power without taking into account the use pattern of the power at all, and the QoL of the user is lost.

[0011]

Consequently, to solve the problems, the present inventors and the like invented an "EoD Control System" and applied the invention as Japanese Patent Application No. 2011-154495 (July 13, 2011) to the Patent Office, in which the user can set two types of limits, "maximum instantaneous power" and "ceiling of accumulated power" in a certain period (such as one day, one week, and one month), for a commercial power source to control the peak reduction in real time, and a dynamic priority control apparatus that can reduce an electric bill and ~~Co2~~ CO_2 is included.

The EoD control system handles instantaneous power of an initial target value as an updated initial target value.

The problems are solved by using: initial target value update means for updating the instantaneous power of the initial target value with the maximum instantaneous power to handle the power as an updated initial target value; and power arbitration means for comparing a power consumption total value with the updated initial target value and referring to electric device characteristic class data to determine which one of the characteristics of the electric device characteristic class data the electric device has based

Non Patent Literature 1: "~~i-Energy and Smart Grid~~Electric Appliance Recognition from Power Sensing Data for Information-Power Integrated Network System," Takekazu Kato and four others, IEICE technical report, pp. 133-138, January 19, 2009

Non Patent Literature 2: "i-Energy and Smart Grid," Professor Takashi Matsuyama, Graduate School, Kyoto University, p. 21, July 29, 2009

Summary of Invention

Technical Problem

[0015]

An object is to provide a multiple power source management system for an on-demand power control system, a multiple power source management system program for an on-demand power control system, and a computer-readable recording medium recording the program that can perform power management including storage batteries based on the "EoD control system" to control charge-discharge management of the storage batteries adapted to an actual power use request while following a power use plan according to a power use pattern of a user and that can design optimal storage capacity and charge-discharge output for the user in a preliminary charge-discharge plan even with the storage batteries with minimum specifications.

Solution to Problem

[0016]

The present inventors and the like have completed the present invention as a result of intensive studies for solving the problems.

1. An on-demand multiple power source management system including: a plurality of power sources; a plurality of electric devices; smart taps connected to the electric devices; a multiple power source management apparatus that includes a memory and that controls supply of power to the electric devices; and a network for the multiple power source management apparatus connected through the smart taps, wherein the multiple power source management apparatus includes: power supply plan generation means for setting a power use plan of a commercial power source as initial values of a supply plan of a ~~capacitor~~storage battery, searching a time zone with a maximum dissatisfaction among the time zones of the initial values to set the time zone as a time-shift destination, searching a time zone with a minimum dissatisfaction to set the time zone as a time-shift source, and repeating the process until the dissatisfaction of the time-shift destination is smaller than the dissatisfaction of the time-shift source to generate a power supply plan; and arbitration means for repeating a process of selecting a device with a minimum priority among an electric device that has requested

power and electric devices in operation, selecting a power source with a maximum power source load factor, reducing or stopping power of the electric device, and reducing supply power of the power source by an amount of the reduced power until the following Expressions (1) and (2) are satisfied, thereby performing arbitration to satisfy Expressions (1) and (2) at the same time.

$$\forall a \in A, \forall s \in S : \mathrm{Pri}_a\left(\mathrm{PD}_a^{\mathrm{REQ}}\right) \geq \mathrm{LF}_s\left(\mathrm{PS}_s^{\mathrm{REQ}}\right) \qquad (1)$$

$$\sum_{a \in A} PD_a^{REQ} = \sum_{s \in S} PS_s^{RES} \qquad (2)$$

2. The on-demand multiple power source management system according to 1, wherein the plurality of power sources include a combination of a commercial power source as well as a storage battery~~capacitor~~ and at least one power source of a storage battery~~capacitor~~ of an electric vehicle and solar power.

3. The on-demand multiple power source management system according to 2, wherein the generated power supply plan is an optimal capacity of the storage battery.

