A system and method of creating and operating a utility structure coupled to a second structure is provided. A utility structure can include a renewable energy source, a control system, water heating system, a communications system, and a solar hot air module. In connection with these features, a utility structure can provide utility access, heated and/or cooled water, and HVAC to the connected structure. A utility structure can be free standing, portable, or attached to another structure.
FIGURE 2

3 - 2 FT X 12 FT SOLAR HOT WATER PANELS

SOLAR THERMAL HOT WATER EAVES TO SHADE EAST-WEST WALLS

EAVES TO SHADE BUILT IN SOLAR HOT AIR PANEL (BISHA)

RAIN GUTTER FOR WATER CAPTURE

SATELLITE WIFI RECEIVER AND TRANSMITTER

FIGURE 3

SOLAR HOT AIR

141 143 142 144

MOUNT ON PIERS

106

13' 151 153

48" 145

24"
4' X 8' CONTROL BOX

250 GAL COLD WATER TANKS (2)

30" Ø HOT WATER TANK

22" X 59" BATTERY BOXES (2)

FIGURE 4a
EXISTING RESIDENCE

CHASE WITH REVERSING FAN DUCT

WIRING AND PLUMBING CHASE

FAN NIGHT VENT COOLING SYSTEM
EXT. T-STAT

T-STAT HIGH/LOW

BIMETAL VENTS

E-PANEL OUTBACK INVERTER CHARGE
CONTROLLER DC DISCONNECT

48" Wide

100 GAL. SOLAR TANK

79" LONG

525 GALLON

SOLAR HOT AIR

THERMAL HEAT EXCHANGER WITH FAN

13" x 8'

FIGURE 4b
UTILITY SHED

WATER TANK 461d

COLD WATER TANK

ENVIROLET MS10 COMPOSTING TOILET

SOLAR HOT AIR MODULE

BATHROOM MODULE FLOOR PLAN

FIGURE 4d
DOUBLE 2X8 FJ AT 24" W / 3/4" PLY SHTG.
SOLID BLOCKING @ 24" O.C.

FIGURE 5

CONCESSION STATION
606
618
611
609
651
653
616
SAND FILL
633

FIGURE 6
FIGURE 10a

SOLAR HOT AIR UNIT

FIGURE 10b

SOLAR HOT AIR PANEL BUILDING FAN AND SOLAR MODULE

100 °F TEMP SENSOR FOR FAN

WALL THERMOSTAT
FLOW CHART OF MULTIPLE FUNCTIONS OF ENERTOPIA MULTIPURPOSE UTILITY STRUCTURE

PORTABLE (AND STATIONARY) SOLAR POWER, GENERATOR BACKUP, SOLAR THERMAL, HOT WATER, HOT AIR, SPACE HEATING, COMMUNICATION

CLIMATE CONTROL OF BUILDING

1200

HIGH LEVEL FILL TRACK SKID SYSTEM 1a

DOMESTIC WATER TANK 1

DC PRESSURE PUMP 2

HWH 3

COLD WATER HOUSE

SOLAR THERMAL PANELS 3b

POWER DUMP FROM CHARGE CONTROLLER

DOMESTIC HOT WATER HOUSE

DC ELEMENT 48 V 3a

1211

THERMAL HYDRONIC SPACE HEATER WITH FAN FOR SILENT AIR NIGHT CYCLE 4

200 CFM DC FAN 1215

1203

LOW FLOAT

1205

SENSOR IN HOUSE

1209

T-STAT IN SKID

1217

T-STAT. NIGHT COOLING CYCLE SUMMER 4b

1225

HEAT EXCHANGER FROM HOUSE TO BATTERY SKID 5

FIGURE 12
MULTIPURPOSE UTILITY STRUCTURE
CROSS-REFERENCE TO RELATED APPLICATIONS


BACKGROUND

Field

Embodiments disclosed herein relate to utility structures. More specifically, certain embodiments concern self contained utility structures that are configured to provide, for example, one or more of heating ventilation and air conditioning ("HVAC"), hot water, wireless communication capabilities, and/or electric power to one or more structures.

SUMMARY

In some embodiments, a utility structure can be configured to provide at least one utility capability to at least one other structure. The utility structure can include, for example, one or more of a housing, an electric power generation system that provides electric power, a control board disposed within the housing that receives electric power from the electric power generation system, a fluid storage tank disposed within the housing, a fluid heating system that receives fluid from the first fluid storage tank and adds thermal energy to the fluid, and a chase that connects the housing to the at least one other structure.

In some embodiments, the housing can be a shed, for example. In some embodiments, the housing can be a floor that is mountable to a foundation, for example. In some embodiments, the housing can be, for example, a floor that is mountable to a wheeled chassis. In some embodiments, the housing can include, for example, at least one vent. In some embodiments, the vent can be a bi-metal vent, for example.

In some embodiments, the utility structure can further include, for example, a fluid capture system. In some embodiments, the fluid capture system can include, for example, a gutter that receives precipitation from a roof of the housing. In some embodiments, the fluid capture system can include, for example, a downspout that receives precipitation from the gutter. In some embodiments, the downspout can direct precipitation away from the gutter, for example. In some embodiments, the downspout can direct precipitation, for example, to the fluid storage tank. In some embodiments, at least a portion of the downspout may be disposed outside of the housing, for example.

In some embodiments, the utility structure can include, for example, a fluid filtration system disposed between the downspout and the first fluid storage tank. In some embodiments, the utility structure can further include a second fluid storage tank configured to receive precipitation from the downspout, for example. In some embodiments, at least a portion of the second fluid storage tank can be, for example, disposed outside of the housing.

In some embodiments, the fluid heating system can include, for example, a heated fluid storage tank. In some embodiments, at least a portion of the heated fluid storage tank can be disposed within the housing, for example. In some embodiments, the fluid heating system can include, for example, at least one solar hot water panel that receives fluid from the heated fluid storage tank. In some embodiments, the fluid heating system can include, for example, at least one solar hot water panel that receives thermal energy from sunlight. In some embodiments, the fluid heating system can include, for example, at least one solar hot water panel that transfers the received thermal energy to the fluid received from the heated fluid storage tank to heat the received fluid. In some embodiments, the fluid heating system can include at least one solar hot water panel that returns the heated fluid to the heated fluid storage tank, for example.

In some embodiments, the fluid heating system can include, for example, an electrical coil disposed at least partially within the heated fluid storage tank. In some embodiments, the electrical coil can receive, for example, electric power from the control board to add thermal energy to fluid disposed within the heated fluid storage tank. In some embodiments, the electric power generation system can include, for example, at least one solar panel. In some embodiments, the at least one solar panel can be located outside of the housing, for example. In some embodiments, the at least one solar panel can be electrically coupled to the control board, for example. In some embodiments, the at least one solar panel can be disposed, for example, on a mast configured to offset the at least one solar panel from a ground surface. In some embodiments, the electric power generation system can include, for example, at least one wind turbine. In some embodiments, the electric power generation system can include, for example, a geothermal system. In some embodiments, the electric power generation system can include, for example, a hydroelectric system. In some embodiments, the hydroelectric system can include a mini-hydroelectric system, for example.

In some embodiments, the control board can include, for example, one or more of an inverter, a direct current disconnect, a high voltage charge controller, and the like.

In some embodiments, the utility structure can include, for example, an energy storage system that can receive electric power from the control board. For example, in some embodiments, the energy storage system can include a battery, a plurality of batteries, etc.

