DESCRIPTION

# CHARGING INFRASTRUCTURE INFORMATION PROVIDING SYSTEM, CHARGING INFRASTRUCTURE INFORMATION PROVIDING DEVICE, CONTROL METHOD AND PROGRAM

## TECHNICAL FIELD

[0001]

The present invention relates to a charging infrastructure information providing system, a charging infrastructure information providing device, a control method, and a program. In particular, the present invention relates to a charging infrastructure information providing system and a charging infrastructure information providing device that provide charging infrastructure information to users of electric vehicles, a control method of controlling the charging infrastructure information providing device, and a program for the charging infrastructure information providing device.

Priority is claimed on Japanese Patent Application No. 2011-208969, filed September 26, 2011, the content of which is incorporated herein by reference.

## BACKGROUND ART

[0002]

In recent years, the term "smart" has been frequently used as in "smart grids," "smart meters," "smart communities," and the like. From a perspective of the future of power networks which are social infrastructure systems in the real world, although star-type structures from large-scale power plants to factories, offices, and households have been built at present, distribution, two-way communication, and individualization

are expected to progress rapidly due to the advancement and development of wind power generation, solar cells, fuel cells, and storage cells and global warming prevention policies for supporting the advancement and development thereof.

[0003]

The research and development disclosed in Non Patent Literature 1 proposes an idea of energy informationization to aim for construction of a new ultra-distributed energy social infrastructure by integration of power networks and information networks. More specifically, the research and development disclosed in Non Patent Literature 1 proposes execution of energy management in consideration of not only quantitative energy saving but also a reduction in the amount of generated carbon dioxide by distinguishing powers of respective power supplies from each other when a plurality of power sources are installed in households.

PRIOR ART LITERATURE

NON PATENT LITERATURE

[0004]

[Non Patent Literature 1]

"<University Research Trend> Energy Informationization: Integration of Power Network and Information Network" by Takashi Matsuyama, Cue: Kyoto University Research Information Repository by Department of Electrical Engineering Kyoto University in March, 2010, No. 23, p. 3 to 8

## DISCLOSURE OF INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005]

According to the research and development disclosed in Patent Literature 1, since the power from each power supply is supplied in association with information regarding this power supply, realization of various types of energy management in light of differences between the power supplies can be considered to be enabled by referring to the information.

[0006]

However, the research and development disclosed in Patent Literature 1 does not propose energy management realized due to a difference between the power supplies by setting a charging infrastructure of electric vehicles as a target.

MEANS FOR SOLVING THE PROBLEMS

[0007]

According to an aspect of the present invention, there is provided a charging infrastructure information providing system providing information regarding charging infrastructures to a user of an electric vehicle. The charging infrastructure information providing system includes a charging infrastructure information providing device configured to provide the information regarding each charging infrastructure to the user of the electric vehicle. The charging infrastructure information providing device includes a charging infrastructure information providing unit configured to preferentially provide information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle.

[0008]

The charging infrastructure information providing device may further include a contribution evaluation unit configured to evaluate a contribution to supply of the power

of the predetermined attribute in each charging infrastructure based on information regarding an amount of power fed to the electric vehicle in each charging infrastructure and attribute information of the power. The charging infrastructure information providing unit of the charging infrastructure information providing device may preferentially provide the information regarding the charging infrastructure making the considerable contribution to the supply of the power of the predetermined attribute based on a result evaluated by the contribution evaluation unit.

[0009]

The charging infrastructure information providing device may further include a power-feed information storage unit configured to sequentially store the information regarding the amount of power fed to the electric vehicle in each charging infrastructure and the attribute information of the power in association therewith. The contribution evaluation unit of the charging infrastructure information providing device may evaluate the contribution to the supply of the power of the predetermined attribute in each charging infrastructure based on the information stored in the power-feed information storage unit.

[0010]

The charging infrastructure information providing system may further include a plurality of charging infrastructure devices configured to be installed in the plurality of charging infrastructures, respectively, and manage information regarding power fed from a charger of the charging infrastructure to the electric vehicle. Each of the charging infrastructure devices may include a power-feed data transmission unit configured to transmit power-feed data including the information regarding the amount of power fed from the charger to the electric vehicle and attribute information of the power to the charging infrastructure information providing device. The charging infrastructure

information providing device may further include a power-feed data reception unit that receives the power-feed data transmitted from each of the charging infrastructure devices. The power-feed information storage unit of the charging infrastructure information providing device may sequentially store the information regarding the amount of power and the attribute information included in the power-feed data received by the power-feed data reception unit in association therewith.

