the tank 3B. Then, if the water level becomes equal to or higher than the predetermined level, the lifting pump 1B is turned off, and water is not supplied to the tank 3B anymore.

In addition, a ventilation fan is one example of an apparatus, which is operated irrespective of power-demand control. The ventilation fan is started and stopped based on the CO2 concentration or the CO concentration of a parking.

As described above, some apparatuses of the electric-load group 200 are operated irrespective of power-demand control. Because of this, according to the power-demand control of the related art, the following situation may occur frequently. That is, such apparatuses are started during a peak period (i.e., period in which power may be overused). Then the predicted power consumption exceeds the target power consumption. Then other apparatuses are forced to be stopped.

Embodiments of the present invention are made to solve the above-mentioned problems. Embodiments of the present invention provide power-demand control apparatus and method capable of reducing the frequency of starting apparatuses, which are operated irrespective of power-demand control, during a period in which power may be overused, and having a smaller impact on power-demand control.

According to a first aspect of the present invention, there is provided a power-demand control apparatus for controlling power demand, the power-demand control apparatus being configured to measure a real power consumption for each control-interval period, the control-interval period being a predetermined period, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time, to predict a consumption of power supplied from the outside during the control-interval period based on the measured real power consumption, and to control, if the predicted power consumption based on the prediction exceeds a preset target

power consumption, operation of a loading apparatus of the electric-load group such that the real power consumption fails to exceed the preset target power consumption, the loading apparatus being registered as an apparatus for adjustment of power consumption, the power-demand control apparatus comprising: a real-power-consumption measuring unit configured to measure a real power consumption, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time; a power predicting unit configured to predict a consumption of power supplied from the outside during the control-interval period based on the real power consumption, the real power consumption being measured by the real-power-consumption measuring unit; a standby-apparatus storage unit configured to store information on a loading apparatus of the electric-load group as a standby apparatus, the loading apparatus being registered as an apparatus operated irrespective of power-demand control; an additional-startup-control unit configured to compare the predicted power consumption with the target power consumption, the predicted power consumption being predicted by the power predicting unit, and to output a startup instruction to an additional-startup-apparatus if there is a margin between the predicted power consumption and the target power consumption, the predicted power consumption being lower than the target power consumption, the additional-startup-apparatus being the standby apparatus capable of being started by using the margin power; and a unit configured to ban operation of the additional-startup-control unit until an elapsed time after the control-interval period is started is within a predetermined period.

According to a second aspect of the present invention, there is provided a power-demand control method for controlling power demand, the power-demand control method including measuring a real power consumption for each control-

interval period, the control-interval period being a predetermined period, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time, predicting a consumption of power supplied from the outside during the control-interval period based on the measured real power consumption, and controlling, if the predicted power consumption based on the prediction exceeds a preset target power consumption, operation of a loading apparatus of the electric-load group such that the real power consumption fails to exceed the preset target power consumption, the loading apparatus being registered as an apparatus for adjustment of power consumption, the power-demand control method comprising: measuring a real power consumption, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time; predicting a consumption of power supplied from the outside during the control-interval period based on the measured real power consumption; storing information on a loading apparatus of the electric-load group as a standby apparatus, the loading apparatus being registered as an apparatus operated irrespective of power-demand control; comparing the predicted power consumption based on the prediction with the target power consumption, and outputting a startup instruction to an additional-startup-apparatus if there is a margin between the predicted power consumption and the target power consumption, the predicted power consumption being lower than the target power consumption, the additional-startup-apparatus being the standby apparatus capable of being started by using the margin power; and banning operation of the additional-startup-control until an elapsed time after the control-interval period is started is within a predetermined period. According to embodiments of the present invention, the real power

consumption is measured. The real power consumption is a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time. A consumption of power supplied from the outside during the control-interval period is predicted based on the measured real power consumption. The predicted power consumption is compared with the target power consumption. A startup instruction is output to an additional-startup-apparatus if there is a margin between the predicted power consumption and the target power consumption, and the predicted power consumption is lower than the target power consumption. The additional-startup-apparatus is the standby apparatus capable of being started by using the margin power.

For example, in embodiments of the present invention, a drain pump is registered as a standby apparatus. If it is possible to start the drain pump by using the margin power, the power-demand control apparatus decides the drain pump as an additional-startup-apparatus. The power-demand control apparatus starts (additionally starts) the drain pump by using the margin power. In this case, as shown in the part (a) of Fig. 5, even if the water level is low, the drain pump is started by using the margin power. Water is thus drained from a tank. As a result, in the next control-interval period, it is unlikely that the drain pump will be started (see the part (b) of Fig. 5).