In some embodiments, the utility structure can include, for example, a communication system. In some embodiments, the communication system can include, for example, one or more of a satellite receiver a Wi-Fi transmitter, a signal repeater, and the like.

In some embodiments, the utility structure can include, for example, a solar hot air module disposed at least partially within the housing. In some embodiments, the solar hot air module can include, for example, a solar module that can receive thermal energy from sunlight incident on the solar module and a solar panel disposed over the solar module, wherein the solar panel can transfer the received thermal energy to air within the panel. In some embodiments, the solar module can be disposed, for example, at least partially outside of the housing. In some embodiments, the solar panel can include, for example, a fan configured to draw air from outside the panel into the panel. In some embodiments, the solar panel can include, for example, a vent configured to exhaust air from the panel.
In some embodiments, the utility structure can include, for example, a thermal hot air matrix that can receive heated fluid from the fluid heating system. The matrix can transfer thermal energy from the heated fluid to air, for example. In some embodiments, the thermal hot air matrix can be disposed at least partially within the housing, for example. In some embodiments, the thermal hot air matrix can include, for example, a fan configured to direct the air in one or more directions.

In some embodiments, the utility structure can include a bathroom module, for example. In some embodiments, the bathroom module can be, for example, disposed at least partially within the housing, at least partially outside of the housing, etc. In some embodiments, the bathroom module can include, for example, a sink and a shower, and in some aspects, the sink and shower can receive fluid from the first fluid storage tank, for example. In some embodiments, the sink and shower can, for example, receive fluid from the fluid heating system.

In some embodiments, the chase can include a first conduit that, for example, can fluidly couple the first fluid storage tank to the at least one other structure. In some embodiments, the first conduit, for example, can fluidly couple the fluid heating system to the at least one other structure. In some embodiments, the first conduit can include, for example, a pipe. In some embodiments, the chase can include, for example, an electrical connection that can electrically couple the control board to the at least one other structure. In some embodiments, the chase can include a second conduit that can fluidly couple the housing to the at least one other structure. In some embodiments, the second conduit can include a duct, for example.

Some embodiments include a method of transferring a gas or fluid such as, for example, air from a first structure to a second structure. This method can include, for example, disposing a fluid storage tank in the first structure and fluidly coupling the heated fluid storage tank to a fluid heating system. In some embodiments, the fluid heating system can include, for example, at least one solar hot water panel that can receive thermal energy from sunlight. The method of transferring air from a first structure to a second structure can include, for example, one or more of transferring received thermal energy from the solar hot water panel to fluid received from the fluid storage tank to heat the fluid, directing the heated fluid to a heated fluid storage tank, directing fluid from the heated fluid storage tank to a thermal hot air matrix, directing air over the thermal hot air matrix to transfer thermal energy from the fluid within the thermal hot air matrix to the air to heat the air, and transferring the heated air from the first structure to the second structure.

In some embodiments, the method of transferring air from a first structure to a second structure can include, for example, one or more of providing a solar hot air module that can transfer thermal energy from sunlight to air disposed within a panel of the solar hot air module, and directing air from the panel to the second structure.

The foregoing is a summary and thus contains, by necessity, simplifications, generalization, and omissions of detail; consequently, those skilled in the art will appreciate that the summary is illustrative only and is not intended to be in any way limiting. Other aspects, features, and advantages of the apparatuses, devices and/or processes and/or other subject matter described herein will become apparent in the teachings set forth herein. The summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The foregoing and other features of the present disclosure will become more fully apparent from the following description taken in conjunction with the accompanying drawings. Understanding that these drawings depict only several embodiments in accordance with the disclosure and are not to be considered limiting of its scope, the disclosure will be described with additional specificity and detail through use of the accompanying drawings.

**FIG. 1** schematically illustrates a top view of a non limiting example of a utility structure coupled to another structure.

**FIG. 2** schematically illustrates a front perspective view of a non limiting example of the utility structure of FIG. 1.

**FIG. 3** schematically illustrates a rear perspective view of a non limiting example of the utility structure of FIG. 1.

**FIG. 4A** schematically illustrates a floor plan of one embodiment of a non limiting example of a utility structure.

**FIG. 4B** schematically illustrates a floor plan of one embodiment of a non limiting example of a utility structure.

**FIG. 4C** schematically illustrates a floor plan of one embodiment of a non limiting example of a utility structure.

**FIG. 4D** schematically illustrates a floor plan of one embodiment of a non limiting example of a utility structure.

**FIG. 4E** schematically illustrates a floor plan of one embodiment of a utility structure.

**FIG. 5** schematically illustrates a top view of an embodiment of a non limiting example of a floor frame for a utility structure.

**FIG. 6** schematically illustrates a partial cross-section of a non limiting example of the utility structure of FIG. 3.

**FIG. 7** schematically illustrates an embodiment of a non limiting example of a solar hot water system that may be incorporated in a utility structure.

**FIG. 8** schematically illustrates an embodiment of a non limiting example of a water tank that may be incorporated in a utility structure to feed water into a hot water tank.

**FIG. 9** schematically illustrates an embodiment of a non limiting example of a solar tracker assembly that may be electrically coupled to a utility structure.

**FIGS. 10A and 10B** schematically illustrate an embodiment of a non limiting example of a solar hot air module.

**FIG. 11** is a block diagram schematically illustrating a non limiting example of how electric power may be distributed through a utility structure.

**FIG. 12** is a block diagram schematically illustrating a non limiting example of a system for distributing water through a utility structure and/or additional structure.
DETAILED DESCRIPTION

[0036] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. The illustrative embodiments described in the detailed description and drawings are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented here. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the Figures, can be arranged, substituted, combined, and designed in a wide variety of different configurations, all of which are explicitly contemplated and make part of this disclosure.

[0037] Some embodiments disclosed herein relate to utility structures that may be coupled to one or more other structures to provide utility access and/or HVAC amenities to the structure(s) coupled thereto. These utility structures may be particularly useful to individuals who live in areas of the world that are not connected to conventional electric grids that provide access to electric power, for example, remote areas on Native American reservations in the United States. Additionally, these structures may be coupled to temporary structures that require utilities, for example, in military, disaster relief, and/or seasonal agricultural applications. Further, these structures may be useful for individuals who desire to consume primarily renewable energy instead of fossil fuel or nuclear based energy. Also, the utility structures disclosed herein may be useful for individuals who may abandon homes for various reasons including, for example, Native Americans who move after a family member passes away at home, and/or for nomadic individuals.

[0038] In some of the embodiments, a utility structure may include at least one renewable source of electric power (e.g., a solar panel, a wind turbine, a geothermal system, and/or a hydroelectric system), a control board or electric panel configured to control and distribute the generated electric power, a solar hot water system, a communications system (e.g., a satellite receiver and optional Wi-Fi signal repeater), and/or a solar hot air module to provide hot air to the utility structure and/or to another structure fluidly coupled thereto. In this way, the utility structure can provide electric power, HVAC, and/or communications capabilities to additional structures that are coupled to the utility structure. Also, the utility structure may be used as a stand alone structure with the same capabilities. For example, the structure can be used to provide electric power, HVAC, and/or communications capabilities to the utility structure itself. Moreover, the utility structures disclosed herein can be constructed to be portable such that they may be easily transported from location to location. A utility structure may also include vents, dampers, and/or fans configured to exchange air within the utility structure with the air from the outside environment and/or with one or more fluidly coupled structures in order to take advantage of diurnal temperature swings. Thus, the ventilation and air exchange systems can be implemented to regulate the temperature of the utility structures and/or other structures fluidly coupled thereto.

