WHAT IS CLAIMED IS:

1. A heat transfer system for sourcing a variable load, comprising:

a heat exchanger that defines a first fluid path and a second fluid path;

a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger;

a variable flow controlling mechanical device for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger;

sensors for detecting variables, the sensors comprising first at least one sensor for sensing at least one variable indicative of the first circulation medium and second at least one sensor for sensing at least one variable indicative of the second circulation medium; and

at least one controller configured to control at least one parameter of the first circulation medium or the second circulation medium by:

detecting the variables using the first at least one sensor and the second at least one sensor, and

controlling flow of one or both of the first variable control pump or the variable flow controlling mechanical device using a feed forward control loop based on the detected variables of the first circulation medium and the second circulation medium to achieve control of the at least one parameter,

wherein the at least one parameter controlled by the at least one controller maintains a specified fixed ratio of flow of the first fluid path to flow of the second fluid path.

2. The heat transfer system as claimed in claim 1, wherein the feed forward control loop is based on a mathematical model between the at least one parameter to be controlled and the detected variables.

3. The heat transfer system as claimed in claim 2, further comprising a memory for storing, for use in the mathematical model by the at least one controller, for at least one or both of the first circulation medium or the second circulation medium:

specific heat capacity as a function of pressure and temperature; and

fluid density.

4. The heat transfer system as claimed in claim 2, wherein the at least one controller is configured to determine a heat transfer coefficient (U) of the heat exchanger, wherein the heat transfer coefficient (U) is used for the mathematical model.

5. The heat transfer system as claimed in claim 4, wherein the determining the heat transfer coefficient (U) of the heat exchanger is determined based on real-time operation by the sensors when sourcing the variable load.

6. The heat transfer system as claimed in claim 5, wherein the determining the heat transfer coefficient (U) of the heat exchanger comprises predicting the heat transfer coefficient (U) based on previous detected variables of the sensors during the real-time operation when sourcing the variable load.

7. The heat transfer system as claimed in claim 5, wherein the determining the heat transfer coefficient (U) of the heat exchanger comprises calculating the heat transfer coefficient (U) based on currently detected variables of the sensors during the real-time operation when sourcing the variable load.

8. The heat transfer system as claimed in claim 4, wherein the determining the heat transfer coefficient (U) of the heat exchanger is determined based on testing prior to installation and/or shipping of the heat exchanger.

9. The heat transfer system as claimed in claim 1, wherein the at least one parameter that is controlled is a different parameter than the detected variables for the feed forward control loop.

10. The heat transfer system as claimed in claim 1, wherein:

the first fluid path is between the heat exchanger and the variable load,

the first variable control pump is between the heat exchanger and the variable load,

the second fluid path is between a temperature source and the heat exchanger, and

the variable flow controlling mechanical device is between the temperature source and the heat exchanger.

11. The heat transfer system as claimed in claim 10, wherein at least the variable flow controlling mechanical device that is between the temperature source and the heat exchanger is controlled by the at least one controller to achieve the control of the at least one parameter.

12. The heat transfer system as claimed in claim 10, wherein the temperature source comprises a boiler, a chiller, a district source, a waste temperature source, or a geothermal source.

13. The heat transfer system as claimed in claim 10, wherein the temperature source comprises a pump that is controlled independently from the at least one controller, wherein the variable flow controlling mechanical device is a second variable control pump.

14. The heat transfer system as claimed in claim 10, wherein the at least one parameter controlled by the at least one controller is output temperature from the heat exchanger to the temperature source.

15. The heat transfer system as claimed in claim 14~~13~~, wherein the temperature source comprises a geothermal source.

16. The heat transfer system as claimed in claim 10, wherein the at least one parameter controlled by the at least one controller maximizes temperature differential across the heat exchanger to the temperature source.

17. The heat transfer system as claimed in claim 16, wherein, when the at least one controller maximizes temperature differential across the heat exchanger to the temperature source, temperature differential is controlled to be constant across the heat exchanger to the variable load and temperature differential is controlled to be constant across the heat exchanger between input temperature from the temperature source and input temperature from the variable load.

18. The heat transfer system as claimed in claim 16, wherein, when the at least one controller maximizes temperature differential across the heat exchanger to the temperature source, temperature differential is controlled to be variable across the heat exchanger to the variable load and temperature differential is controlled to be variable across the heat exchanger between input temperature from the temperature source and input temperature from the variable load.