4. A program causing a computer to operate as a multiple power source management apparatus in an on-demand multiple power source management system, the on-demand multiple power source management system including: a plurality of power sources; a plurality of electric devices; smart taps connected to the electric devices; the multiple power source management apparatus that

includes a memory and that controls supply of power to the electric devices; and a network for the multiple power source management apparatus connected through the smart taps, wherein the multiple power source management apparatus executes: a process of setting a power use plan of a commercial power source as initial values of a supply plan of a storage battery~~capacitor~~, searching a time zone with a maximum dissatisfaction among the time zones of the initial values to set the time zone as a time-shift destination, searching a time zone with a minimum dissatisfaction to set the time zone as a time-shift source, and repeating the process until the dissatisfaction of the time-shift destination is smaller than the dissatisfaction of the time-shift source to generate a power supply plan; and a process of repeating a process of selecting a device with a minimum priority among an electric device that has requested power and electric devices in operation, selecting a power source with a maximum power source load factor, reducing or stopping power of the electric device, and reducing supply power of the power source by an amount of the reduced power until the following Expressions (1) and (2) are satisfied, thereby performing arbitration to satisfy Expressions (1) and (2) at the same time.

$$\forall a \in A, \forall s \in S : \mathrm{Pri}_a\left(\mathrm{PD}_a^{\mathrm{REQ}}\right) \geq \mathrm{LF}_s\left(\mathrm{PS}_s^{\mathrm{REQ}}\right) \qquad (1)$$

$$\sum_{a \in A} PD_a^{REQ} = \sum_{s \in S} PS_s^{RES} \qquad (2)$$

Data of fields of values is associated with device identification ID, type of message, permitted average power, and permitted use time shown in fields of items of Table 5. The priority apparatus transmits the data to the ST.

[0058]

[Table 5]

Item	Value
Device identification ID	ID
Type of message	Permit/refuse
Permitted average power	E_{supply} (W)
Permitted use time	Time

[0059]

The above-described dynamic priority control apparatus 1 ~~dynamic priority control means 1~~ including the initial target value update means 120 and the power arbitration means 122 can save power by reducing the accumulated power and can avoid a massive blackout at the peak, because the instantaneous power does not exceed the upper limit, and the accumulated power does not exceed the target value C.

[0060]

(Second Embodiment)

The priority apparatus 1 can ultimately control the instantaneous power equal to or below the maximum instantaneous power and can control the power to satisfy the target value C of the accumulated power. However, when a device is used, there may be an unexpected

increase in the instantaneous power due to load fluctuation or the like, and the power may exceed the maximum instantaneous power. A second embodiment for handling such a case will be described.

Figure 16 is a functional block diagram explaining functions included in a multiple power source management apparatus, and Figure 17 is a functional block diagram of the second embodiment.

The priority apparatus includes the initial target value update means 120, ~~priority arbitration means 123~~power arbitration means 122, and constant monitoring means 124.

The initial target value update means 120 and the power arbitration means 122~~priority arbitration means 123~~ have the same functions as the means described above, and the description will not be repeated.

The constant monitoring means 124 constantly monitors the power consumption, and when the entire power consumption exceeds the maximum instantaneous power for equal to or longer than a certain period d (about 0.5 to 2 seconds), the priority arbitration means 123 performs arbitration based on the priorities without waiting for a lapse of τ, so that the entire power consumption falls below the maximum instantaneous power.

