[005] Many mitigation strategies have been developed to address Low Delta T Syndrome, such as through the use of sophisticated sequencing programs and equipment ON/OFF selection algorithms, but none have proven to completely resolve this phenomenon. In most instances, the chilled water plant operator simply pumps more water to system air handlers to increase their output, but this has the compounding effect of further reducing the already low Delta T. Also, increased pumping in the secondary loop results in higher than necessary pumping energy usage.

[006] From the discussion that follows, it will become apparent that the present invention addresses the deficiencies associated with the prior art while providing numerous additional advantages and benefits not contemplated or possible with prior art constructions.

SUMMARY OF THE INVENTION

[007] Demand Flow provides a method and apparatus for highly efficient operation of chilled water plants. In fact, when compared to traditional operational schemes, Demand Flow provides substantial energy savings while meeting cooling output requirements. In general, Demand Flow controls pumping of chilled water, condenser water, or both according to a constant Delta T line. This reduces energy utilization, reduces or eliminates Low Delta T Syndrome, while allowing a chilled water plant to meet cooling demand. In one or more embodiments, the constant Delta T line may be reset to another Delta T line to meet changing cooling demands while remaining energy efficient.

[008] Low Delta T Syndrome has and continues to plague chilled water plants causing excess energy usage and artificial capacity reductions. This prevents chilled water plants from meeting cooling demands, even at partial load. Demand Flow and its operational strategy address these issues and provide additional benefits as will be described herein.

[008a] In accordance with one aspect, there is provided a method for efficient operation of a chilled water plant comprising: setting a chilled water Delta T comprising a chilled water entering temperature and a chilled water leaving temperature at one or more components of the chilled water plant; controlling chilled water flow rate through the one or more components to maintain the chilled water Delta T across the one or more components, wherein the chilled water flow rate is controlled by one or more chilled water pumps; and performing a critical zone reset to adjust the chilled water Delta T when one or more triggering events occur, wherein the chilled water Delta T is reset by an action selected from the group consisting of adjusting the chilled water entering temperature and adjusting the chilled water leaving temperature; wherein the control of chilled water flow rate through the one or more components to maintain the chilled water Delta T reduces Low Delta T Syndrome at the chilled water plant.

[008b] In accordance with another aspect, there is provided a method for operating one or more pumps of a chilled water plant comprising: pumping water at a first flow rate through a chiller with a first pump; adjusting the first flow rate to maintain a first Delta T across the chiller, wherein the first Delta T comprises a chiller entering temperature and a chiller leaving temperature which provides refrigerant superheat at an evaporator of the chiller regardless of chilled water plant, load conditions; pumping the water at a second flow rate through an air handler unit with a second pump; adjusting the second flow rate to maintain a second Delta T across the air handler unit, wherein the second Delta T comprises an air handler unit entering temperature and an air handler unit leaving temperature which provides desired cooling output at the air handler unit regardless of the chilled water plant load conditions; wherein the first Delta T and the second Delta T are similar to balance the first flow rate and the second flow rate and reduce bypass mixing at a bypass of the chilled water plant.

[008c] In accordance with another aspect, there is provided a controller for controlling one or more pumps of a chilled water plant comprising: an input configured to receive sensor information from one or more sensors; a processor configured to control a flow rate provided by the one or more pumps to maintain a Delta T across a component of the chilled water plant, wherein the processor increases or decreases the flow rate to maintain the Delta T based on the sensor information and generates one or more signals to control the flow rate provided by the one or more pumps, the Delta T comprising an entering temperature and a leaving temperature; an output configured to send the one or more signals to the one or more pumps.

[009] In one embodiment, Demand Flow provides a method for efficient operation of a chilled water plant. The method may comprise setting a chilled water Delta T, and controlling chilled water flow rate through the one or more components to maintain the chilled water Delta T across one or more chilled water plant components. The chilled water Delta T includes a chilled water entering temperature and a chilled water leaving temperature at the chilled water plant components. In one or more embodiments, the chilled water Delta T may be maintained by increasing the chilled water flow rate to reduce the chilled water Delta T and decreasing the chilled water flow rate to increase the chilled water Delta T. Typically, the chilled water flow rate will be controlled through one or more chilled water pumps.