

CONCISE EXPLANATION OF RELEVANCY

Reference #1 Griffith et. al. – (U.S. Patent Pub. 2022/0344941 issued as US 11,870,263)

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1. A system for intelligent power management, comprising: an appliance; a battery module coupled to the appliance, the battery module being configured to provide power to the appliance; a bidirectional converter coupled to the appliance and the battery module by a power bus, the directional converter converting between alternating current (AC) and direct current (DC) and interfacing with a power infrastructure external to the appliance; and	“FIG. 4 illustrates one example embodiment of a battery system that can comprise one or more batteries, a processor, a memory, a clock, a battery control system, a communication system, an interface and an electrical power bus.” (Para. [0012]). “FIG. 3a illustrates an example of a stove load source that comprises a battery system...” (Para. [0009], see also Fig. 3a). “...the first load source being configured to be fully powered by power stored by the first battery and configured to be fully powered by power obtained from the first receptacle and configured to be partially powered by both the first battery and power obtained from the first receptacle...” (Para. [0067]). “Also, in some embodiments where a load source 200 (e.g., an appliance) has an internal rectification circuit, such as an induction stove or the like, that is converting 60 Hz AC current to DC, it can be desirable in some examples to connect the battery system 300 directly into the internal circuitry of the load source (e.g., to avoid costly addition of high-power inversion).” (Para. [0053]). “In various embodiments, edge storage can enable strategies for load sharing between appliances, including the use of bi-directional power converters...” (Para. [0108]). “In various examples, it can be beneficial to minimize inversions (e.g., inverter in battery module that sits on DC bus can prevent multiple inversions).” (Para. [0131]).

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2. The system of claim 1, wherein the battery module is coupled to the appliance by integrating into the appliance.	“FIG. 3a illustrates an example of a stove 125 load source 200 that comprises an embodiment 300A of a battery system 300 having a battery 305. For example, the battery system 300A can be an internal component of the stove 125, an integral component of the stove 125, disposed within a housing of the stove 125, or the like.” (Para. [0050]).
3. The system of claim 1, wherein the battery module provides power to the appliance according to the determined charge and discharge schedule.	“The battery control system 440 in various embodiments can be configured to control power storage and/or power discharge of the battery 305 based on instructions from the processor, or the like.” (Para. [0070]). “Determining an output configuration can be for various suitable purposes, such as to maximize use of renewable energy sources (e.g., solar panels 115); to maximize storage of power from renewable energy sources; to maximize storage of power from a power grid 110 when such power is at a low or lower cost; to maximize performance of a load source 200; to maximize energy efficiency of a load source; to maximize energy storage by one or more batteries 305; to minimize charging time for one or more batteries 305; and the like.” (Para. [0104], see also Figs. 6a, 6b, [0098]-[0105], [0108]-[0115], [0123]-[0127] and [0136]-[0137]).

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4. The system of claim 1, wherein the control unit is further configured to determine a power usage pattern of the appliance and a power supply pattern of the power infrastructure for providing power to the battery module.	“Additionally, in some embodiments, on-board or network control laws can be adaptive to patterns of use, which can allow a given battery capacity to adapt to expected demands. Further, these laws in various embodiments can be configured to adapt to local time-of-use rates, allowing behind-the-scenes energy arbitrage. Implementation of these control laws can be based on reinforcement learning and controls techniques, accompanied by best practice user interfaces allowing homeowner monitoring and tuning. For example, FIG. 6a illustrates an example method 600 of updating a user power profile...” (Para. [0098]). “In some embodiments, such a method 601 can be performed by one or more battery systems 300 individually and/or separately...” (Para. [0103]). “For example, a power profile can comprise ... real-time and historical data on power used, stored or provided by one or more batteries 305, load source 200, battery system 300, grid power source 110, solar power source 115, or the like.” (Para. [0101], see also figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0118]-[0119], [0123]-[0127], [0136]-[0137]. Usage patterns: [0085], [0096], [0098]).