As described in this example, according to embodiments of the present invention, the power-demand control apparatus starts as many apparatuses, which are operated irrespective of power-demand control in a case where there is a power margin, as possible. The frequency of starting apparatuses, which are operated irrespective of power-demand control, is reduced during a period in which power may be overused.

According to embodiments of the present invention, the standby-apparatus storage unit may be configured to store information on a rated power of the standby apparatus. The

standby-apparatus storage unit may be configured to store, in a case where there are a plurality of standby apparatuses, startup-priority-levels of the standby apparatuses, respectively. In this case, the additional-startup-control unit is configured to determine an additional-startup-apparatus, to which the startup instruction is output, based on the stored startup-priority-levels.

Further, according to embodiments of the present invention, the additional-startup-control unit may be configured to output a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, when the next control-interval period is started. The additional-startup-control unit may be configured to output a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, in response to an instruction from the outside. Further, the power-demand control apparatus may include a stop-instruction-output-mode selecting unit configured to select a mode of outputting a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, from two modes, one mode being to output the stop instruction when the next control-interval period is started, the other mode being to output the stop instruction in response to an instruction from the outside. The additional-startup-control unit may be configured to output the stop instruction to the additional-startup-apparatus, to which the startup instruction is output, based on the output mode selected by the stop-instruction-output-mode selecting unit.

Further, according to embodiments of the present invention, the additional-startup-control unit may be configured to output a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, after an operable time passes, the operable time being calculated based on a rated power of the additional-startup-apparatus and the margin power.

Further, according to embodiments of the present invention, operation of the additional-startup-control unit may be banned until an elapsed time after the control-interval period is started is within a predetermined period. The power-demand control apparatus may further include a unit configured to store an additional-startup-control effectiveness judgment threshold, the additional-startup-control effectiveness judgment threshold being a predetermined value lower than the target power consumption. Operation of the additional-startup-control unit may be banned if the predicted power consumption is equal to or lower than the additional-startup-control effectiveness judgment threshold.

According to embodiments of the present invention, the real power consumption is measured. The real power consumption is a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time. A consumption of power supplied from the outside during the control-interval period is predicted based on the measured real power consumption. The predicted power consumption is compared with the target power consumption. A startup instruction is output to an additional-startup-apparatus if there is a margin between the predicted power consumption and the target power consumption, and the predicted power consumption is lower than the target power consumption. The additional-startup-apparatus is the standby apparatus capable of being started by using the margin power. As a result, the power-demand control apparatus starts as many apparatuses, which are operated irrespective of power-demand control in a case where there is a power margin, as possible. The frequency of starting apparatuses, which are operated irrespective of power-demand control, is reduced during a period in which power may be overused. There is thus a smaller impact on power-demand control.

Brief Description of Drawings

Fig. 1 is a functional block diagram showing the

What is claimed is:

1. A power-demand control apparatus for controlling power demand, the power-demand control apparatus being configured

to measure a real power consumption for each control-interval period, the control-interval period being a predetermined period, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time,

to predict a consumption of power supplied from the outside during the control-interval period based on the measured real power consumption, and

to control, if the predicted power consumption based on the prediction exceeds a preset target power consumption, operation of a loading apparatus of the electric-load group such that the real power consumption fails to exceed the preset target power consumption, the loading apparatus being registered as an apparatus for adjustment of power consumption,

the power-demand control apparatus comprising:

a real-power-consumption measuring unit configured to measure a real power consumption, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the

current time;

a power predicting unit configured to predict a consumption of power supplied from the outside during the control-interval period based on the real power consumption, the real power consumption being measured by the real-power-consumption measuring unit;

a standby-apparatus storage unit configured to store information on a loading apparatus of the electric-load group as a standby apparatus, the loading apparatus being registered as an apparatus operated irrespective of power-demand control;

an additional-startup-control unit configured

to compare the predicted power consumption with the target power consumption, the predicted power consumption being predicted by the power predicting unit, and

to output a startup instruction to an additional-startup-apparatus if there is a margin between the predicted power consumption and the target power consumption, the predicted power consumption being lower than the target power consumption, the additional-startup-apparatus being the standby apparatus capable of being started by using the margin power; and

a unit configured to ban operation of the additional-startup-control unit until an elapsed time after the control-interval period is started is within

a predetermined period.

2. The power-demand control apparatus according to claim 1, wherein

the standby-apparatus storage unit is configured to store information on a rated power of the standby apparatus.

3. The power-demand control apparatus according to claim 1 or claim 2, wherein

the standby-apparatus storage unit is configured to store, in a case where there are a plurality of standby apparatuses, startup-priority-levels of the standby apparatuses, respectively, and

the additional-startup-control unit is configured to determine an additional-startup-apparatus, to which the startup instruction is output, based on the stored startup-priority-levels.

