

WHAT IS CLAIMED IS:

1. A method of controlling a direct evaporative cooling unit, comprising:
predicting water consumption and energy consumption of the direct evaporative cooling unit based on a supply air temperature of the direct evaporative cooling unit;
selecting a target for the supply air temperature based on an optimization of an objective function, the objective function comprising the water consumption and the energy consumption; and
controlling an amount of airflow over evaporation media of the direct evaporative cooling unit based on the target for the supply air temperature.
2. The method of Claim 1, wherein the water consumption comprises at least one of water that evaporates during operation of the direct evaporative cooling unit or water drained from a water tank of the direct evaporative cooling unit.
3. The method of Claim 1, wherein predicting the water consumption is based on the amount of airflow over an evaporation medium of the direct evaporative cooling unit and an expected change in humidity of the airflow across the evaporation medium.
4. The method of Claim 1, wherein the energy consumption comprises energy consumption of a fan of the direct evaporative cooling unit.
5. The method of Claim 1, wherein the supply air temperature of the direct evaporative cooling unit is associated with bypass damper positions as a function of outside air temperature, and wherein predicting the energy consumption is based on the bypass damper positions.
6. The method of Claim 1, wherein controlling the direct evaporative cooling unit comprises controlling a bypass damper to a position determined based on the target for the supply air temperature and an outdoor air temperature.

7. The method of Claim 1, wherein predicting the water consumption and the energy consumption of the direct evaporative cooling unit based on the supply air temperature of the direct evaporative cooling unit comprises utilizing a plurality of curves representing relationships between pressure differential and flow rate for a plurality of bypass damper positions.
8. A method of controlling a group of direct evaporative cooling units serving a data center, comprising:
 - selecting a target supply air temperature for the group of direct evaporative cooling units based on predicted water and energy consumption of the group of direct evaporative cooling units;
 - distributing the predicted water and energy consumption among the group of direct evaporative cooling units by selecting one or more of the group of direct evaporative cooling units to provide evaporative cooling based on the target supply air temperature; and
 - controlling an amount of airflow over evaporation media of the direct evaporative cooling units selected to provide evaporative cooling based on the target supply air temperature.
9. The method of Claim 8, wherein selecting the target supply air temperature comprises predicting the predicted water and energy consumption for a plurality of possible supply air temperatures.
10. The method of Claim 8, wherein the water consumption comprises an amount of water that evaporates during operation of the group of direct evaporative cooling units.
11. The method of Claim 8, comprising predicting the predicted water consumption based on the amount of airflow over the evaporation media of the group of direct evaporative cooling units and an expected change in humidity of the airflow across the evaporation media.
12. The method of Claim 8, comprising predicting the predicted energy consumption by finding a fan speed based on a pressure differential and volumetric flow rate associated with the target supply air temperature.

13. The method of Claim 8, wherein distributing the predicted water and energy consumption among the group of direct evaporative cooling units comprises determining different control action for different units of the one or more of the group of direct evaporative cooling units selected to provide evaporative cooling, and controlling an amount of air flow over the evaporation media of the direct evaporative cooling units comprises causing the different units to operate in accordance with the different control actions.

14. The method of Claim 8, comprising predicting the water and energy consumption of the group of direct evaporative cooling units based on possible supply air temperatures by utilizing a plurality of curves representing relationships between pressure differential and flow rate for a plurality of bypass damper positions.

15. A direct evaporative cooling system comprising a controller programmed to:
predict water consumption and energy consumption of the direct evaporative cooling system based on a selected supply air temperature;
find a target supply air temperature by adjusting the selected supply air temperature such that a value of an objective function improves, the objective function comprising the predicted water and energy consumption of the direct evaporative cooling system; and
control an amount of air flow over evaporation media of the direct evaporative cooling system based on the target supply air temperature.

16. The direct evaporative cooling system of Claim 15, wherein the water consumption comprises an amount of water that evaporates during operation of the direct evaporative cooling system.

17. The direct evaporative cooling system of Claim 15, wherein the controller is programed to predict the water consumption based on an amount of airflow over an evaporation medium of the direct evaporative cooling system and an expected change in humidity of the airflow across the evaporation medium.

18. The direct evaporative cooling system of Claim 15, wherein the controller is programed to predict the water consumption and the energy consumption utilizing a plurality of curves representing relationships between pressure differential and flow rate for a plurality of bypass damper positions.

19. The direct evaporative cooling system of Claim 15, wherein:
the direct evaporative cooling unit comprises a bypass damper; and
the controller is configured to control the direct evaporative cooling system in accordance with the target supply air temperature by causing a change in position of the bypass damper.

20. The direct evaporative cooling system of Claim 15, wherein the controller is programmed to predict the energy consumption by finding a fan speed based on a pressure differential and volumetric flow rate associated with the selected supply air temperature.