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5. The system of claim 4, wherein the control unit is further configured to determine the charge and discharge schedule for the battery module based on the power usage pattern and the power supply pattern.	“Additionally, in some embodiments, on-board or network control laws can be adaptive to patterns of use, which can allow a given battery capacity to adapt to expected demands. Further, these laws in various embodiments can be configured to adapt to local time-of-use rates, allowing behind-the-scenes energy arbitrage. Implementation of these control laws can be based on reinforcement learning and controls techniques, accompanied by best practice user interfaces allowing homeowner monitoring and tuning. For example, FIG. 6a illustrates an example method 600 of updating a user power profile...” (Para. [0098]). “In some embodiments, such a method 601 can be performed by one or more battery systems 300 individually and/or separately...” (Para. [0103]). “For example, a power profile can comprise ... real-time and historical data on power used, stored or provided by one or more batteries 305, load source 200, battery system 300, grid power source 110, solar power source 115, or the like.” (Para. [0101], see also figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0118]-[0119], [0123]-[0127], [0136]-[0137]. Usage patterns: [0085], [0096], [0098]).

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8. The system of claim 6, wherein the control unit is further configured to adjust the determined schedule based on the collected contextual information.	“In various embodiments, control schemes for battery integrated appliances may function using several levels of data including one or more of the following examples. First, they may rely only on calendar and time of day to predict loads and supply. Second, they may incorporate historical use data to tailor the algorithms to the habits of the user.” (Para. [0125], see also Figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0123]-[0127], [0136]-[0137]).
9. The system of claim 1, further comprising a physical user interface configured to receive a user input for manually editing the charge and discharge schedule for the battery module at a time point.	“Implementation of these control laws can be based on reinforcement learning and controls techniques, accompanied by best practice user interfaces allowing homeowner monitoring and tuning.” (Para. [0098]). “The interface 460 can include various elements configured to receive input and/or present information (e.g., to a user). For example, in some embodiments, the interface can comprise a touch screen, a keyboard, one or more button, one or more light, a speaker, a microphone, a haptic interface, and the like. In various embodiments, the interface 460 can be used by a user for various suitable purposes, such as to configure the battery system 300, view an aspect, characteristic or state of the battery system 300, configure network connections of the battery system 300, or the like.” (Para. [0072], see also Fig. 4). ...

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	“If a determination is made that a change to the current battery configuration should be made (e.g., it would be desirable to make a change), then one or more suggested changes can be indicated to a user (e.g., via an interface 460, user device 520, or the like).” (Para. [0089], see also Fig. 5). Fourth, it may accept user input to switch control modes (for instance, a user can press a button to prepare the stove to cook a large meal, during which it will pre-charge to full capacity and/or load share between the battery and plug during operation).” (Para. [0137]). “Various embodiments can be configured to forecast use based on data discussed above, or the like. Some embodiments can be configured to operate based on user input (e.g., user indicates he is about to or will cook a meal at a later time or date). Forecasting can be based on data such as user calendars, user defined schedules, or the like.” (Para. [0137]).
10. The system of claim 1, wherein the appliance comprises two or more appliances, and the battery module comprises two or more battery modules, and at least two of the two or more appliances are coupled to the two or more battery modules.	“...one or more load sources...” (Para. [0073] and Abstract; see also Figs. 1, 2, 5, 7-9, 13). “...one or more battery systems...” (Para. [0083], [0089], [0099], [0101], [0103], [0105] and Abstract; see also Figs. 1, 2, 5, 7-9, 13).

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11. The system of claim 10, wherein the control unit is further configured to redistribute power stored in the two or more battery modules by providing power to an appliance from a battery module not directly coupled to the appliance.	“Power can be distributed to or among such load sources 200 via an electric power distribution system 150 that can comprise power lines 155, electrical sub-elements 160 that provide power to electric receptacles 165, or the like.” (Para. [0039]). “For example, FIG. 7 illustrates an embodiment of a powered building system 100 that comprises a battery system set 705 comprising three battery systems 300A, 300B, 300C, which are configured to share power via a plurality of power sharing lines 710. In some embodiments, some or all of the power sharing lines can be mono or bi-directional. For example, in some embodiments, the first battery system 300A can provide power to the second and third battery systems 300B, 300C and the first battery system 300A can receive power from the second and third battery systems 300B, 300C.” (Para. [0106], see also Figs. 1, 2, 5, 7-9 and 13).
12. A method of intelligent power management, comprising:	“FIG. 6b illustrates an example method of determining a power output configuration.” (Para. [0015], see also Figs. 6a and 6b).
collecting power usage data of an appliance for a first period of time;	“Turning to FIG. 6b , an example method 601 of determining a power output configuration is illustrated, which includes block 620 where current power use data is obtained...” (Para. [0102], see also [0099], [0102]- [0103] and Figs. 6a and Fig. 6b).
determining a power usage pattern of the appliance based on the power usage data;	“For example, a power profile can comprise ... real-time and historical data on power used, stored or provided by one or more batteries 305, load source 200, battery system 300, grid power source 110, solar power source 115, or the like.” (Para. [0101], see also figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0118]-[0119], [0123]-[0127], [0136]-[0137]. Usage patterns: [0085], [0096], [0098]).