[0011]

Each of the charging infrastructure devices may further include an attribute information acquisition unit configured to acquire attribute information of power supplied from a commercial power supply installed in the charging infrastructure to the charger. When the power supplied from the commercial power supply to the charger is fed to the electric vehicle, the power-feed data transmission unit of each of the charging infrastructure devices may transmit power-feed data including information regarding an amount of power fed to the electric vehicle and the attribute information of the power acquired by the attribute information acquisition unit.

[0012]

Each of the charging infrastructure devices may further include an attribute information generation unit configured to generate attribute information of power supplied from distributed generation installed in the charging infrastructure to the charger. When the power supplied from the distributed generation to the charger is fed to the electric vehicle, the power-feed data transmission unit of each of the charging infrastructure devices may transmit power-feed data including information regarding an amount of power fed to the electric vehicle and the attribute information of the power generated by the attribute information generation unit.

[0013]

According to another aspect of the present invention, there is provided a charging infrastructure information providing device providing information regarding charging infrastructures to a user of an electric vehicle. The charging infrastructure information providing device includes a charging infrastructure information providing unit configured to preferentially provide information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle.

[0014]

According to still another aspect of the present invention, there is provided a control method of controlling a charging infrastructure information providing device providing information regarding charging infrastructures to a user of an electric vehicle. The control method includes preferentially providing information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle.

[0015]

According to further still another aspect of the present invention, there is provided a program for a charging infrastructure information providing device providing information regarding charging infrastructures to a user of an electric vehicle. The program causes the charging infrastructure information providing device to function as a charging infrastructure information providing unit configured to preferentially provide information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle.

[0016]

In Summary of Invention described above, all of the characteristics necessary

for the present invention are not listed, but sub-combinations of the characteristic groups can also be realized as inventions.

## EFFECTS OF THE INVENTION

[0017]

According to the present invention, as described above, it is possible to encourage operators of charging infrastructures to actively supply power of predetermined attributes to electric vehicles.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 is a diagram illustrating an example of a use environment of a charging infrastructure information providing system 100 according to an embodiment.

Fig. 2 is a diagram illustrating an example of a block configuration of a charging infrastructure information providing device 110.

Fig. 3 is a diagram illustrating an example of information stored in a power feed information storage unit 114 in a table form.

Fig. 4 is a diagram illustrating an example of information stored in a charging infrastructure information storage unit 115 in a table form.

Fig. 5 is a diagram illustrating an example of a block configuration of a charging infrastructure device 130a.

Fig. 6 is a diagram illustrating an example of information stored in an attribute information storage unit 135 in a table form.

Fig. 7 is a diagram illustrating an example of an operation sequence of the charging infrastructure information providing device 110, a charging infrastructure

device 130, a power company device 150, and an on-vehicle device 170.

Fig. 8 is a diagram illustrating an example of a hardware configuration when the charging infrastructure information providing device 110 and the charging infrastructure device 130 are configured by electronic information processing devices such as computers.

## PREFERRED EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0019]

Hereinafter, the present invention will be described according to embodiments of the present invention. Also, the following embodiments do not limit the present invention described in the scope of the claims. Further, all of the combinations of the characteristics to be described in the embodiments may not be said to be requisites for the solutions to problems in the present invention.

[0020]

Fig. 1 is a diagram illustrating an example of a use environment of a charging infrastructure information providing system 100 according to an embodiment. In the use environment of the charging infrastructure information providing system 100, it is assumed that there are a plurality of charging infrastructures Sa, Sb, Sc, etc. (hereinafter generically referred to as charging infrastructures S), a plurality of power companies Ea, Eb, Ec, etc. (hereinafter generically referred to as power companies E), and a plurality of electric vehicles Va, Vb, Vc, etc. (hereinafter generically referred to as electric vehicles V). The charging infrastructure information providing system 100 is a system that provides information regarding the charging infrastructures S to users of the electric vehicles V. More specifically, the charging infrastructure information providing system 100 preferentially provides the users of the electric vehicles V with the information

regarding the charging infrastructure S making a considerable contribution to supply of power of a predetermined attribute. Here, the attribute refers to, for example, information indicating by which power generation method the power is generated. The power generation method is broadly classified into a power generation method using renewable energy and a power generation method using exhaustible energy. Examples of the renewable energy include energies of wind power, solar light, hydraulic power, a biomass, and the like.

Examples of the exhaustible energy include energies of petroleum, natural gas, oil sands, methane hydrate, uranium, and the like. Also, the contribution refers to an action of preferentially employing power of a predetermined attribute by the charging infrastructure S. Specifically, the contribution refers to an action of preferentially employing energy with a low environment load as in renewable energy instead of exhaustible energy.