[0039] Several non-limiting examples of embodiments will now be described with reference to the accompanying figures, wherein like numerals refer to like elements throughout. The terminology used in the description presented herein is not intended to be interpreted in any limited or restrictive manner, simply because it is being utilized in conjunction with a detailed description of certain specific embodiments. Furthermore, embodiments can include several novel features, no single one of which is solely responsible for its desirable attributes or which is essential to practicing the technology herein described.

[0040] FIG. 1 is a top view of one embodiment of a utility structure 100 that is fluidly coupled to another structure 105 by chase 103. Chase 103 may define a conduit or passageway configured to receive plumbing, wiring, or other conduits to transfer fluids, communication signals, and/or electric power there through. Although the term "chase" is used, it should be understood that the structure 103 should not be limited, but can be any space, conduit, groove, hollow, etc., that connects or connect to the two structures. The utility structure 100 is also electrically coupled to an energy source, which within the depicted example is a solar panel 107 that includes a plurality of solar cells or photovoltaic cells 109. The solar panel 107 may be a tracking solar panel configured to orient the solar cells toward the sun to increase the efficiency of the solar panel 107 (e.g., to expose the solar panel 107 a maximum amount of sun as the earth rotates relative to the sun). In some embodiments, the solar panel 107 is mounted on a mast such that the panel 107 is elevated from the ground. In such embodiments, the panel 107 and mast may cast a shadow toward the utility structure. Thus, panel 107 may be offset from the utility structure 107 by a distance D3 to avoid shading of the structure 107. In some embodiments, distance D3 may be determined, at least in part, by the height of the mast. It can be determined by the location and the need to avoid blocking or shade from structures, trees, hills, etc. In one embodiment, distance D3 can be, for example, between 10 and 150 feet. As a more specific example, D3 can be greater than about 20 feet, for example, about 40 feet.

[0041] The solar panel 107 may be electrically coupled to the utility structure 100 by an electrical umbilical (not shown) to transmit electric power from the solar tracker 107 to the utility structure 100. The transmitted electric power may then be stored within the utility structure 100 by batteries and/or redistributed to one or more additional structures, for example, structure 105. As mentioned above, in some embodiments, chase 103 may include wiring to electrically couple utility structure 100 to structure 105. In this way, utility structure 100 may provide electric power and/or exchange hot and/or cold air with the structure 105. Thus, the utility structure 100 may be a "stand alone" unit or "self contained" meaning that the utility structure 100 may be a separate or distinct structure from the coupled structure 105. In some embodiments, the utility structure 100 may provide all of the primary utility needs of the coupled structure 105. In some aspects, it can be part of the structure 105. In some embodiments, chase 103 includes one or more latching or connecting elements to removably couple the chase 103 to either of the structure 105 and utility structure 100.

[0042] Utility structure 100 may include, for example, various structures capable of at least partially containing or housing electric, HVAC, plumbing, and/or communication elements. In some embodiments, utility structure 100 may include, for example, one or more of a portable shed or building that can be transported from one location to another. For example, utility structure 100 can comprise one or more of a shed, trailer, recreational vehicle, bus, motor coach, box car, shipping container, or any other suitable structure. The utility structure 100 can be formed from various materials...
including, for example, ceramics (e.g., bricks), composites (e.g., concrete), organic materials (e.g., wood), polymers, and/or metals. In some embodiments, the utility structure 100 may be manufactured using one or more methods that have been adapted from the home industry. A utility structure 100 may be built, for example, on a removable axle or frame at a factory and the structure may be hauled to a particular site or location with a light vehicle, for example, a four wheel drive pick-up truck. Once at the site, the utility structure 100 may be removed from the frame with one or more jacks (e.g., hydraulic jacks) and placed on piers (e.g., stationary piers and/or adjustable piers) or a foundation to situate the utility structure at the site. The frame may then be re-used for the transport of another utility structure. Such a method may prevent the need for heavy equipment and reduce equipment and personnel costs. Additionally, should the need arise to relocate a utility structure 100, the utility structure may be lifted from the piers and/or foundation using one or more jacks, disposed on a removable frame, and transported to a subsequent location by a light vehicle. In some aspects the structures can be lifted and lowered using inflatable devices that upon inflation and deflation act to raise and lower the devices.

[0043] The utility structure 100 can also include insulation in the walls, floor, and/or ceiling to insulate the interior from the environmental conditions outside the utility structure 100. For example, the walls and/or floor can be insulated with R-38 insulation. Also, a ceramic radiant barrier can optionally be applied to the walls, floor, and/or ceiling to insulate the utility structure 100. The utility structure 100 as depicted also includes an entrance 104 for entry into or exit out of the structure 100. Furthermore, the depicted utility structure 100 includes a door 101.

[0044] Turning now to FIG. 2, a front perspective view of the utility structure 100 of FIG. 1 is schematically illustrated. The utility structure 100 includes a roof 119. As depicted in the non-limiting example, the roof 119 is slanted downward from north to south. One of skill in the art will understand that the slant of the roof may be configured differently, for example, to maximize sun exposure to the solar hot water panels 117 mounted thereon. For example, the roof may be oriented differently in the southern and northern hemispheres (e.g., from south to north). The directional orientation (e.g., north, south, east and west) shown in the Figures is not meant to be limiting as the structure can be oriented in any direction (north, south, east west, northeast, northwest, southeast, southwest, etc.). Also, although the roof is depicted and described in some Figures and in the description as slanted, in other embodiments the roof is not slanted. Solar hot water panels 117 may cyclically work fluid, for example, water, there through to expose the working fluid to sunlight thus heating the working fluid. As discussed in more detail below, the heated fluid may pass through a heat exchanger that transfers the thermal energy from the heated fluid to another liquid, for example, to potable water for use or consumption by humans. In this way, the solar hot water panels 117 can collect thermal energy from the sun and redistribute the thermal energy within the utility structure 100. Utility structure 100 may also include a rafter 115 that extends over entrance 104 to shade the entrance from incident sunlight. As shown, utility structure 100 may also include a receiver 121 configured to receive signals and/or communications transmissions such as a wireless signal, for example, a Wi-Fi signal, and optionally transmit a signal, for example, a Wi-Fi signal, to the surrounding area. In some embodiments, the receiver 121 can be coupled to a repeater (not shown) to extend the range of a local wireless network. In one embodiment, the receiver 121 can transmit a signal via one or more wires or cables to other components. The receiver/transmitter 121 can be any suitable device for receiving or transmitting information, such as for example, a satellite dish, a radio frequency antenna, a wireless telephone technology receiver/transmitter, and the like. FIG. 2 also depicts an entrance 104, a slanted roof 119, and a floor 106. The depicted dimensions are merely non-limiting examples of possible dimensions.