19. The heat transfer system as claimed in claim 16, wherein the temperature source comprises a cooling tower.

20. The heat transfer system as claimed in claim 19, further comprising a chiller in parallel to the heat exchanger for sourcing the variable load from the cooling tower.

21. The heat transfer system as claimed in claim 19, further comprising a chiller in series between the heat exchanger and the variable load.

22. The heat transfer system as claimed in claim 16, wherein the temperature source comprises a boiler, a chiller, a district source, or a waste temperature source.

23. The heat transfer system as claimed in claim 1, wherein the at least one parameter controlled by the at least one controller is output temperature from the heat exchanger to the variable load.

24. The heat transfer system as claimed in claim 23, further comprising a hot water heater in series between the heat exchanger and the variable load.

25. The heat transfer system as claimed in claim 1, wherein the at least one parameter is controlled by the at least one controller to be a specified value.

26. The heat transfer system as claimed in claim 1, wherein the at least one parameter is controlled by the at least one controller to be optimized or maximized.

27. The heat transfer system as claimed in claim 1, further comprising a heat transfer module that includes the heat exchanger and at least one further heat exchanger in parallel

with the heat exchanger and each other, wherein the first fluid path and the second fluid path are further defined by the at least one further heat exchanger.

28. The heat transfer system as claimed in claim 27, wherein the sensors comprise:

a first pressure sensor configured to detect pressure measurement of input to the first fluid path of the heat transfer module;

a second pressure sensor configured to detect pressure measurement of input to the second fluid path of the heat transfer module;

a first pressure differential sensor across the input to output of the first fluid path of the heat transfer module;

a second pressure differential sensor across the input to output of the second fluid path of the heat transfer module;

a first temperature sensor configured to detect temperature measurement of the input of the first fluid path of the heat transfer module;

a second temperature sensor configured to detect temperature measurement of the output of the first fluid path of the heat transfer module;

a third temperature sensor configured to detect temperature measurement of the input of the second fluid path of the heat transfer module;

a fourth temperature sensor configured to detect temperature measurement of the output of the second fluid path of the heat transfer module; and

a respective temperature sensor to detect temperature measurement of output of each fluid path of each heat exchanger of the heat transfer module.

29. The heat transfer system as claimed in claim 1, wherein the sensors comprise:

a first flow sensor configured to detect flow measurement of the first fluid path of the

heat exchanger; and

a second flow sensor configured to detect flow measurement of the second fluid path of the heat exchanger.

30. The heat transfer system as claimed in claim 1, wherein the sensors comprise at least one pressure sensor, configured to detect pressure measurement at the heat exchanger.

31. The heat transfer system as claimed in claim 1, wherein the first at least one sensor comprises first at least one temperature sensor and the second at least one sensor comprises second at least one temperature sensor.

32. The heat transfer system as claimed in claim 31, wherein the sensors include a flow sensor to detect flow measurement of the first fluid path or the second fluid path of the heat exchanger that has the at least one parameter that is being controlled.

33. The heat transfer system as claimed in claim 1, wherein the sensors include a flow sensor to detect flow measurement of the first fluid path or the second fluid path of the heat exchanger that has the at least one parameter that is being controlled.

34. The heat transfer system as claimed in claim 1, wherein the heat exchanger is a plate type counter current heat exchanger that includes a plurality of brazed plates for causing turbulence when facilitating heat transfer between the first fluid path and the second fluid path.

35. The heat transfer system as claimed in claim 1, wherein the heat exchanger is a shell and tube heat exchange or a gasketed plate heat exchanger.

36. The heat transfer system as claimed in claim 1, wherein the variable flow controlling mechanical device is a second variable control pump.

37. The heat transfer system as claimed in claim 36, further comprising at least one processor configured for facilitating selection of one or both of the first variable control pump or the second variable control pump from a plurality of variable control pumps for installation

to source the variable load, the at least one processor configured for:

generating, for display on a display screen a graphical user interface;

receiving, through the graphical user interface, a design setpoint of the variable load;

determining that an additional capacity of the rated total value of the first parameter or the second parameter is required to account for changes in system resistance to the variable load caused by a heat exchanger; and

displaying one or more of the variable control pumps which minimally satisfies the additional capacity required to source the variable load taking into account the heat exchanger,

wherein the one or more of the variable speed devices is selected as one or both of the first variable control pump or the second variable control pump for the installation.

