THERMOELECTRIC RETROFIT UNIT FOR A LIQUID RECIPIENT

Inventors: Andre Boulay, L’Ile-Bizard (CA); Jason M. Gallovich, Valleyfield (CA); Yvon White, Pierrefonds (CA)

Correspondence Address:
OGILVY RENAULT LLP
1, Place Ville Marie, SUITE 2500
MONTREAL, QC H3B 1R1 (CA)

Filed: Mar. 13, 2009

Related U.S. Application Data

Provisional application No. 61/036,107, filed on Mar. 13, 2008.

ABSTRACT

A retrofit unit for heating and cooling liquid stored in a recipient, the retrofit unit comprising: a housing defining a cavity and allowing the retrofit unit to be external to the recipient; a thermoelectric device in the cavity, comprising at least one thermoelectric module having a heat radiation side and a heat absorption side; a control unit in the cavity, for controlling the energy to be applied to the thermoelectric module; and a connecting element on the housing, the connecting element allowing the thermoelectric device one of direct contact and indirect contact with the liquid stored in the recipient to selectively heat and cool the liquid by emitting and absorbing heat, respectively.
THERMOELECTRIC RETROFIT UNIT FOR A LIQUID RECIPIENT
CROSS-REFERENCE TO RELATED APPLICATIONS


TECHNICAL FIELD

[0002] The present patent application relates to the field of heating and cooling a liquid contained in a recipient, such as a water tank, a swimming pool, and others.

BACKGROUND

[0003] Recent studies have shown that residential hot water heating can represent as much as 30% of the overall electrical consumption in an average household. As energy demand and cost continue to grow there is an ever increasing need for more efficient means of heating water.

[0004] Also associated to the ever increasing demand for electrical energy is the problem of higher and longer peak demand periods. Energy providers have begun to create what are called demand side management programs. These programs have been created with the ultimate goal of lowering peak and overall energy consumption. Primarily, energy providers, through incentives, encourage, and in some cases require, their customers to adopt more energy efficient technologies.

[0005] With respect to hot water heaters, there simply aren’t any available technologies that can address both the need for overall and peak demand reduction. The only solutions brought on by the energy providers are control solutions geared towards the reduction of peak electrical demand during these peak periods. A typical control program involves controlling the times at which a customer’s hot water heater has access to electrical energy. This is done in several ways. Either through a dedicated electrical meter which can be remotely controlled by the provider or with the use of a dedicated timer that simply cuts power to the hot water heater during known peak demand periods. Because there is a risk that a customer could run out of hot water, adding hot water capacity is required. Adding an additional tank or replacing the existing tank with a larger sized unit is part of the overall strategy. While this type of program reduces the overall peaks, it inherently will cause a more significant problem upon mass adoption. Under these programs the customer is required to significantly increase the overall hot water capacity, thus increasing his overall electrical energy consumption, and will also increase the standby loss associated with conventional hot water heater tanks.

[0006] Furthermore, in a conventional electric hot water heater tank, there is provided at least one electrical heating element. These heating elements are known to have an operational efficiency that is less than 100%. With electrical resistive heating elements, the resistive or “Joule heat” created is proportional to the square of the current applied (I^2R). This, coupled with the fact that conventional hot water tanks constantly lose heat and thus have a standby loss (average energy consumption used for maintaining set temperature throughout the tank for a 24 hr period) of 89 to 95 watts/hour, results in less than 100% efficiency. Conventional hot water heaters simply cannot operate at greater than 95% efficiency.

[0007] Therefore, there is a need for a system that will overcome some of the drawbacks of the prior art.

SUMMARY

[0008] The system and methods described herein address these needs as well as others by using thermoelectric module technology.