[0045] The structure can be of any desired size and dimension. In some non-limiting embodiments, the structure can have a length and width to permit transportation of the structure, for example, behind a vehicle as a trailer that can be towed behind a vehicle, in an aircraft such as a helicopter or airplane, on a ship or boat, on a train, or in a trailer such as a tractor trailer, etc. Some embodiments relate to trailers, aircraft, trains, ships, boats, trucks, tractor trailers, motorhomes, houseboats, etc. that comprise, include or a structure as described herein. Examples of lengths are from 3 feet to 150 feet, for example, 6 feet, 8 feet, 10 feet, 12 feet, 20 feet, 28 feet, 45 feet, 53 feet, and 102 feet, or any value there between. Examples of widths include 3 feet to about 150 feet, including, for example, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 20, 30, 50, 75, 100 feet or any value there between. Examples of heights include 3 to about 50 feet, for example, 3 feet, 6 feet, 8 feet, 10 feet, 12 feet, 20 feet, 28 feet, 45 feet or any value there between.

[0046] FIG. 3 shows a rear perspective view of the utility structure 100 of FIG. 2. As schematically illustrated in FIG. 3, utility structure 100 may further include a solar hot air module 141 disposed on or in the south facing wall 142 of the utility structure 100. In the illustrated embodiment, the south facing wall is assumed to receive the most amount of sun throughout the year. However, one having skill in the art will understand that the solar air module 141 can be disposed to face various other directions to take advantage of optimal sun exposure. The solar hot air module 141 can include a solar module 145 configured to absorb and collect thermal energy from sunlight incident thereon and transfer the collected thermal energy to a solar panel 143. The solar panel 143 may include an inlet fan and an outlet damper to cycle air from the utility shed through the solar panel 143. The fan and outlet damper may control the flow rate of air therethrough depending on the heat transfer from the solar module 145. For example, on a particularly sunny day the solar panel 143 may cycle air therethrough at a higher flow rate than on a less sunny day as the solar module 145 will transfer more heat to the panel 143 on sunnier days. As discussed in more detail below, the solar hot air module 141 may be used to provide heat to the utility structure 100 and/or to a structure that is fluidly coupled to the utility structure 100, for example, structure 105 in FIG. 1. The depicted dimensions are merely non-limiting examples of possible dimensions. Example, non-limiting dimensions are discussed herein.

[0047] Still referring to FIG. 3, the utility structure 100 may optionally include a water capture system including a gutter 131 and a downspout 133. Gutter 131 may be positioned near the downward side of slanted roof 119 to receive rain water or other condensation that is biased by gravity toward the downward side. Downspout 133 may receive the collected condensation from the gutter 131 and direct the fluid toward one or more receptacles or reservoirs (not shown). The collected condensation can then be stored and/or directed by plumbing
to the utility structure 100 and/or to another structure that is fluidly coupled to the utility structure 100. In some embodiments, the collected condensation can be filtered using various methods, for example, the methods disclosed in U.S. Provisional Patent Application Number 61/370,808 which is hereby expressly incorporated by reference in its entirety.

As discussed above, utility structure 100 may be constructed to be portable such that it can be transported from location to location. The floor 106 can be constructed with various floor joists and bearers such that the utility structure 100 may be mounted on piers 153 by supports 151. The floor 106 can also be constructed to be “foundation ready” such that it may be secured to an existing foundation, for example, a concrete foundation, by fasteners or other coupling members. In some embodiments, floor 106 can be mounted to a chassis (not shown) with wheels or to a chassis that may be coupled with wheels in order to permit wheeled movement of the utility structure 100 from one location to another. In one embodiment, floor 106 may be constructed to form a skid system or package such that the utility structure 100 can be conveyed using various means of transport. The depicted dimensions are merely non-limiting examples of possible dimensions.

It should be noted that any of the features depicted or described in FIGS. 1-3 (e.g., features 101-145) can be specifically excluded from some embodiments. Also, some features can be combined in any combination of features 101-145 even though not shown in the figures.

Turning now to FIGS. 4A-4D, floor plans of various embodiments of utility structures 400 are schematically illustrated. FIG. 4A shows the floor plan of one example of a utility structure 400a that includes battery boxes 467a, a hot water tank 463a, two cold water tanks 461a, and a control board 479a. The utility structure 400a includes an 8’ by 14’ floor and a door 401a that allows a user to access the interior of the utility structure 400a through an entrance 404a. The depicted dimensions of FIGS. 4A-4D are merely non-limiting examples of possible dimensions.

Cold water tanks 461a may be configured to store and hold potable water or water that is to be purified for use in the utility structure 400a or for use in more or more structures that are fluidly coupled to structure 400a (e.g., structure 105 in FIG. 1). Tanks 461a may be periodically filled by a water source, for example, a fill truck or attached plumbing, as the stored water is used or otherwise disposed of. Tanks 461a can comprise various shapes and sizes. In one non-limiting embodiment, tanks 461a each may be configured to store about 250 gallons and are similarly shaped and sized. In another embodiment, tanks 461a may be different from one another. Utility structure 400a may also include any number of tanks 461a, for example, a single tank or more than two tanks. An example of a suitable storage tank is discussed in more detail below with reference to FIG. 8.

Tanks 461a may be fluidly coupled to hot water tank 463a to direct water therefrom to the hot water tank for heating. In some non-limiting embodiments, the hot water tank 463a comprises a 30” diameter tank and may be heated by a solar hot water system (e.g., the system discussed with reference to FIG. 2 or 7) and/or by electricity provided, for example, by a source of renewable electric power that is coupled to the utility structure 400a (e.g., solar panel 107 discussed with reference to FIG. 1). In other embodiments, hot water tank 463a may be heated using electricity or fuel provided by other means.

Batteries 467a are configured to receive and store electric power provided by a source of renewable electric power that is coupled to the utility structure 400a (not shown). In some embodiments, the batteries can be configured to receive electric power from a solar tracker (not shown) and transmit the stored electric power to one or more circuits or loads. In this way, a solar tracker can be configured to provide power to the utility structure 400a during the day and a portion of the provided power can be transmitted to a load or circuit while another portion can be stored by the batteries 467a to be consumed at a later time, for example, at night. Control board 479a can be configured to include various structures including, for example, a high voltage charge controller, an inverter, a direct current (“DC”) disconnect, a satellite receiver, and/or a power panel. In this way, the control board 479a can control the distribution of electric power received by a source of renewable power to a load or circuit. Although two batteries are shown in the depicted example, any suitable number can be used, for example, 1, 2, 3, 4, 5 or more batteries.

Turning now to FIG. 4B, a floor plan of another embodiment of a utility structure 400b is schematically illustrated. Utility structure 400b includes a chase 403b configured to couple plumbing and/or wiring from the utility structure 400b to another structure 405b. In some embodiments, utility structure 400b is configured to provide electric power and/or air (e.g., warm or hot air) to structure 405b. Utility structure 400b can also be configured to receive hot air and/or electric power from structure 405b. Electric power may be provided through the chase 403b from one or more batteries 467b and/or from electric panel 473b. Electric panel 473b can be configured to receive electric power from a source of energy such as renewable electric energy, for example, from a solar tracker, wind turbine, geothermal system, or hydroelectric system that is coupled to our house within the utility structure 400b. Electric panel 473b can include an inverter, charge controller, and/or DC disconnect and can provide electric power directly to a load or circuit and/or to batteries 467b for storage. The conditions of the utility structure 400b may be monitored remotely by wirelessly connecting to a receiver such as receiver 121 of FIG. 3. Additionally, various components of the utility structure 400b can be controlled remotely by sending a signal to receiver 121. The utility structure 400b can include any number of batteries 467b, for example, one or more. In one embodiment, utility structure 400b includes vents 468b disposed near the batteries 467b to vent gases exhausted by the battery from the interior of the utility structure 400b. Vents 468b can include backflow preventers to prevent outside air from passing therethrough into the utility structure 400b.

