected into the thermal energy storage (2).

3. Thermal energy storage system according to any previous claim, further comprising at least one immersion heater arranged within said energy storage (2).

4. Thermal energy storage system according to any of the previous claims, further comprising at least one heat-absorbing system (3, 4).

5. Thermal energy storage system according to claim 4, wherein at least one of said heat-absorbing system (3) is a low temperature system.

6. Thermal energy storage system according to claim 4 or 5, wherein at least one of said heat-absorbing system (4) is a high temperature system.

7. Thermal energy storage system according to any of the previous claims, further comprising a heat-emitting system (7).

8. Thermal energy storage system according to claim 7, wherein said heat-emitting system (7) comprises a combined heat and power plant.

9. Thermal energy storage system according to claim 7 or 8, wherein said heat-emitting system (7) comprises an electrical hot water boiler and/or an electrical steam boiler.

10. Method for using a thermal energy storage system according to any of claims 1-9, comprising the steps of:
retrieving fluid from a first level of temperature from the energy storage (2),
returning heated fluid having a second, higher temperature to a corresponding level of said energy storage (2) or to a heat-emitting system (7), and
returning cooled fluid having a third, lower temperature to a corresponding level of said energy storage (2) or to a heat-absorbing system (3, 4).