[0009] According to a broad aspect there is provided a retrofit unit for heating and cooling liquid stored in a recipient, the retrofit unit comprising: a housing defining a cavity and allowing the retrofit unit to be external to the recipient; a thermoelectric device in the cavity, comprising at least one thermoelectric module having a heat radiation side and a heat absorption side; a control unit in the cavity, for controlling the energy to be applied to the thermoelectric module; and a connecting element on the housing, the connecting element allowing the thermoelectric device one of direct contact and indirect contact with the liquid stored in the recipient to selectively heat and cool the liquid by emitting and absorbing heat, respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Further features and advantages of the present invention will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

[0011] FIG. 1 is a schematic diagram of a system having a retrofit unit connected to a recipient by a single passage, according to one embodiment;

[0012] FIG. 2 is a side view of a system having a retrofit unit connected to a recipient by a system inlet pipe and a drain pipe, according to one embodiment;

[0013] FIG. 3 is a side view of a system having a retrofit unit being connected to a recipient by inlet and outlet passages, according to one embodiment;

[0014] FIG. 4 is a cross-sectional side view of a retrofit unit of FIG. 1 showing the liquid flowing in the cavity of the housing, according to one embodiment;

[0015] FIG. 5 is a cross-sectional side view of a retrofit unit as shown in FIG. 4 including a heat exchanger pipe system, according to one embodiment;

[0016] FIG. 6 is a schematic illustration of a system having a retrofit unit being conductively connected to the surface of a recipient, according to one embodiment; and

[0017] FIG. 7 is a cross-sectional view of a retrofit unit as shown in FIG. 6, according to one embodiment.

[0018] It will be noted that throughout the appended drawings, like features are identified by like reference numerals.

DETAILED DESCRIPTION

[0019] Reference is now made to FIG. 1, which illustrates a cross-sectional side view of an embodiment of a system 10 for heating or cooling liquid stored within a recipient 11 to which a thermoelectric retrofit unit 70 is connected via a connecting element 91. The thermoelectric retrofit unit 70 comprises a housing 181 defining a cavity to allow the thermoelectric retrofit unit 70 to be external to the housing 181 of the recipient 11. In one embodiment the housing of the retrofit unit 70 can be made of metal such as steel or plastic materials such as
polypropylene, polycarbonate, polyethylene, or any plastic materials which are capable of withstanding high operating temperatures.

In one embodiment, the connecting element 91 is located on the housing 181 and comprises at least one passage for fluidly connecting the retrofit unit 70 to the recipient and allowing the liquid to flow inside a cavity of the thermoelectric retrofit unit 70. The liquid may flow in and out of the retrofit unit 70 via a single passage. In another embodiment, two passages are provided, allowing liquid to flow into the unit 70 via an inlet passage and out of the unit via an outlet passage. In one embodiment, the inlet passage is suitable to be connected to a source such as the city water. In one embodiment, the outlet passage is suitable to be connected to, for example, a drain of the recipient to allow the liquid to exit the retrofit unit 70 and enter the recipient. In another embodiment, the thermoelectric retrofit unit 70 mates, via the connecting element 91, with any type of outlet/inlet found on a conventional hot water heater tank, such as a heating element bracket, a drain valve, or the like.

In one embodiment, liquid from the recipient 11 may circulate inside the thermoelectric retrofit unit 70 and will come into contact with one side of a thermoelectric device 80 to be heated or cooled during this circulation process. Some possibilities for the liquid include water, glycol, oil, and other liquids that need to be maintained at a specific temperature.

The thermoelectric device 80 is inside the thermoelectric retrofit unit 70 to allow the hot or cold side to come into thermal contact with the liquid in a direct or indirect manner, thereby raising or lowering the temperature of the liquid. While FIG. 1 illustrates the thermoelectric device 80 as being positioned on a sidewall of the thermoelectric retrofit unit 70, other alternatives are possible which do not require the thermoelectric device 80 to be in contact with a sidewall or to be placed on the far-side of the unit 70 with respect to the recipient 11.