38. The heat transfer system as claimed in claim 37, wherein the at least one processor is configured for facilitating selection of the heat exchanger from a plurality of heat exchangers for installation to source the variable load, the at least one processor configured for:

displaying one or more of the heat exchangers which satisfy the design setpoint of the variable load at part load operation,

wherein the heat exchange is selected from the one or more of the heat exchangers for the installation to source the variable load.

39. The heat transfer system as claimed in claim 38, wherein the first variable control pump, the second variable control pump and the heat exchange are selected which collectively optimize cost for the part load operation of the variable load over a specified number of years.

40. The heat transfer system as claimed in claim 37, wherein the capacity is power capacity.

41. The heat transfer system as claimed in claim 37, wherein the capacity is heat transfer capacity.

42. The heat transfer system as claimed in claim 1, wherein the variable flow controlling mechanical device is a variable control valve.

43. The heat transfer system as claimed in claim 1, wherein the sensors are integrated with the heat exchanger.

44. The heat transfer system as claimed in claim 1, wherein the at least one controller is integrated with the heat exchanger.

~~45. A heat transfer system, comprising:~~

~~a heat exchanger that defines a first fluid path and a second fluid path;~~

~~a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger;~~

~~a variable flow controlling mechanical device for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger;~~

~~sensors for detecting variables, the sensors comprising first at least one sensor for sensing at least one variable indicative of the first circulation medium and second at least one sensor for sensing at least one variable indicative of the second circulation medium; and~~

~~at least one controller configured to control the first variable control pump in a first type of flow control mode, and switch control of the first variable control pump to a second type of flow control mode that is different than the first type of control mode.~~

~~46. The system as claimed in claim 45, wherein the first type of flow control mode or the second control mode uses a feed forward control loop based on the detected variables of the first circulation medium and the second fluid circulation medium.~~

~~47. The system as claimed in claim 45, wherein the first type of flow control mode or the~~

second control mode uses a feed forward control loop based on the detected variables of the first circulation medium and the second fluid circulation medium.

48. The system as claimed in claim 45, wherein the controller is configured to automatically perform the switch based on the variables detected from the sensors.

49. A heat transfer system for sourcing a variable load, comprising:

a heat exchanger that defines a first fluid path and a second fluid path;

a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger;

at least one pressure sensor or temperature sensor configured to detect measurement at the heat exchanger; and

at least one controller is configured to:

calculate, from measurement of the at least one pressure sensor or temperature sensor during real-time operation when sourcing the variable load, an actual heat transfer coefficient value or heat transfer capacity of the heat exchanger,

repeat said calculating of the actual coefficient value of the heat exchanger at different points in time, and

predict, from the calculating, when the heat exchanger will require maintenance due to fouling of the heat exchanger.

50. The system as claimed in claim 49, wherein the controller is further configured to predict, from measurement of the at least one pressure sensor or temperature sensor during the real-time operation when sourcing the variable load, a time of when the heat exchanger will reach a specified heat transfer capacity or heat transfer coefficient value.

51. The system as claimed in claim 49, wherein the controller is further configured to control the first variable control pump to a first flow amount of the first circulation medium in order to flush the fouling of the heat exchanger, and estimate from history the heat transfer capacity or the heat transfer coefficient value of the heat exchanger after the flushing of the fouling of the heat exchanger.

52. The system as claimed in claim 49, further comprising sensors for detecting variables for use by the controller, the sensors comprising at least one sensor for sensing at least one variable indicative of the first circulation medium.

53. The system as claimed in claim 49, further comprising an output interface for outputting data relating to the predicting.

54. The system as claimed in claim 49, wherein the predicting when the heat exchanger will require maintenance is on previous measurement of the at least one pressure sensor or temperature sensor during the real-time operation when sourcing the variable load.

