CLAIMS

1. A cooling plant system, the system comprising,

one or more cooling towers;

one or more thermal energy storage systems coupled to the one or more cooling towers;

one or more electrical energy storage systems, the one or more electrical energy storage systems being coupled to the one or more thermal energy storage systems for selectively providing electrical energy to the one or more thermal energy storage systems; and

an energy storage and scheduling control system coupled to the one or more thermal energy storage systems and the one or more electrical energy storage systems, the energy storage and scheduling control system being configured to control operations of the one or more thermal energy storage systems and the one or more electrical energy storage systems via a scheduling of the operations per time slot, the operations including the selective provision of electrical energy to the one or more thermal energy storage systems;

wherein the energy storage and scheduling control system comprises

a modelling module to obtain component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems;

a scheduling module that is configured to receive the component models and to optimise the scheduling of the operations per time slot based on the component models and data obtained from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems; and

further wherein the energy storage and scheduling control system is configured to optimise the scheduling based on the component models in a stepwise manner that includes a scheduling of the operations of the one or more thermal energy storage systems in one step that is separate from another scheduling of the operations of the one or more electrical energy storage systems in another step.

~~2. The cooling plant system of claim 1, wherein the energy storage and scheduling control system comprises a scheduling module that is configured to receive component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems, and further configured to optimise the scheduling of the operations per time slot based on the component models and data obtained from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems.~~

~~3. The cooling plant system of claim 2, wherein the energy storage and scheduling control system further comprises a modelling module to obtain the component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems.~~

24. The cooling plant system of claims 12 or 3, wherein the energy storage and scheduling control system is configured to optimise the scheduling based on subjecting the component models to cost constraints and minimising a total net cost based on the component models.

~~5. The cooling plant system of any one of claims 2 to 4, wherein the energy storage and scheduling control system is configured to optimise the scheduling based on the component models in a stepwise manner.~~

36. The cooling plant system of ~~any one of~~ claims 1 or 2~~1 to 5~~, wherein the one or more electrical energy storage systems is capable of providing frequency regulation to a power grid, based on the scheduling of the operations per time slot provided by the energy storage and scheduling control system.

47. The cooling plant system of any one of claims 1 to 3~~1 to 6~~, wherein the one or more electrical energy storage systems is capable of providing a contingency reserve service to a power grid to compliment the one or more thermal energy storage systems in case of a contingency, the provision of the contingency reserve service being based on the scheduling of the operations per time slot provided by the energy storage and scheduling control system.

58. A method of operating a cooling plant system, the method comprising,

providing one or more cooling towers;

coupling one or more thermal energy storage systems to the one or more cooling towers;

coupling one or more electrical energy storage systems to the one or more thermal energy storage systems;

selectively providing electrical energy to the one or more thermal energy storage systems using the one or more electrical energy storage systems;

coupling an energy storage and scheduling control system to the one or more thermal energy storage systems and the one or more electrical energy storage systems; ~~and~~

controlling operations of the one or more thermal energy storage systems and the one or more electrical energy storage systems using a scheduling of the operations per

time slot, the operations including the step of selectively providing electrical energy to the one or more thermal energy storage systems;

wherein the step of controlling operations of the one or more thermal energy storage systems and the one or more electrical energy storage systems further comprises:

using a modelling module of an energy storage and scheduling control system to obtain component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems;

receiving, using a scheduling module of the energy storage and scheduling control system, the component models;

obtaining data from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems;

optimising the scheduling of the operations per time slot based on the component models and the data obtained from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems; wherein

the step of optimising the scheduling based on the component models is performed in a stepwise manner including scheduling the operations of the one or more thermal energy storage systems in one step that is separate from another scheduling of the operations of the one or more electrical energy storage systems in another step.

~~9. The method of claim 8, further comprising receiving, using a scheduling module of the energy storage and scheduling control system, component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems;~~

~~obtaining data from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems; and~~

~~optimising the scheduling of the operations per time slot based on the component models and the data obtained from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems.~~

~~10. The method of claim 9, further comprising using a modelling module of the energy storage and scheduling control system to obtain the component models based on~~

~~the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems.~~

~~6~~11. The method of claim~~s~~ ~~5~~9 ~~or 10~~, further comprising optimising the scheduling based on subjecting the component models to cost constraints and minimising a total net cost based on the component models at the energy storage and scheduling control system.

~~12. The method of any one of claims 9 to 11, further comprising optimising the scheduling based on the component models in a stepwise manner at the energy storage and scheduling control system.~~

~~7~~13. The method of ~~any one of~~ claims ~~5 or 6~~8 ~~to 12~~, further comprising providing frequency regulation to a power grid using the one or more electrical energy storage systems, based on the scheduling of the operations per time slot provided by the energy storage and scheduling control system to the one or more electrical energy storage systems.

8~~14~~. The method of any one of claims 5 to 7~~8 to 13~~, further comprising providing a contingency reserve service to a power grid using the one or more electrical energy storage systems to compliment the one or more thermal energy storage systems in case of a contingency, the provision of the contingency reserve service being based on the scheduling of the operations per time slot provided by the energy storage and scheduling control system to the one or more electrical energy storage systems.

9~~15~~. An energy storage and scheduling control system, the energy storage and scheduling control system,

being capable of coupling to one or more cooling towers, to one or more thermal energy storage systems and to one or more electrical energy storage systems;

the energy storage and scheduling control system being configured to control operations of the one or more thermal energy storage systems and the one or more electrical energy storage systems via a scheduling of the operations per time slot, the operations including selective provision of electrical energy to the one or more thermal energy storage systems;

wherein the energy storage and scheduling control system comprises a modelling module being capable of obtaining component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems;

a scheduling module being capable of receiving the component models and further being capable of optimising the scheduling of the operations per time slot based on the component models and data obtained from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems; and

wherein the scheduling module is further capable of optimising the scheduling based on the component models in a stepwise manner that includes a scheduling of the operations of the one or more thermal energy storage systems in one step that is separate from another scheduling of the operations of the one or more electrical energy storage systems in another step.

~~16. The energy storage and scheduling control system of claim 15, wherein the energy storage and scheduling control system comprises a scheduling module being~~

~~capable of receiving component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems, and further being capable of optimising the scheduling of the operations per time slot based on the component models and data obtained from the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems.~~

~~17. The energy storage and scheduling control system of claim 16, wherein the energy storage and scheduling control system further comprises a modelling module being capable of obtaining the component models based on the one or more cooling towers, the one or more thermal energy storage systems and the one or more electrical energy storage systems.~~

1018. The energy storage and scheduling control system of claims 916 or 17, wherein the scheduling module is further being capable of optimising the scheduling based on subjecting the component models to cost constraints and minimising a total net cost based on the component models.

~~19. The energy storage and scheduling control system of any one of claims 16 to 18, wherein the scheduling module is further being capable of optimising the scheduling based on the component models in a stepwise manner.~~

1120. The energy storage and scheduling control system of ~~any one of~~ claims 9 or 10~~15 to 19~~, wherein the energy storage and scheduling control system is capable of controlling the one or more electrical energy storage systems to provide frequency regulation to a power grid, based on the scheduling of the operations per time slot provided by the energy storage and scheduling control system.

1221. The energy storage and scheduling control system of any one of claims 9 to 11~~15 to 20~~, wherein the energy storage and scheduling control system is capable of controlling the one or more electrical energy storage systems to provide a contingency reserve service to a power grid to compliment the one or more thermal energy storage systems in case of a contingency, the provision of the contingency reserve service being based on the scheduling of the operations per time slot provided by the energy storage and scheduling control system.