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collecting power supply data of a battery module for a second period of time,	“For example, a power profile can comprise ... real-time and historical data on power used, stored or provided by one or more batteries 305, load source 200, battery system 300, grid power source 110, solar power source 115, or the like.” (Para. [0101], see also figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0118]-[0119], [0123]-[0127], [0136]-[0137]).
the battery module being coupled to the appliance via a bidirectional converter and configured to provide power to the appliance;	“Also, in some embodiments where a load source 200 (e.g., an appliance) has an internal rectification circuit, such as an induction stove or the like, that is converting 60 Hz AC current to DC, it can be desirable in some examples to connect the battery system 300 directly into the internal circuitry of the load source (e.g., to avoid costly addition of high-power inversion).” (Para. [0053]). “In various embodiments, edge storage can enable strategies for load sharing between appliances, including the use of bi-directional power converters...” (Para. [0108]). “In various examples, it can be beneficial to minimize inversions (e.g., inverter in battery module that sits on DC bus can prevent multiple inversions).” (Para. [0131]).
determining a power supply pattern of the battery module based on the power supply data; and	“For example, a power profile can comprise ... real-time and historical data on power used, stored or provided by one or more batteries 305, load source 200, battery system 300, grid power source 110, solar power source 115, or the like.” (Para. [0101], see also figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0118]-[0119], [0123]-[0127], [0136]-[0137]).

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determining a charge and discharge schedule of t battery module based on the power usage pattern of the appliance and the power supply pattern of the battery module.	“Turning to FIG. 6b , an example method 601 of determining a power output configuration is illustrated, which includes ... block 630, a power output configuration is determined...” (Para. [0102]). “Additionally, in some embodiments, on-board or network control laws can be adaptive to patterns of use, which can allow a given battery capacity to adapt to expected demands. Further, these laws in various embodiments can be configured to adapt to local time-of-use rates, allowing behind-the-scenes energy arbitrage. Implementation of these control laws can be based on reinforcement learning and controls techniques, accompanied by best practice user interfaces allowing homeowner monitoring and tuning. For example, FIG. 6a illustrates an example method 600 of updating a user power profile, which begins in block 605, where user power data is obtained. In block 610, power cost data is obtained, and in block 615, a user power profile is updated.” (Para. [0098], see also [0069], [0098]-[0104], [0115], [0137] and Figs. 6a and 6b).
13. The method of claim 12, further comprising: collecting contextual information related to one or more of power usage of the appliance or power supply for the battery module for a time point of a day; and adjusting the charge and discharge schedule for the time point based on the collected contextual information.	“In various embodiments, control schemes for battery integrated appliances may function using several levels of data including one or more of the following examples. First, they may rely only on calendar and time of day to predict loads and supply. Second, they may incorporate historical use data to tailor the algorithms to the habits of the user.” (Para. [0125], see also Figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0123]-[0127], [0136]-[0137]).