55. A heat transfer system for sourcing a load, comprising:

a heat exchanger that defines a first fluid path and a second fluid path;

a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger; and

at least one controller configured to:

control the first variable control pump to control the first circulation medium through the heat exchanger in order to source the load,

determine that the heat exchanger requires maintenance due to fouling of the heat exchanger, and

control the first variable control pump to effect a pulsed flow of the first circulation

~~medium in order to flush the fouling of the heat exchanger.~~

~~56. The system as claimed in claim 55, wherein the controlling the first variable control pump to the pulsed flow in order to flush the fouling of the heat exchanger is configured to be performed during real-time sourcing of the load.~~

~~57. The system as claimed in claim 55, further comprising a second variable control pump for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger, wherein the at least one controller is configured to, in response to said determining, control the second variable control pump to effect a second pulsed flow of the second circulation medium in order to flush the fouling of the heat exchanger.~~

~~58. The system as claimed in claim 55, wherein the pulsed flow comprises increasing flow of the first circulation medium from a specified flow level to an increased flow level, reverting the first circulation medium to the specified flow level, and repeating the increasing and the reverting.~~

~~59. The system as claimed in claim 55, wherein the at least one controller is configured to determine that the flushing from the pulsed flow was not successful, and in response control the first variable control pump to a maximum flow setting.~~

~~60. The system as claimed in claim 55, wherein the at least one controller is configured to determine that the flushing from the pulsed flow was successful versus not successful, wherein the successful determination is determined from a variable of the heat exchanger exceeding a threshold, the variable being heat transfer coefficient (U) of the heat exchanger, delta pressure across the heat exchanger, or heat transfer capacity of the heat exchanger.~~

~~61. The system as claimed in claim 55, wherein the determining that the heat exchanger requires maintenance includes predicting based on previous measurement when sourcing the load.~~

~~62.~~45. A method for sourcing a variable load using a heat transfer system, the heat transfer

system including a heat exchanger that defines a first fluid path and a second fluid path, the heat transfer system including: i) a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of heat exchanger, ii) a variable flow controlling mechanical device for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger, and iii) sensors for detecting variables, the sensors comprising first at least one sensor for sensing at least one variable indicative of the first fluid circulation medium and second at least one sensor for sensing at least one variable indicative of the second circulation medium, the method being performed by at least one controller and comprising:

detecting the variables using the first at least one sensor and the second at least one sensor; and

controlling one or both of the first variable control pump or the variable flow controlling mechanical device using a feed forward control loop based on the detected variables of the first circulation medium and the second circulation medium to achieve control of at least one parameter of the first circulation medium or the second circulation medium,

wherein the at least one parameter controlled by the at least one controller maintains a specified fixed ratio of flow of the first fluid path to flow of the second fluid path.

~~63.~~46. A non-transitory computer readable medium having instructions stored thereon executable by at least one controller for performing the method as claimed in claim 454~~562~~.

~~64.~~47. A heat transfer system for sourcing a variable load, comprising:

a heat exchanger that defines a first fluid path and a second fluid path;

a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger;

a variable flow controlling mechanical device for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger;

sensors for detecting variables, the sensors comprising first at least one sensor for sensing at least one variable indicative of the first circulation medium and second at least one sensor for sensing at least one variable indicative of the second circulation medium; and

at least one controller configured to control at least one parameter of the first circulation medium or the second circulation medium by:

detecting the variables using the first at least one sensor and the second at least one sensor,

controlling flow of one or both of the first variable control pump or the variable flow controlling mechanical device using a feed forward control loop based on the detected variables of the first circulation medium and the second circulation medium to achieve control of the at least one parameter; and

at least one processor configured for facilitating selection of one or both of the first variable control pump or the variable flow controlling mechanical device~~second variable control pump~~ from a plurality of ~~variable control pumps~~devices for installation to source the variable load, the at least one processor configured for:

generating, for display on a display screen a graphical user interface;

receiving, through the graphical user interface, a design setpoint of the variable load;

determining that an additional capacity of a~~the~~ rated total value of the at least one parameter of the first circulation medium ~~first parameter~~ or the at least one parameter of the second circulation medium ~~second parameter~~ is required to account for changes in system resistance to the variable load caused by the~~a~~ heat exchanger; and

displaying one or more of the ~~variable control pumps~~devices which minimally satisfies the additional capacity required to source the variable load taking into account the heat exchanger,

wherein the one or more of the ~~variable speed~~ devices is selected as one or both of the

first variable control pump or the variable flow controlling mechanical device~~second variable control pump~~ for the installation.