Reference is now made to FIG. 2, which is a side view of a system 20 having a thermoelectric retrofit unit 70 fluidly connected to a recipient 11. In this embodiment, the recipient 11 is a hot water tank for heating water for residential purposes. A city water inlet 171 allows water to flow into the unit 70 and the drain valve 172 flows the water into the recipient 11. The back side of the unit 70 has a heat sink 174 along part of its length, and fans 175 to maintain the heat sink 174 at ambient or higher temperatures.

In one embodiment, the retrofit unit 70 has the capability of being used in conjunction with at least one of the heating elements 12 found in the recipient. FIG. 3 illustrates a side view of a system 120 having a thermoelectric retrofit unit 70 connected to the surface of a recipient 11. The thermoelectric retrofit unit 70 is electrically connected to the recipient 11 via the wire 152 for the heating element of the recipient. The electrical ground point found near the heating element is also used for the thermoelectric retrofit unit 70.

Also illustrated in the embodiment shown in FIG. 3 are the inlet passage 176 and outlet passage 177, which allow the liquid to circulate in and out of the retrofit unit 70, respectively.

Reference is now made to FIG. 4, which illustrates a cross-sectional side view of another embodiment of a thermoelectric retrofit unit 70. The thermoelectric retrofit unit 70 comprises a cavity 74 which is fluidly connected to the recipient 11 and has a gasket 88 for providing a waterproof seal of the mating connection between the cavity 72 and the recipient 11. The retrofit unit 70 contains a thermoelectric device 80, which comprises at least one thermoelectric module 71.

Thermoelectric modules are solid-state devices (no moving parts) that convert electrical energy into a temperature gradient, known as the "Peltier effect" or convert thermal energy from a temperature gradient into electrical energy, the "Seebeck effect". When the appropriate power is applied, from a battery or other DC source, one side of the module will be made cold while the other is made hot. If the polarity or current flow through the module is reversed, the cold side will become the hot side and vice versa. This allows thermoelectric modules to be used for heating, cooling and temperature stabilization. Since thermoelectric modules are electrical in nature, in a closed-loop system with an appropriate temperature sensor and controller, they can maintain temperatures that vary by less than one degree Celsius.

Larger areas than an individual module can maintain are cooled or have the temperature controlled by using multiple modules like the module 71. For example, individual thermoelectric modules having physical dimensions of 40 mm wide by 40 mm long by 3.5 mm thick can be used. These modules operate at 24 volts DC and are electrically connected in series in order to divide the supplied 336 DC volts into the modules. It is important to note that a variable number of modules that operate at different voltages (e.g. 12 vdc or 17.4 vdc) may be included and/or used. The module will absorb heat on the “cold side” and eject it out the “hot side”.

Thermoelectric modules have advantages over conventional methods of heating liquid, such as those that use electrical resistance heating elements. A thermoelectric module may be used continuously for twenty or more years and the life of a module often exceeds the life of the associated equipment. In addition, Mean Time Between Failures (MTBF’s) in excess of 200,000 hours are not uncommon in such cases and this MTBF value generally is considered to be an industry standard. A thermoelectric module can be used to provide greater than 100% efficiency to the hot water heater given that when used for heating, thermoelectric modules can produce heat energy with over 200% efficiency. The heat created by a thermoelectric module is proportional to the current because the flow of current is working in two directions (the thermoelectric effect). Therefore, the total heat ejected by the thermoelectric module is the sum of the current plus the heat being pumped through the heat absorption side.

For example, the actual heat/attagage being created by the thermoelectric module may be as follows; 12 vdc×5 amps=60 watts of energy consumed+445 heat absorption watts=505 watts of total heat pumped to the heat radiation side of the module while using only 60 watts of electrical energy. This describes a thermoelectric module operating at 175% efficiency when being used for heating. The efficiency at which a thermoelectric module will operate is dependent of many factors. For example, a factor can be the current applied to the thermoelectric module or can be the temperature differential between the both sides of the thermoelectric module. The smaller the temperature differential is, the more heat pumping power the thermoelectric module will generate and thus the more efficient it will be.