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14. The method of claim 13, wherein the contextual information is collected from one or more sensors coupled to one or more of the appliance or battery module.	“For example, in various embodiments, a battery system 300 can comprise various suitable sensors to determine such aspects, characteristics or states of the battery 305 or aspects, characteristics or states of other elements of a building system 100 which can include environmental conditions such as temperature, humidity, or the like internal to or external to a building 105.” (Para. [0070]).
15. The method of claim 13, wherein the contextual information is collected from one or more third party services.	“In some examples, the battery server 510 can be a remote physical or cloud-based server or server system that can be configured to store data related to the battery systems 300, store data provided by the battery systems 300 and/or user device 520, or configure the battery systems 300 and/or user device 520 as discussed in more detail herein.” (Para. [0082], see also Fig. 5 and [0081]-[0084], [0087], [0099]-[0103]).
16. A method of intelligent power management, comprising:	“FIG. 6b illustrates an example method of determining a power output configuration.” (Para. [0015], see also Figs. 6a and 6b).
collecting power usage data of two or more appliances;	“Turning to FIG. 6b , an example method 601 of determining a power output configuration is illustrated, which includes block 620 where current power use data is obtained...” (Para. [0102]). ...

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	“In some embodiments, such a method 601 can be performed by one or more battery systems 300 individually and/or separately or can be performed by one or more battery systems 300, user device 520 or battery server 510 to configure one or more battery systems 300. For example, using FIG. 5 for purposes of illustration, in some embodiments, each of the battery systems 300A, 300B, 300C can individually control its own configuration (e.g., via the method 601) and/or one or more of the battery systems can be configured by another device (e.g., another battery system 300, the battery server 510, the user device 520, or the like). In other words, in some embodiments, individual battery systems 300 can be self-controlled and/or a set of battery systems 300 can be controlled individually or as a group by another device or one of the battery systems 300 (e.g., a primary battery system 300). Accordingly, power use data and power output capacity data can be obtained from a plurality of battery systems 300...” (Para. [0103],], see also [0099], [0102]-[0103] and Figs. 1, 2, 5, 6a, 6b, 7-9 and 13).
determining a power usage pattern of each of the two or more appliances based on the power usage data;	“For example, a power profile can comprise ... real-time and historical data on power used, stored or provided by one or more batteries 305, load source 200, battery system 300, grid power source 110, solar power source 115, or the like.” (Para. [0101], see also figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0118]-[0119], [0123]-[0127], [0136]-[0137]. Usage patterns: [0085], [0096], [0098]).

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determining a charge and discharge schedule of each of the two or more battery modules based on the power usage pattern of each of the two or more appliances and the power supply pattern of each of the two or more battery modules.	“Turning to FIG. 6b , an example method 601 of determining a power output configuration is illustrated, which includes ... block 630, a power output configuration is determined...” (Para. [0102]). “Additionally, in some embodiments, on-board or network control laws can be adaptive to patterns of use, which can allow a given battery capacity to adapt to expected demands. Further, these laws in various embodiments can be configured to adapt to local time-of-use rates, allowing behind-the-scenes energy arbitrage. Implementation of these control laws can be based on reinforcement learning and controls techniques, accompanied by best practice user interfaces allowing homeowner monitoring and tuning. For example, FIG. 6a illustrates an example method 600 of updating a user power profile, which begins in block 605, where user power data is obtained. In block 610, power cost data is obtained, and in block 615, a user power profile is updated.” (Para. [0098], see also [0069], [0098]-[0104], [0115], [0137] and Figs. 6a and 6b).
17. The method of claim 16, further comprising: dynamically adjusting a charge and discharge schedule of at least one of the two or more battery modules based on contextual information related to a power usage of the at least one appliance.	“In various embodiments, control schemes for battery integrated appliances may function using several levels of data including one or more of the following examples. First, they may rely only on calendar and time of day to predict loads and supply. Second, they may incorporate historical use data to tailor the algorithms to the habits of the user.” (Para. [0125], see also Figs. 6a, 6b, [0069]-[0070], [0084], [0098]-[0105], [0108]-[0115], [0123]-[0127], [0136]-[0137]).