4. The power-demand control apparatus according to any one of claim 1 to claim 3, wherein

the additional-startup-control unit is configured to output a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, when the next control-interval period is started.

5. The power-demand control apparatus according to any one of claim 1 to claim 3, wherein

the additional-startup-control unit is configured to output a stop instruction to the additional-startup-apparatus, to which the startup instruction is output,

in response to an instruction from the outside.

6. The power-demand control apparatus according to any one of claim 1 to claim 3, further comprising:

a stop-instruction-output-mode selecting unit configured to select a mode of outputting a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, from two modes, one mode being to output the stop instruction when the next control-interval period is started, the other mode being to output the stop instruction in response to an instruction from the outside, wherein

the additional-startup-control unit is configured to output the stop instruction to the additional-startup-apparatus, to which the startup instruction is output, based on the output mode selected by the stop-instruction-output-mode selecting unit.

7. The power-demand control apparatus according to any one of claim 1 to claim 3, wherein

the additional-startup-control unit is configured to output a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, after an operable time passes, the operable time being calculated based on a rated power of the additional-startup-apparatus and the margin power.

8. The power-demand control apparatus according to any one of claim 1 to claim 7, further comprising:

a unit configured to store an additional-startup-

control effectiveness judgment threshold, the additional-startup-control effectiveness judgment threshold being a predetermined value lower than the target power consumption; and

a unit configured to ban operation of the additional-startup-control unit if the predicted power consumption is equal to or lower than the additional-startup-control effectiveness judgment threshold.

9. A power-demand control method for controlling power demand, the power-demand control method including

measuring a real power consumption for each control-interval period, the control-interval period being a predetermined period, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time,

predicting a consumption of power supplied from the outside during the control-interval period based on the measured real power consumption, and

controlling, if the predicted power consumption based on the prediction exceeds a preset target power consumption, operation of a loading apparatus of the electric-load group such that the real power consumption fails to exceed the preset target power consumption, the loading apparatus being registered as an apparatus for adjustment of power consumption,

the power-demand control method comprising:

measuring a real power consumption, the real power consumption being a consumption of power supplied from the outside by an electric-load group of a customer from the start of the control-interval period until the current time;

predicting a consumption of power supplied from the outside during the control-interval period based on the measured real power consumption;

storing information on a loading apparatus of the electric-load group as a standby apparatus, the loading apparatus being registered as an apparatus operated irrespective of power-demand control;

comparing the predicted power consumption based on the prediction with the target power consumption, and outputting a startup instruction to an additional-startup-apparatus if there is a margin between the predicted power consumption and the target power consumption, the predicted power consumption being lower than the target power consumption, the additional-startup-apparatus being the standby apparatus capable of being started by using the margin power; and

banning operation of the additional-startup-control until an elapsed time after the control-interval period is started is within a predetermined period.

10. The power-demand control method according to claim 9, further comprising:

storing information on a rated power of the standby apparatus.

11. The power-demand control method according to claim 9 or claim 10, further comprising:

storing, in a case where there are a plurality of standby apparatuses, startup-priority-levels of the standby apparatuses, respectively; and

determining an additional-startup-apparatus, to which the startup instruction is output, based on the stored startup-priority-levels.

12. The power-demand control method according to any one of claim 9 to claim 11, further comprising:

outputting a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, when the next control-interval period is started.

13. The power-demand control method according to any one of claim 9 to claim 11, further comprising:

outputting a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, in response to an instruction from the outside.

14. The power-demand control method according to any one of claim 9 to claim 11, further comprising:

selecting a mode of outputting a stop instruction to the additional-startup-apparatus, to which the

startup instruction is output, from two modes, one mode being to output the stop instruction when the next control-interval period is started, the other mode being to output the stop instruction in response to an instruction from the outside;

outputting the stop instruction to the additional-startup-apparatus, to which the startup instruction is output, based on the selected output mode.

15. The power-demand control method according to any one of claim 9 to claim 11, further comprising:

outputting a stop instruction to the additional-startup-apparatus, to which the startup instruction is output, after an operable time passes, the operable time being calculated based on a rated power of the additional-startup-apparatus and the margin power.

16. The power-demand control method according to any one of claim 9 to claim 15, further comprising:

storing an additional-startup-control effectiveness judgment threshold, the additional-startup-control effectiveness judgment threshold being a predetermined value lower than the target power consumption; and

banning operation of the additional-startup-control if the predicted power consumption is equal to or lower than the additional-startup-control effectiveness judgment threshold.