In the embodiment illustrated in FIG. 4, the thermoelectric device 80 comprises two heat sinks 76, 77 connected to each side of the thermoelectric module 71. In this embodiment, the two heat sinks 76, 77 and the thermoelectric module 71 form the thermoelectric device 80. One heat sink 76 is
conductively connected to the heat radiation side of the thermoelectric module 71 to function as an element to heat or cool the water contained within the cavity 74 and/or the recipient 11. The heat sink 77 is conductively connected to the heat absorption side of the thermoelectric module 71 to function as a tempering mechanism in order to maintain the temperature of the heat absorbing side at room temperature or above, in order to keep the temperature differential between the heat absorption and heat radiating sides as small as possible. In one embodiment, there is provided a spacer 180 between the thermoelectric module 71 and the heat sink 77.

In one embodiment, a fan 79 mounted to the heat sink 77 that is conductively connected to the heat absorption side of the thermoelectric module 71 is used for assisting in the tempering of the heat sink 77 by blowing air towards the heat sink 77. Alternatively, the fan 79 may also incorporate the use of an inlet duct 81 which is positioned in such a way as to retrieve warmer air from various sources, such as the air generally located closer to the ceiling height of a room, the air within the vicinity of a heat source such as an ac motor found in HVAC systems, outdoor air (if above room temperature), or heat energy escaping from the recipient 11 to which the retrofit unit is mated. The inlet duct 81 may be used as a heat recuperating device by re-circulating heated air that has been heated with wasted energy and using it to temper and heat the heat sink 77 located on the heat absorption side of the thermoelectric module 70 in order to minimize the temperature differential, thus maximizing the thermoelectric module’s efficiency. Alternatively the use of ambient heat energy which is normally wasted and has also been created with technologies such as thermo pumps which can operate at greater than 400% efficiency may serve to increase overall energy efficiency.

In a further embodiment, the thermoelectric retrofit unit 70 may include the use of a circulating pump 84 in order to facilitate and/or accelerate the circulation of water between a recipient and the thermoelectric retrofit unit 70. The circulating pump also serves to provide the capability of heating all of the liquid located throughout the recipient 11 and, more specifically, the water located below the heating elements, in order to increase overall hot water capacity by, for example, five to ten gallons. This may also help to maximize off-peak energy consumption.

The thermoelectric retrofit unit 70 comprises a control unit 75. In one embodiment the control unit 75 can be a Control Processing Unit (CPU), a processor, or the like used to control the current being applied to the thermoelectric module 71. The current level applied is based on several factors, such as the time allotted to heat the water in order to stay out of peak periods. For example, if in a colder climate where energy consumption peaks for longer periods of time due to heating and the allotted time for off peak operation is reduced, then the control unit 75 will operate the thermoelectric module 71 at higher power in order to heat the required volume of liquid in a shorter amount of time.

With respect to predicted water consumption, the control unit 75 may calculate this based on historical consumption data. For example, if the predicted water consumption of the user for the next twenty-four hours is sixty-four gallons, the system will then optimize the output wattage being applied to the thermoelectric module in order to heat sixty-four gallons over the entire twenty-four hour period versus operating at its full power capability for a shorter amount of time. The first scenario represents a much higher degree of efficiency because thermoelectric modules typically will operate more efficiently at less than full capacity.

In another embodiment, the control unit 75 can also take into account ambient temperatures. For example, in a warmer climate, when home owners are away they will typically lower the air conditioning, thus increasing the ambient temperature in the home and allowing the thermoelectric module to operate more efficiently. This is because by increasing the ambient temperature, the home owner is thereby reducing the temperature differential of the heat absorption and radiating sides of the module. The control unit 75 can then operate the thermoelectric module 70 at higher power during this more efficient operating period. It is to be understood that a role of the control unit 75 is to maximize operational efficiency of the system 10 by maximizing system 10 operating time during the most favorable conditions.