~~65.~~48. The heat transfer system as claimed in claim 474~~764~~, wherein the at least one processor is configured for facilitating selection of the heat exchanger from a plurality of heat exchangers for installation to source the variable load, the at least one processor configured for:

displaying one or more of the heat exchangers which satisfy the design setpoint of the variable load at part load operation,

wherein the heat exchange is selected from the one or more of the heat exchangers for the installation to source the variable load.

~~66.~~49. The heat transfer system as claimed in claim 484~~865~~, wherein the first variable control pump, the variable flow controlling mechanical device~~second variable control pump~~ and the heat exchange are selected which collectively optimize cost for the part load operation of the variable load over a specified number of years.

~~67.~~50. The heat transfer system as claimed in claim 474~~764~~, wherein the capacity is power capacity.

~~68.~~51. The heat transfer system as claimed in claim 474~~764~~, wherein the capacity is heat transfer capacity.

~~69.~~52. A heat transfer system for sourcing a variable load, comprising:

a heat exchanger that defines a first fluid path and a second fluid path;

a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger;

a variable flow controlling mechanical device for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger;

sensors for detecting variables, the sensors comprising first at least one sensor for sensing at least one variable indicative of the first circulation medium and second at least one sensor for sensing at least one variable indicative of the second circulation medium; and

at least one controller configured to control at least one parameter of the first circulation medium or the second circulation medium by:

detecting the variables using the first at least one sensor and the second at least one sensor, and

controlling flow of one or both of the first variable control pump or the variable flow controlling mechanical device using a feed forward control loop based on the detected variables of the first circulation medium and the second circulation medium to achieve control of the at least one parameter, and

wherein the at least one parameter controlled by the at least one controller is source-side output temperature of the heat exchanger at a fixed setpoint.

~~70.~~53. A heat transfer system for sourcing a variable load, comprising:

a heat exchanger that defines a first fluid path and a second fluid path;

a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger;

a variable flow controlling mechanical device for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger;

sensors for detecting variables, the sensors comprising first at least one sensor for sensing at least one variable indicative of the first circulation medium and second at least one sensor for sensing at least one variable indicative of the second circulation medium; and

at least one controller configured to control at least one parameter of the first circulation medium or the second circulation medium by:

detecting the variables using the first at least one sensor and the second at least one sensor, and

controlling flow of one or both of the first variable control pump or the variable flow controlling mechanical device using a feed forward control loop based on the detected variables of the first circulation medium and the second circulation medium to achieve control of the at least one parameter, and

wherein the at least one parameter controlled by the at least one controller is output temperature from the heat exchanger to the variable load source-side output temperature of the heat exchanger at a fixed setpoint.

~~71.~~54. A heat transfer system for sourcing a variable load, comprising:

a heat exchanger that defines a first fluid path and a second fluid path;

a first variable control pump for providing variable flow of a first circulation medium through the first fluid path of the heat exchanger;

a variable flow controlling mechanical device for providing variable flow of a second circulation medium through the second fluid path of the heat exchanger;

sensors for detecting variables, the sensors comprising first at least one sensor for sensing at least one variable indicative of the first circulation medium and second at least one sensor for sensing at least one variable indicative of the second circulation medium; and

at least one controller configured to control at least one parameter of the first circulation medium or the second circulation medium by:

detecting the variables using the first at least one sensor and the second at least one sensor, and

controlling flow of one or both of the first variable control pump or the variable flow

controlling mechanical device using a feed forward control loop based on the detected variables of the first circulation medium and the second circulation medium to achieve control of the at least one parameter,

wherein the at least one parameter controlled by the at least one controller maximizes temperature differential across the heat exchanger to the temperature source.

~~72.~~55. The heat transfer system as claimed in claim 54~~5~~471~~,~~, wherein temperature differential is constant across the heat exchanger to the variable load and temperature differential is constant across the heat exchanger between input temperature from the temperature source and input temperature from the variable load.

~~73.~~56. The heat transfer system as claimed in claim 54~~5~~471~~,~~, wherein temperature differential is variable across the heat exchanger to the variable load and temperature differential is variable across the heat exchanger between input temperature from the temperature source and input temperature from the variable load.