Still referring to FIG. 4B, utility structure 400b also includes a water storage tank 461b fluidly coupled to a hot water tank 463b. It should be noted that the listed capacities and dimensions are non-limiting and are provided as examples. Storage tank 461b can be configured to direct stored water from the tank 461b to the hot water tank 463b. Hot water tank 463b can be heated by a solar hot water heating system that includes solar hot water panels disposed on the roof of the utility structure 400b. In some embodiments, the electric panel 473b may distribute electric power to a coil in the hot water tank 463b to heat the water contained therein.

The hot water tank 463b may be fluidly coupled to a heat exchanger element 469b that is configured to receive hot water from tank 463b. The heat exchanger element 469b can
be configured in a variety of shapes and sizes. The heat exchanger element 469b can have a variety of different designs and be configured for the transfer of different amounts of heat. The heat exchanger element 469b can be an off-the-shelf component, or can be task specific. In some embodiments, the heat exchanger element 469b can, for example, be a thermo matrix heat exchanger. The heat exchanger element 469b may include a fan or air distribution means configured to direct air over the received hot water to transfer thermal energy from the hot water to air. The heat exchanger element 469b may then be configured to direct the heated air through one or more conduits or ducts to heat the utility structure 400b and/or to heat another structured coupled thereto. Similarly, the utility structure 400b can also optionally include a solar hot air module 443b similar to solar hot air module 443 in FIG. 1 to transfer solar energy to air from the utility structure 400b. The heated air may then be directed through one or more conduits or ducts to heat the utility structure 400b and/or to heat another structured coupled thereto.

Utility structure 400b may also include a passive cooling system (not shown), for example, an evaporative or “swamp” cooling system, configured to cool air by transferring energy from hot air to water provided by the water tank 461b. In some embodiments, the utility structure 400b may include a dual swing night ventilation and cooling system. Such a system may include a pressure input to pressurize the interior of the utility structure 400b and one or more vents disposed above the floor of the structure 400b (e.g., ceiling vents). The pressure input may pressurize the utility structure 400b such that colder air drops to the floor of the structure while warmer air is forced out of the structure 400b through the one or more vents. As a result, colder air may be drawn into the utility structure 400b and warmer air may be exhausted from the utility structure to cool the interior.

In this way, utility structure 400b can provide hot and/or cold air HVAC capabilities to the utility structure itself and/or one or more other structures coupled thereto. Similarly, utility structure 471b may also include bi-metal vents 471b that are triggered by external sensors 475b to open or close depending on various outside conditions. For example, the vents 400b can be configured to open in the summer at night when the outside temperature is below a certain threshold, for example, a threshold of 60, 70, 75, 80, 85, or 90 degrees Fahrenheit, and above a certain threshold, for example, 40, 45, 50, 60, or 65 degrees Fahrenheit. In the winter, vents 471b can be configured to remain closed when the temperature is below a certain threshold to maintain a temperature within the utility structure 400b to preserve the batteries 467b. As many remote residences can be efficiently heated during winter months by wood burning stoves or fires, the utility structure 400b can be configured to receive heat from another structure fluidly coupled thereto. However, if a structure coupled to the utility structure 400b does not have its own heating capabilities, the utility structure 400b may transfer warm or hot air to the coupled structure, even at night, by the heat exchanger 469b. The depicted dimensions and capacities are merely non-limiting examples.

FIG. 4C schematically illustrates a floor plan of another embodiment of a utility structure 400c, including a door 401c that allows a user to access the interior of the utility structure 400c through an entrance 404c. Similar to utility structure 400b discussed with reference to FIG. 4B, utility structure 400c includes a hot water tank 463c, cold water tank 461c, a heat exchanger element 469c, that is configured to receive hot water from hot water tank 463c, control board 479c, solar hot air module 443c, bi-metal vents 471c, and battery box 467c. Additionally, utility structure 400c includes a workspace and a pump 477c is illustrated. Pump 477c may be configured to pump hot water from tank 463c to an adjoining structure through chase 403c. As indicated, chase 403c may also optionally include a reversing fan to prevent a back flow of air from an adjoining structure into the utility structure 403c. This reversing fan can be turned off to allow the flow of hot air through the chase 403c into utility structure 403c when necessary, for example, in the winter to maintain a temperature within utility structure 403c in order to preserve the batteries 467c. The control board 479c can optionally include a high voltage charge controller, an inverter, a DC disconnect, a Wi-Fi satellite receiver, and/or a power panel. The depicted dimensions and capacities are merely non-limiting examples.

Turning now to FIG. 4D, a floor plan of an embodiment of a bathroom module 400d is schematically illustrated. Bathroom module 400d may be incorporated in, or coupled to, any of the utility structures disclosed herein, for example, utility structure 400c of FIG. 4C. As illustrated, bathroom module 400d is disposed adjacent to a utility structure 402d housing a water tank 461d. Bathroom module 400d may receive hot and/or cold water from water tank 402d for the shower 481d, sink 483d, and/or toilet 485d. In some non-limiting embodiments, toilet 485d may comprise a composting toilet including an aerobic processing system. In other non-limiting embodiments, toilet 485d may be connected to a septic system. Bathroom module 400d may be heated by a solar hot air module 443d and/or may be heated by utility structure 402d. In embodiments where the bathroom module 400d is separate from a utility structure, bathroom module 400d may include a door 401d to provide ingress and egress. In embodiments where the bathroom module 400d is disposed within a utility structure, bathroom module 400d may optionally include a partition or door to provide privacy for the bathroom module portion of the utility structure. In some embodiments, a utility structure or bathroom module may further include a sleeping area for one or more persons. In one embodiment, a sleeping area is disposed on an elevated bunk or in a loft above an area of a utility structure, for example, above a water tank. The depicted dimensions and capacities are merely non-limiting examples.

FIG. 4E depicts a floor plan of one embodiment of a utility structure 400e attached to an existing structure 402e via a common wall 404e. In some embodiments, the utility structure 400e can be attached to a north wall, a west wall, a south wall, an east wall, or any other wall of the existing structure 402e. The utility structure 400e also referred to as the “bump out version” can have all of the same functionalities and features described in connection with other embodiments of a utility structure. In some embodiments, the utility structure 400e may be configured to receive electric power from the structure 402e, from batteries, or from a power generation source, such as, for example, a photovoltaic panel, a wind turbine, a geothermal system, a hydroelectric system, a motor/engine driven generator, or any other power source. FIG. 4E depicts an embodiment in which one power source is batteries 467e. In some embodiments, the batteries 467e and other power sources and consuming devices are connected via a sub panel 408e. The sub panel 408e can include, for example, electrical connection, monitoring devices configured to, for example, monitor temperature, current, resis-
tance, or any other desired attribute, safety features, such as, for example, a fuse or a circuit breaker, and any other desired feature. In some embodiment of a utility structure 400e, the current of electricity provided may be different than the current of electricity required by power consuming devices. Thus, in some embodiments, electricity may be converted from direct current (DC) to alternating current (AC) or from AC to DC. Some embodiments of a utility structure include an inverter 410e configured to convert electric current. Some embodiments of a utility structure can additionally include features such as a charge controller, and/or DC disconnect to assist in power management with multiple power sources and power consuming devices and can be configured to provide electric power directly to a load or circuit and/or to batteries 467e for storage. In some embodiments, the utility structure 400e can include a control panel 424e. The control panel can allow control of all or some of the components and systems of the utility structure 400e. In some embodiments, the conditions of the utility structure 400e may be monitored remotely by wirelessly connecting to a receiver such as receiver 121 of FIG. 3. Additionally, various components of the utility structure 400e can be controlled remotely by sending a signal to the receiver 121. The utility structure 400e can include any number of batteries 467e, for example, one or more. In one embodiment, utility structure 400e may include vents 468e to vent gasses exhausted by, for example, the battery 467e from the interior of the utility structure 400e. Vents 468e can include backflow preventers to prevent outside air from passing through and into the utility structure 400e.