In yet another embodiment, the control unit 75 is an intelligent control unit used to control the supply of power to the thermoelectric module 71 and the heating elements 10 on the recipient 11, record and monitor temperature readings, monitor system integrity and normal operation, manage heating or cooling cycles in such a way as to maximize the operating time of the system in off-peak periods, and calculate and store consumption.

In one embodiment the system may also incorporate the use of one or more thermometers 90 connected to the control unit 75, and used to monitor various temperature points, such as both sides of a thermoelectric module 71, liquid temperatures found in the thermoelectric retrofit unit 70 and within the recipient 11, indoor and outdoor air temperatures, and so on.

In one embodiment, the thermoelectric retrofit unit 70 comprises a power supply unit 82 used for providing AC and/or DC power to the thermoelectric retrofit unit 70 and/or the recipient 11. In yet another embodiment there is provided a means for converting the electrical supply of energy to the thermoelectric device from Alternating Current (AC) to Direct Current (DC). This conversion is achieved using standard high power rectifying diodes which basically combine the AC electrical cycle into a DC electrical cycle. Another method that may be used is a high speed switching power supply. Other components such as filtering capacitors may also be used to linearize the output DC current. One embodiment may include a fan 79 mounted to the heat sink 77 that is conductively connected to the heat absorption side of the thermoelectric module 71, the fan 79 assisting in the tempering of the heat sink 77. The fan 79 may also incorporate the use of an inlet duct 81 which is positioned in a manner to retrieve warmer air from various sources such as air generally located closer to the ceiling height of a room, air within the vicinity of a heat source such as an ac motor found in HVAC systems, outdoor air (if above room temperature), and heat energy escaping from the recipient to which the thermoelectric retrofit unit 70 is mated. Retrieval of heated air using the inlet duct 81 is done to further help with the maintaining of the cavity 74 at a temperature equal to or above the temperature of the heat sink 77 in order to further maximize overall system efficiency.

Also provided in one embodiment is a hot and cold water separator 185. The separator 185 provides the functionality of increasing fluid displacement through convection between the cavity 74 and the recipient 11 by creating a thermosiphon. It can be attached to the inner walls of the passage of retrofit unit 70 using various means, such as a
plastic bracket, positioned so as not to disrupt the flow of the liquid. Cold liquid will therefore be directed inside the retrofit unit 70 towards the bottom of the cavity, and the pump 84 will circulate hot liquid back out through the passage and into the recipient 11.

As illustrated in FIGS. 4 and 5, there may be a power supply unit 82 used for providing AC and/or DC power to the thermoelectric retrofit unit 70 and or the hot water heater, as well as a means for converting the electrical supply of energy to the thermoelectric modules 71 from Alternating Current (AC) to Direct Current (DC).

In another embodiment, there is provided a heat recuperation unit 83 between the power supply 82 and the heat sink 77, which may be positioned to recuperate the heat being dissipated by the power supply unit 82 and then used to distribute the heat to the heat sink 77, which is conductively connected to the heat absorption side of the thermoelectric module 71. The heat recuperation unit 83 provides the power supply with a greater overall efficiency since during electrical conversion, energy is lost in the form of heat which is in turn dissipated, thus reducing the overall efficiency of the power supply unit 82. The industry efficiency standard for AC to DC power supplies is approximately 80%. Recuperation of this heat generated by the power supply serves to substantially increase the power supply unit’s efficiency.

In yet another embodiment, a heat sink 77 located on the heat absorption side of the thermoelectric module 71 and the heat recuperation unit 83 found in the power supply unit 82 are positioned in such a way as to maintain conductive contact with each other.

In a further embodiment, there is provided a mechanism for reversing the electrical polarity of the current supplied to the thermoelectric module in order to switch between heating and/or cooling cycles. This is done using a simple dual-pull dual-throw electrical relay. As an example this would be done when during extended periods there is no hot water usage, such as family vacations. The standby loss of energy will be significantly higher if the water in the recipient is kept hot rather than maintaining the water at cooler temperatures. The water is cooled not only to reduce energy consumption but also in order to maintain safe temperatures that are not within bacterial growth ranges. Standby energy consumption is therefore significantly reduced and this provides bacterial growth prevention.