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18. The method of claim 16, further comprising: determining whether a power redistribution is required for one of the two or more appliances; and when it is determined that the one of the two or more appliances requires the power redistribution, redistributing power from an uncoupled battery module to the one of the two or more appliances.	“For example, FIG. 7 illustrates an embodiment of a powered building system 100 that comprises a battery system set 705 comprising three battery systems 300A, 300B, 300C, which are configured to share power via a plurality of power sharing lines 710. In some embodiments, some or all of the power sharing lines can be mono or bi-directional. For example, in some embodiments, the first battery system 300A can provide power to the second and third battery systems 300B, 300C and the first battery system 300A can receive power from the second and third battery systems 300B, 300C.” (Para. [0106]). “In various embodiments, edge storage can enable strategies for load sharing between appliances, including the use of bi-directional power converters at the plug, as well as dedicated wired connections. For example, during a Thanksgiving marathon cooking session, the clothes dryer battery capacity (e.g., a battery system 300A associated with a clothes dryer) can be called on to supplement that of the stove (e.g., via a battery system 300B associated with the stove). Additionally, battery capacity from other sources can be drawn if necessary, such as battery capacity from a water heater (e.g., a battery system 300C associated with the water heater), being drawn to further supply the stove and/or to power the clothes dryer later in the night if power from the battery system 300A of the clothes dryer has been depleted and it is undesirable to use power from the grid 110 or if renewable energy (e.g., from solar panels 115) is not available based on the time of day or conditions.” (Para. [0108], see also [0107]-[0108], [0117]-[0118] and Figs. 1, 2, 5, 7-9 and 13).

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19. The method of claim 16, further comprising: determining whether a power redistribution is required for at least two of the two or more appliances; and when it is determined that at least two of the two or more appliances require the power redistribution, determining a priority of each of the at least two of the two or more appliances.	“For example, FIG. 7 illustrates an embodiment of a powered building system 100 that comprises a battery system set 705 comprising three battery systems 300A, 300B, 300C, which are configured to share power via a plurality of power sharing lines 710. In some embodiments, some or all of the power sharing lines can be mono or bi-directional. For example, in some embodiments, the first battery system 300A can provide power to the second and third battery systems 300B, 300C and the first battery system 300A can receive power from the second and third battery systems 300B, 300C.” (Para. [0106]). “In various embodiments, edge storage can enable strategies for load sharing between appliances, including the use of bi-directional power converters at the plug, as well as dedicated wired connections. For example, during a Thanksgiving marathon cooking session, the clothes dryer battery capacity (e.g., a battery system 300A associated with a clothes dryer) can be called on to supplement that of the stove (e.g., via a battery system 300B associated with the stove). Additionally, battery capacity from other sources can be drawn if necessary, such as battery capacity from a water heater (e.g., a battery system 300C associated with the water heater), being drawn to further supply the stove and/or to power the clothes dryer later in the night if power from the battery system 300A of the clothes dryer has been depleted and it is undesirable to use power from the grid 110 or if renewable energy (e.g., from solar panels 115) is not available based on the time of day or conditions.” (Para. [0108], see also [0107]-[0108], [0117]-[0118] and Figs. 1, 2, 5, 7-9 and 13).

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20. The method of claim 19, further comprising: redistributing power to the at least two of the two or more appliances according to the determined priority of each of the at least two appliances.	“For example, FIG. 7 illustrates an embodiment of a powered building system 100 that comprises a battery system set 705 comprising three battery systems 300A, 300B, 300C, which are configured to share power via a plurality of power sharing lines 710. In some embodiments, some or all of the power sharing lines can be mono or bi-directional. For example, in some embodiments, the first battery system 300A can provide power to the second and third battery systems 300B, 300C and the first battery system 300A can receive power from the second and third battery systems 300B, 300C.” (Para. [0106]). “In various embodiments, edge storage can enable strategies for load sharing between appliances, including the use of bi-directional power converters at the plug, as well as dedicated wired connections. For example, during a Thanksgiving marathon cooking session, the clothes dryer battery capacity (e.g., a battery system 300A associated with a clothes dryer) can be called on to supplement that of the stove (e.g., via a battery system 300B associated with the stove). Additionally, battery capacity from other sources can be drawn if necessary, such as battery capacity from a water heater (e.g., a battery system 300C associated with the water heater), being drawn to further supply the stove and/or to power the clothes dryer later in the night if power from the battery system 300A of the clothes dryer has been depleted and it is undesirable to use power from the grid 110 or if renewable energy (e.g., from solar panels 115) is not available based on the time of day or conditions.” (Para. [0108], see also [0107]-[0108], [0117]-[0118] and Figs. 1, 2, 5, 7-9 and 13).