[0062] Still referring to FIG. 4E, utility structure 400e also can include a water storage tank 461e fluidly coupled to a hot water tank 463e. Storage tank 461e can be configured to direct stored water from the tank 461e to the hot water tank. Hot water tank 463e can be heated by a solar hot water heating system that includes solar hot water panels disposed on the roof of the utility structure 400e. In some embodiments, sub panel 408e may distribute electric power to a coil in the hot water tank 463e to heat the water contained therein.

[0063] The hot water tank 463e may be fluidly coupled to a heat exchanger element that is configured to receive hot water from tank 463e as discussed in greater detail above as relating to FIG. 4B. Similarly, the utility structure 400e can optionally include a solar hot air module 443e similar to solar hot air module 143 in FIG. 1 to transfer solar energy to air from the utility structure 400e. The heated air may then be directed through one or more conduits or ducts to heat the utility structure 400e and/or to heat another structure coupled thereto.

[0064] Utility structure 400e may also include a passive cooling system (not shown), for example, an evaporative or “swamp” cooling system, configured to cool air by transferring energy from hot air to water provided by the water tank 461e. In some embodiments, the utility structure 400e may include a diurnal swing night ventilation and cooling system as discussed above in relation to the embodiment of FIG. 4B. In some embodiments, the door 420e can provide access to a hot water tank 461e, which can, in some embodiments, be separated from other portions of the utility structure 400e by, for example, a wall. The door 420e can be, for example, insulated. Advantageously, this separation can limit heating of air surrounding the hot water tank 461e to the area immediately surrounding the hot water tank 461e. Further, in some embodiments, door 420e can be automatically opened and closed according to air temperatures measured around the hot water tank 461e and inside the remaining portions of the utility structure 400e. When additional heating is required in the utility structure 400e, door 420e can open to allow flow of warm air from the area around the water tank 420 to the other portions of the utility structure 400e. In some embodiments, the utility structure 400e can include an overhang 422e. The overhang can provide partial shade to portions of the utility structure 400e including, for example, the hot air cone 443e.

[0065] It should be noted that in FIGS. 4A-4E, one or more of the features listed above can specifically be excluded from some embodiments or combined together in some embodiments. Thus, any of the structures 400-499 can be excluded or combined in any combination.

[0066] FIG. 5 schematically illustrates an example of a top view of an embodiment of a floor frame 506 for a utility structure. Floor frame 506 may include bearers 511 disposed perpendicularly to joists 509. Floor frame 506 can be configured to support an overlying utility structure, for example, utility structure 100 of FIGS. 1-3, over a variety of underlying structures. For example, frame 506 may be disposed on piers, disposed on a foundation, disposed on a chassis, and/or disposed directly on a ground surface. The depicted dimensions are provided as non-limiting examples.

[0067] As shown in FIG. 6, a frame 606 including bearers 611 and joists 609 can support a utility structure frame 618 over concrete piers 653. Supports 651 can be disposed between the floor frame 606 and concrete piers and the piers 653 can be set in a sand filled volume 616 overlying a ground surface 633. Piers 653 can be disposed intermittently underneath the frame 606, for example, under corner regions of frame 606. In some embodiments, piers 653 can be disposed under the center of frame 606 as well to provide additional support thereto.

[0068] FIG. 7 schematically illustrates one example of an embodiment of a solar hot water system 700 that may be incorporated in a utility structure to heat water within a tank 763. In some embodiments the tank 763 can have a diameter of 31 inches and a height of 37 inches. System 700 can include at least one solar panel 701 configured to transfer thermal energy received from sunlight to a working fluid, for example, water, that passes therethrough, a condenser 703 configured to provide a cycle path for the working fluid from a heat exchanger 764 within tank 763 through the panel 701, a pump 707 configured to pump the working fluid through conduit 703, and a controller 705 configured to control the flow rate of the working fluid through system 700. Tank 763 also includes a heated water outlet 709 and a cold water intake 711. Heated water that passes through outlet 709 may be distributed to a structure fluidly coupled to a utility structure and/or may be utilized by a thermal matrix heating element to provide hot air to the coupled structure.

[0069] FIG. 8 schematically illustrates one example of an embodiment of a cold water tank 800 that includes an inlet 801 and a reservoir. In some embodiments, tank 800 can be a horizontal tank. In one exemplary embodiment, the tank 800 can be, for example, a horizontal tank enclosing a volume of 500 gallons. In some embodiments, the tank can be, for example, 79 inches long, 48 inches wide, and 43 inches tall. An example of a suitable tank 800 is the “Flat Bottom Utility Tank” available from plastic-mart.com (part number “Energy525-DSF”).

[0070] FIG. 9 schematically illustrates one example of an embodiment of a solar tracker assembly 909 that may be used
to convert sunlight to electric power. Solar tracker assembly 909 can include a plurality of solar panels 901 each configured to convert incident sunlight into electric power and transmit the electric power to a junction box 907. Junction box 907 can be configured to consolidate the production of the different solar panels and transmit the resultant electric power to a utility structure, for example, any of the utility structures disclosed herein. Solar panels 901 may be supported within a canister 903 by a support structure 905. Support structure 905 can include various suitable elements including, for example, axles, rails, and/or truss tubes, configured to couple the solar panels 901 to the canister 903. Canister 903 may be elevated from the ground by a mast 909 such that shading of the canister 903 is minimized. The junction box 907 may be disposed on a side of mast 909 and mast 909 may be supported in an upright position by one or more outriggers or trusses 911. Trusses 911 may be disposed on the ground surface and optionally coupled to barrels 913. Barrels 913 can be filled with sand or another material to increase the weight of the barrels 913 in order to provide stability to the trusses 911 and mast 909. As discussed above with reference to FIG. 1, solar tracker assembly 909 may be offset from a utility structure to limit shading of the utility structure by the assembly 909 and the tracker assembly may be electrically coupled to the utility structure, for example, by an umbilical connection. The depicted dimensions are provided as non-limiting examples of dimensions.

[0071] FIGS. 10A and 10B schematically illustrate examples of an embodiment of a solar hot air module 1041 including a solar module 1045 and a solar hot air panel 1043. Solar module 1045 can be configured to receive and absorb thermal energy from sunlight in order to transfer the thermal energy to air within the hot air panel 1043. Hot air panel 1043 can include a fan 1003 to draw air into the hot air panel and a damper or control element 1001 configured to allow hot air to exhaust from the hot air panel 1043. In this way, air may be drawn into the hot air panel 1043 by fan 1003, heated by solar module 1045, and exhausted from the panel 1043 by damper 1001. The exhausted hot air may be directed through one or more ducts or conduits to distribute the hot air to a utility structure and/or to a structure coupled thereto. For example, solar hot air module 1041 can be disposed in a utility structure and configured to exhaust hot air in the winter time into a structure, for example, a house, fluidly coupled to the utility structure. The operation, including the flow rate, of the hot air module 1041 can be automatically controlled by sensor elements 1005, 1007 and/or can be manually controlled remotely by sending signals to a receiver within a utility structure (not shown).