FIG. 5 illustrates an embodiment incorporating a hot/cold plate 85. A hot/cold plate is a plate, made of aluminum or other materials, containing internal tubing 86 through which a liquid is forced to absorb heat transferred to the plate. As illustrated in FIG. 5, hot/cold plate 85 is used as a hot plate and the liquid from the recipient 11 circulates in the tubing 86 of the hot plate. In another embodiment, as illustrated in FIG. 5, a circulation pump 89 is used to circulate the liquid in the hot/cold plate 85. The hot/cold plate 85 transfers the heat/cold energy to the liquid flowing through the piping 86 embedded therein. The liquid is heated or cooled by the plate 85 which is conductively connected to the thermoelectric module 71. The liquid then flows back into the recipient 11 via the piping 86.

In yet another embodiment, the heat sink 77 of FIG. 5 may be substituted by another hot/cold plate with piping embedded therein. This hot/cold plate may comprise a liquid coolant that flows in a closed circuit, and which is circulated by a circulating pump. The hot/cold plate would function similarly to the heat sink 77 to act as a tempering mechanism in order to maintain the temperature of the heat absorbing side at room temperature or above, in order to keep the temperature differential between the heat absorption and heat radiating sides as small as possible. The liquid coolant circulates between the hot/cold plate system and a radiator, provided inside the retrofit unit 70 or external thereto, in a closed circuit. The radiator may have a fan attached thereto.

Reference is now made to FIG. 6, which illustrates an embodiment of a system 10 for heating or cooling liquid stored within a recipient 11 to which a thermoelectric retrofit unit 50 is affixed. In one embodiment, the recipient 11 can have an opened or closed housing like conventional water tanks. In this embodiment, the thermoelectric retrofit unit 50 provides heating or cooling of stored liquid by maintaining conductive surface contact with the recipient 11.

In FIG. 6, the hot side of the thermoelectric device 60 is provided on the side of the housing 181 in contact with a surface of the recipient 11 and heat is used to raise the temperature of the liquid inside the recipient 11 via the thermal contact between the thermoelectric device 60 and the liquid in the recipient 11 when the two surfaces are in contact with each other. By reversing the polarity or current flow through the thermoelectric device 60, the liquid inside the recipient 11 may be cooled instead of heated. In one embodiment, the contact surface 13 of the thermoelectric retrofit unit 50 can be made of a material that allows an efficient transfer of heat from the thermoelectric retrofit unit 50 to the recipient 11. In some embodiments, a connecting element (not shown) such as straps, thermally conductive adhesives, thermally conductive epoxy compounds and/or the like can be used to apply a pressure between the thermoelectric retrofit unit 50 and the recipient 10 to provide stability to the system 10 and to ensure the proper contact between the two surfaces.

FIG. 7 illustrates one embodiment of the thermoelectric retrofit unit 50 used for heating or cooling water, where the mating occurs conductively via a surface of the recipient 11. In one embodiment, the thermoelectric retrofit unit comprises a conductive heat transferring block to improve thermal contact with one or more individual surfaces of the recipient 11 in which fluid is to be heated and/or cooled. A thermoelectric module 71 is placed between at least two opposing blocks. A first heat transferring block 95 is placed between the recipient 11 and the heat dissipating side of the thermoelectric module 71 in order to conductively transfer heat generated by the module to the recipient 11. A second heat sink 97 operatively connected to the heat absorption side of the thermoelectric module functions as a tempering device in order to maintain the temperature of the heat absorbing side at room temperature or above in order to keep the temperature differential between the heat absorption and heat radiating sides as small as possible. Possible materials for the heat transferring block 95 are aluminum, copper, gold, and any other highly thermally conductive metals or synthetic compounds such as silicon-carbide.