[0061]

The former immediately makes a determination in response to the power request transmitted from a device when, for example, the switch is turned on and maintains

Commercial power source		Storage battery	
Maximum instantaneous power	$\overline{PS_C\ (t)}$ [W]	Maximum discharge power	$\overline{PS_b}$ [W]
Ceiling	$\overline{ES_c}$ [Wh]	Maximum charge power	$\underline{PS_b}$ (<0) [W]
Power cost	C (t) [***/Wh]	Storage capacity	$\overline{ES_b}$ [Wh]
~~CO2~~ $\underline{CO_2}$ emission factor	G [kg/kWh]	Charge efficiency	α_i ($0<\alpha_i<1$)
		Discharge efficiency	α_o ($0<\alpha_o<1$)
		Self-discharge power	α_n [W]
Power source load factor	LF_c (p)	Power source load factor	LF_b (p)

[0072]

The maximum instantaneous power and the ceiling of the commercial power source are the upper limit of the instantaneous power and the upper limit of the accumulated power used in the conventional EoD control system, and the user can arbitrarily set them. The electric bill, the CO_2 emission factor, and the like of each time are set based on the power contract.

For the storage battery, a maximum value of power that can be supplied from the storage battery (maximum discharge power), a maximum value of power that can be charged in the storage battery (maximum charge power), and electric energy that can be charged in the storage

Claims

[Claim 1]

An on-demand multiple power source management system comprising:

a plurality of power sources; a plurality of electric devices; smart taps connected to the electric devices;

a multiple power source management apparatus that includes a memory and that controls supply of power to the electric devices; and a network for the multiple power source management apparatus connected through the smart taps, wherein the multiple power source management apparatus comprises: power supply plan generation means for setting a power use plan of a commercial power source as initial values of a supply plan of a storage battery~~capacitor~~, searching a time zone with a maximum dissatisfaction among the time zones of the initial values to set the time zone as a time-shift destination, searching a time zone with a minimum dissatisfaction to set the time zone as a time-shift source, and repeating the process until the dissatisfaction of the time-shift destination is smaller than the dissatisfaction of the time-shift source to generate a power supply plan; and

arbitration means for repeating a process of selecting a device with a minimum priority among an electric device that has requested power and electric

devices in operation, selecting a power source with a maximum power source load factor, reducing or stopping power of the electric device, and reducing supply power of the power source by an amount of the reduced power until the following Expressions (1) and (2) are satisfied, thereby performing arbitration to satisfy Expressions (1) and (2) at the same time.

$$\forall a \in A, \forall s \in S : \mathrm{Pri}_a\left(\mathrm{PD}_a^{\mathrm{REQ}}\right) \geq \mathrm{LF}_s\left(\mathrm{PS}_s^{\mathrm{REQ}}\right) \qquad (1)$$

$$\sum_{a \in A} PD_a^{REQ} = \sum_{s \in S} PS_s^{RES} \qquad (2)$$

[Claim 2]

The on-demand multiple power source management system according to claim 1, wherein

the plurality of power sources include a combination of a commercial power source as well as a storage battery~~capacitor~~ and at least one power source of a storage battery~~capacitor~~ of an electric vehicle and solar power.

[Claim 3]

The on-demand multiple power source management system according to claim 2, wherein

the generated power supply plan is an optimal capacity of the storage battery.

[Claim 4]

A program causing a computer to operate as a multiple power source management apparatus in an on-

demand multiple power source management system, the on-demand multiple power source management system comprising: a plurality of power sources; a plurality of electric devices; smart taps connected to the electric devices; the multiple power source management apparatus that includes a memory and that controls supply of power to the electric devices; and a network for the multiple power source management apparatus connected through the smart taps,

the program further causing the computer to cause the multiple power source management apparatus to execute: a process of setting a power use plan of a commercial power source as initial values of a supply plan of a storage battery~~capacitor~~, searching a time zone with a maximum dissatisfaction among the time zones of the initial values to set the time zone as a time-shift destination, searching a time zone with a minimum dissatisfaction to set the time zone as a time-shift source, and repeating the process until the dissatisfaction of the time-shift destination is smaller than the dissatisfaction of the time-shift source to generate a power supply plan; and

a process of repeating a process of selecting a device with a minimum priority among an electric device that has requested power and electric devices in operation, selecting a power source with a maximum power source load factor, reducing or stopping power of the electric device, and reducing supply power of the power