[0072] FIG. 11 is a block diagram schematically illustrating one non-limiting example of how electric power may be distributed through a utility structure. The process of distributing electric power begins by generating electric power using at least one of a solar photovoltaic module, wind generator, hydroelectric system, and/or geothermal system as indicated by block 1101. The generated electric power is then distributed to a high voltage charge controller as indicated by block 1103. The electric power may then be transmitted to DC disconnect and over current protection elements and through an inverter as indicated by blocks 1105 and 1107, respectively. From there, electric power may be distributed to a standby generator as indicated by block 1108, to one or more batteries or energy storage elements as indicated by block 1109, and/or to a power protection panel as indicated by block 1111. Electric power can be distributed from the power protection panel to a utility structure subpanel and/or to a structure that is electrically coupled to the utility structure as indicated by block 1113.

[0073] In certain conditions, the system may generate more electric power than is required by the electric loads of the utility structure and any other connected structures. In these situations, excess power may be shunted off as indicated by process line 1116. The excess power can then be distributed to one or more auxiliary batteries as indicated by block 1117 and/or used to heat water in a water tank as indicated by block 1115. In certain situations, a utility structure can be located in an area that has access to an existing power grid. In this case, the system can be optionally tied to the power grid to distribute excess power thereto and/or to draw electric power from the grid when the power generated at block 1101 is insufficient. In some embodiments, a utility structure may include an electric coil within a hot water tank to heat and/or provide supplemental heating to water stored therein. Further, thermal energy from the heated water can be transferred by an element or heat exchanger to air to provide air to a utility structure and/or a structure fluidly coupled thereto. Thus, the excess power can be stored, used to heat water, and/or used to heat water to heat air.

[0074] FIG. 12 is a block diagram schematically illustrating an example of a system 1200 for distributing water through a utility structure and/or additional structure. System 1200 includes a source of water 1201, for example, a fill truck or plumbing connection, configured to provide water to a water tank 1203. In some embodiments, source of water 1201 may comprise a natural source of water, for example, a well, creek, river, wash, spring, etc. Water may be pumped from water tank 1203 to a hot water tank 1207 and/or directly to a cold water output, for example, a sink, in a utility structure or another structure. Water pumped into hot water tank 1207 may be heated by a DC element 1211 and/or by a solar hot water heating system 1209. DC element 1211 may receive electric power from a source of renewable electric power (not shown), for example, from one of the solar tracker systems discussed herein. Heated water from tank 1207 may be directed from tank 1207 for use in a utility structure and/or in a structure that is fluidly connected to the utility structure. Additionally, hot water may be bled from the hot water tank 1207 to a element 1213 configured to transfer thermal energy from the hot water to air to provide heating to a utility structure and/or to a structure that is fluidly connected to the utility structure. In one embodiment, heated air may be directed from a utility structure through a chase to a residence in order to heat the residence. In some embodiments, heated air may be directed over one or more batteries contained within a utility structure to preserve the batteries in cold conditions. Similarly, in some embodiments, a structure fluidly coupled to a utility structure may have independent heating capabilities, for example, a wood burning stove, and may include a heat exchanger 1225 configured to direct heated air to the utility structure (e.g., to heat batteries housed therein).

[0075] One of skill in the art will understand that the self contained capabilities of the utility structures disclosed herein can be used in various circumstances to heat, cool, provide electric power, and/or provide communications capabilities to a utility structure and/or to one or more structures coupled thereto.

[0076] The technology is operational with numerous other general purpose or special purpose computing system envi-
ronments or configurations. Examples of well known computing systems, environments, and/or configurations that may be suitable for use with the invention include, but are not limited to, personal computers, server computers, hand-held or laptop devices, multiprocessor systems, microprocessor-based systems, programmable consumer electronics, network PCs, minicomputers, mainframe computers, distributed computing environments that include any of the above systems or devices, and the like.

[0077] As used herein, instructions refer to computer-implemented steps for processing information in the system. Instructions can be implemented in software, firmware or hardware and include any type of programmed step undertaken by components of the system.

[0078] A Local Area Network (LAN) or Wide Area Network (WAN) may be a corporate computing network, including access to the Internet, to which computers and computing devices comprising the system are connected. In one embodiment, the LAN conforms to the Transmission Control Protocol/Internet Protocol (TCP/IP) industry standard.

[0079] As used herein, media refers to images, sounds, video or any other multimedia type data that is entered into the system.

[0080] A microprocessor may be any conventional general purpose single- or multi-chip microprocessor such as a Pentium® processor, a Pentium® Pro processor, a 8051 processor, a MIPS® processor, a PowerPC® processor, or an Alpha® processor. In addition, the microprocessor may be any conventional special purpose microprocessor such as a digital signal processor or a graphics processor. The microprocessor typically has conventional address lines, conventional data lines, and one or more conventional control lines.

[0081] The system is comprised of various modules as discussed in detail. As can be appreciated by one of ordinary skill in the art, each of the modules comprises various sub-routines, procedures, definitional statements and macros. Each of the modules is typically separately compiled and linked into a single executable program. Therefore, the description of each of the modules is used for convenience to describe the functionality of the preferred system. Thus, the processes that are undergone by each of the modules may be arbitrarily redistributed to one of the other modules, combined together in a single module, or made available in, for example, a shareable dynamic link library.

[0082] The system may be used in connection with various operating systems such as Linux®, UNIX® or Microsoft Windows®.

[0083] The system may be written in any conventional programming language such as C, C++, BASIC, Pascal, or Java, and run under a conventional operating system. C, C++, BASIC, Pascal, Java, and FORTRAN are industry standard programming languages for which many commercial compilers can be used to create executable code. The system may also be written using interpreted languages such as Perl, Python or Ruby.

[0084] A web browser comprising a web browser user interface may be used to display information (such as textual and graphical information) to a user. The web browser may comprise any type of visual display capable of displaying information received via a network. Examples of web browsers include Microsoft’s Internet Explorer browser, Netscape’s Navigator browser, Mozilla's Firefox browser, PalmSource’s Web Browser, Apple’s Safari, or any other browsing or other application software capable of communicating with a network.

[0085] Those of skill will further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as software, computer software, or combinations thereof. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as software or hardware depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

[0086] The various illustrative logical blocks, modules, and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0087] In one or more example embodiments, the functions and methods described may be implemented in hardware, software, or firmware executed on a processor, or any combination thereof. If implemented in software, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage media may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray disc where disks usually reproduce data magnetically, while discs
reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media.

[0088] Appendix A includes additional and/or supplemental disclosure relating to one non-limiting embodiment of utility structures and components thereof.

[0089] The foregoing description details certain embodiments of the systems, devices, and methods disclosed herein. It will be appreciated, however, that no matter how detailed the foregoing appears in text, the systems, devices, and methods can be practiced in many ways. As is also stated above, it should be noted that the use of particular terminology when describing certain features or aspects of the invention should not be taken to imply that the terminology is being redefined herein to be restricted to including any specific characteristics of the features or aspects of the technology with which that terminology is associated.