The embodiments of the invention described above are intended to be exemplary only. The scope of the invention is therefore intended to be limited solely by the scope of the appended claims.

1. A retrofit unit for heating and cooling liquid stored in a recipient, the retrofit unit comprising:
a housing defining a cavity and allowing the retrofit unit to be external to the recipient;
a thermoelectric device in the cavity, comprising at least one thermoelectric module having a heat radiation side and a heat absorption side; a control unit in the cavity, for controlling the energy to be applied to the thermoelectric module; and a connecting element on the housing, the connecting element allowing the thermoelectric device one of direct contact and indirect contact with the liquid stored in the recipient to selectively heat and cool the liquid by emitting and absorbing heat, respectively.

2. The retrofit unit of claim 1, wherein the connecting element comprises at least one passage for fluidly connecting the retrofit unit to the recipient and allowing said liquid to flow inside said cavity of the housing.

3. The retrofit unit of claim 2, wherein the at least one passage comprises:
   an inlet passage for liquid entering the retrofit unit; and an outlet passage for liquid exiting the retrofit unit.

4. The retrofit unit of claim 3, wherein the inlet passage is connectable to a city water supply.

5. The retrofit unit of claim 3, wherein the outlet passage is connectable to a drain of the recipient.

6. The retrofit unit of claim 2, further comprising a hot/cold plate inside said cavity on the heat radiation side of the thermoelectric module, for circulating the liquid from the recipient inside the cavity.

7. The retrofit unit of claim 6, further comprising a pump inside the cavity to circulate the liquid in the hot/cold plate.

8. The retrofit unit of claim 2, further comprising a pump inside the cavity to circulate the liquid between the cavity and the recipient.

9. The retrofit unit of claim 1, wherein said connecting element comprises at least one of straps, thermally conductive adhesives, and thermally conductive epoxy compounds to securely attach the retrofit unit to said recipient and thereby provide a physical contact between said housing and said recipient and a thermal contact between said thermoelectric device and said liquid in said recipient.

10. The retrofit unit of claim 1, wherein the thermoelectric device comprises a heat sink attached to the at least one thermoelectric module.

11. The retrofit unit of claim 10, wherein the heat sink is attached to the heat radiation side of the at least one thermoelectric module.

12. The retrofit unit of claim 10, wherein the heat sink is attached to the heat absorption side of the at least one thermoelectric module to maintain the temperature of the heat absorbing side close to an ambient temperature.

13. The retrofit unit of claim 1, wherein the thermoelectric device comprises a hot/cold plate having an embedded piping, the hot/cold plate attached to the heat absorption side of the at least one thermoelectric module to maintain the temperature of the heat absorbing side at an ambient temperature, the piping connected to a radiator to circulate a liquid coolant between the radiator and the hot/cold plate.

14. The retrofit unit of claim 1, wherein the thermoelectric device comprises at least one conductive heat transferring block attached to the at least one thermoelectric module.

15. The retrofit unit of claim 12, wherein the thermoelectric device comprises a fan adjacent to said heat sink.

16. The retrofit unit of claim 15, wherein the fan comprises an inlet duct positioned for retrieving ambient air.

17. The retrofit unit of claim 13, wherein the thermoelectric device comprises a fan adjacent to said radiator.

18. The retrofit unit of claim 11, further comprising at least one thermometer in said cavity for providing temperature readings to the control unit.

19. The retrofit unit of claim 18, wherein the control unit is adapted to record and monitor the temperature readings to determine energy to be applied to the at least one thermoelectric module.

20. The retrofit unit of claim 1, wherein said control unit is adapted to determine power energy to be supplied from a power supply to the thermoelectric module during peak and off-peak periods.

21. The retrofit unit of claim 1, wherein said control unit is adapted to operate the thermoelectric module at a predetermined power in order to selectively heat and cool the liquid, in a predetermined period of time.

* * * * *