[0090] It will be appreciated by those skilled in the art that various modifications and changes may be made without departing from the scope of the described technology. Such modifications and changes are intended to fall within the scope of the embodiments. It will also be appreciated by those of skill in the art that parts included in one embodiment are interchangeable with other embodiments; one or more parts from a depicted embodiment can be included with other depicted embodiments in any combination. For example, any of the various components described herein and/or depicted in the Figures may be combined, interchanged, or excluded from other embodiments.

[0091] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

[0092] It will be understood by those within the art that, in general, terms used herein are generally intended as “open” terms (e.g., the term “including” should be interpreted as “including but not limited to,” the term “having” should be interpreted as “having at least,” the term “includes” should be interpreted as “includes but is not limited to,” etc.). It will be further understood by those within the art that a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases “at least one” and “one or more” to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles “a” or “an” limits any particular claim containing such introduced claim recitation to embodiments containing only one such recitation, even when the same claim includes the introductory phrases “one or more” or “at least one” and indefinite articles such as “a” or “an” (e.g., “a” and/or “an” should typically be interpreted to mean “at least one” or “one or more”); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of “two recitations,” without other modifiers, typically means at least two recitations, or two or more recitations). Furthermore, in those instances where a convention analogous to “at least one of A, B, and C,” etc.,” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, and C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to “at least one of A, B, or C, etc.” is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., “a system having at least one of A, B, or C” would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase “A or B” will be understood to include the possibilities of “A” or “B” or “A and B.”

[0093] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting.

What is claimed is:

1. A utility structure configured to provide at least one utility capability to at least one other structure, the utility structure comprising:
   a housing:
   an electric power generation system configured to provide electric power;
   a control board disposed within the housing and configured to receive electric power from the electric power generation system;
   a first fluid storage tank disposed within the housing;
   a fluid heating system configured to receive fluid from the first fluid storage tank and add thermal energy to the fluid; and
   a chase configured to connect the housing to the at least one other structure.
2. The utility structure of claim 1, wherein the housing comprises a shed.
3. The utility structure of claim 1, wherein the housing comprises a floor configured to be mounted to a foundation and/or configured to be mounted to a wheeled chassis.
4. The utility structure of claim 1, further comprising one or more of a fluid capture system, an energy storage system configured to receive electric power from the control board, a communication system, a solar hot air module disposed at least partially within the housing, a thermal hot air matrix configured to receive heated fluid from the fluid heating system and to transfer thermal energy from the heated fluid to air, a bathroom module.
5. The utility structure of claim 4, wherein the fluid capture system comprises a gutter configured to receive precipitation from a roof of the housing and a downsput configured to receive precipitation from the gutter.
6. The utility structure of claim 5, wherein the downsput is configured to direct precipitation away from the gutter, the downsput is configured to direct precipitation to the fluid storage tank, and/or the downsput is disposed outside of the housing.
7. The utility structure of claim 5, further comprising a fluid filtration system disposed between the downspout and the first fluid storage tank and/or further comprising a second fluid storage tank configured to receive precipitation from the downspout.

8. The utility structure of claim 7, wherein at least a portion of the second fluid storage tank is disposed outside of the housing.

9. The utility structure of claim 1, wherein the fluid heating system comprises a heated fluid storage tank.

10. The utility structure of claim 9, wherein at least a portion of the heated fluid storage tank is disposed within the housing.

11. The utility structure of claim 9, wherein the fluid heating system comprises at least one solar hot water panel configured to receive fluid from the heated fluid storage tank, receive thermal energy from sunlight, transfer the received thermal energy to the fluid received from the heated fluid storage tank to heat the received fluid, and return the heated fluid to the heated fluid storage tank.

12. The utility structure of claim 9, wherein the fluid heating system comprises an electrical coil disposed at least partially within the heated fluid storage tank.

13. The utility structure of claim 12, wherein the electrical coil is configured to receive electric power from the control board to add thermal energy to fluid disposed within the heated fluid storage tank.

14. The utility structure of claim 1, wherein the electric power generation system comprises at least one solar panel, at least one wind turbine, a geothermal system and/or a hydroelectric system.

15. The utility structure of claim 1, wherein the control board comprises an inverter, a direct current disconnect, a high voltage charge controller.

16. The utility structure of claim 4, wherein the energy storage system comprises a battery or a plurality of batteries.

17. The utility structure of claim 4, wherein the communication system comprises one or more of a satellite receiver, a Wi-Fi transmitter, and a signal repeater.

18. The utility structure of claim 4, wherein the solar hot air module comprises a solar module configured to receive thermal energy from sunlight incident on the solar module and a solar panel disposed over the solar module, wherein the solar panel is configured to transfer the received thermal energy to air within the panel.

19. The utility structure of claim 4, wherein the solar module is disposed at least partially outside of the housing, wherein the solar panel comprises a fan configured to draw air from outside the panel into the panel, and/or wherein the solar panel comprises a vent configured to exhaust air from the panel.

20. The utility structure of claim 4, wherein the thermal hot air matrix is disposed at least partially within the housing.

21. The utility structure of claim 4, wherein the thermal hot air matrix comprises a fan configured to direct the air in one or more directions.

22. The utility structure of claim 1, further comprising.

23. The utility structure of claim 4, wherein the bathroom module is disposed at least partially within the housing or is disposed outside of the housing.

24. The utility structure of claim 4, wherein the bathroom module comprises a sink and a shower.

25. The utility structure of claim 4, wherein the sink and shower are configured to receive fluid from the first fluid storage tank and/or wherein the sink and shower are configured to receive fluid from the fluid heating system.

26. The utility structure of claim 1, wherein the chase comprises a first conduit configured to fluidly couple the first fluid storage tank to the at least one other structure.

27. The utility structure of claim 26, wherein the first conduit is configured to fluidly couple the fluid heating system to the at least one other structure.

28. The utility structure of claim 26, wherein the first conduit comprises a pipe.

29. The utility structure of claim 4, wherein the chase comprises an electrical connection configured to electrically couple the control board to the at least one other structure.

30. The utility structure of claim 29, wherein the chase comprises a second conduit configured to fluidly couple the housing to the at least one other structure.

31. The utility structure of claim 30, wherein the second conduit comprises a duct.

32. A method of transferring air from a first structure to a second structure, the method comprising:

- disposing a fluid storage tank in the first structure;
- fluidly coupling the heated fluid storage tank to a fluid heating system, wherein the fluid heating system comprises at least one solar hot water panel configured to receive thermal energy from sunlight;
- transferring received thermal energy from the solar hot water panel to fluid received from the fluid storage tank to heat the fluid;
- directing the heated fluid to a heated fluid storage tank;
- directing fluid from the heated fluid storage tank to a thermal hot air matrix;
- directing air over the thermal hot air matrix to transfer thermal energy from the fluid within the thermal hot air matrix to the air to heat the air;
- transferring the heated air from the first structure to the second structure.

33. The method of claim 32, further comprising:

- providing a solar hot air module configured to transfer thermal energy from sunlight to air disposed within a panel of the solar hot air module; and
- directing air from the panel to the second structure.

34. A vehicle or portable structure comprising a utility structure according to claim 1.

35. The vehicle or portable structure of claim 34, wherein the vehicle or portable structure is selected from the group consisting of a trailer, a truck, a semi truck, a tractor trailer, a recreational vehicle selected from a fifth wheel or a motorhome, a houseboat, a ship, and an aircraft.