[0021]

The charging infrastructure information providing system 100 includes a charging infrastructure information providing device 110 and a plurality of charging infrastructure devices 130a, 130b, 130c, etc. (hereinafter generically referred to as charging infrastructure devices 130). The charging infrastructure information providing device 110 and each charging infrastructure device 130 are connected to a communication line N. Also, a plurality of power company devices 150a, 150b, 150c, etc. (hereinafter generically referred to as power company devices 150) and a plurality of on-vehicle devices 170a, 170b, 170c, etc. (hereinafter generically referred to as on-vehicle devices 170) are connected to the communication line N. Here, the communication line N includes computer networks such as the Internet, core networks of communication operators, and various local networks. Also, the on-vehicle device 170

may be an example of a "user terminal of a user" in the present invention.

[0022]

The charging infrastructure information providing device 110 is a device that provides the information regarding the charging infrastructures S to the users of the electric vehicles V. More specifically, the charging infrastructure information providing device 110 receives power-feed data transmitted from each charging infrastructure device 130. The power-feed data includes information regarding an amount of power fed from a charger of the charging infrastructure S to the electric vehicle V and attribute information of the power. Further, the charging infrastructure information providing device 110 sequentially stores the information regarding the amount of power and the attribute information included in the power-feed data received from the charging infrastructure devices 130 in a power-feed information database in association therewith. Furthermore, the charging infrastructure information providing device 110 evaluates a contribution to supply of the power of the predetermined attribute in each charging infrastructure S based on the information stored in the power-feed information database. Here, as a contribution evaluation method, an evaluation method of referring to the absolute values of supply amounts of the power of predetermined attributes or an evaluation method of referring to relative values of the supply amounts of the power of the predetermined attributes is considered. In the evaluation method of referring to the absolute values, for example, when the charging station Sa supplies 10 (kW) of power of a predetermined attribute and the charging station Sb supplies 20 (kW) of power of a predetermined attribute, the charging station Sb is evaluated as making a greater contribution to the supply of the power of the predetermined attribute than the charging station Sa. On the other hand, in the evaluation method of referring to the relative values, for example, when the charging station Sa supplies 100 (kW) of power of various

attributes and supplies 10 (kW) of power of a predetermined attribute among the power of the various attributes and the charging station Sb supplies 400 (kW) of power of various attributes and supplies 20 (kW) of power of a predetermined attribute among the power of the various attributes, a ratio of the power of the predetermined attribute supplied by the charging infrastructure Sa to the power of the various attributes is 10 (%) and a ratio of the power of the predetermined attribute supplied by the charging infrastructure Sb is 5 (%). Accordingly, the charging station Sa is evaluated as making a greater contribution to the supply of the power of the predetermined attribute than the charging station Sb. Further, based on the evaluation result, the charging infrastructure information providing device 110 preferentially provides the on-vehicle devices 170 of the users of the electric vehicles V with the information regarding the charging infrastructure S making the considerable contribution to the supply of the power of the predetermined attribute. Also, the power-feed information database may be an example of a "power-feed information storage unit" in the present invention.

[0023]

The charging infrastructure device 130 is a device that is installed in the charging infrastructure S and manages information regarding power fed from a charger of the charging infrastructure S to an electric vehicle. More specifically, a commercial power supply or a power supply for a charger of a solar light generation system, a storage cell, or the like is assumed to be installed in the charging infrastructure S. Also, operators of the charging infrastructures S are assumed to purchase system power generated by the contracted power companies E. Further, the purchased system power is assumed to be supplied to a charger via a commercial power supply. Also, a storage cell is assumed to be charged with power generated by a solar light generation system. Further, the power discharged from a storage cell is supplied to a charger. That is, a

charger is assumed to be supplied with system power from a commercial power supply or to be supplied with power from a storage cell. When a commercial power supply is installed in the charging infrastructure S, the charging infrastructure device 130 acquires data indicating attribute information of the system power supplied from the commercial power supply to the charger. The attribute information of the system power is, for example, assumed to be provided from the power company device 150 of each power company E. Further, when the power supplied from the commercial power supply to the charger is fed to an electric vehicle, the charging infrastructure device 130 transmits power-feed data including an amount of power fed to the electric vehicle and the attribute information of the power indicated by data received from the power company device 150 to the charging infrastructure information providing device 110. Also, when a solar light generation system and a storage cell are installed in the charging infrastructure S, the charging infrastructure device 130 generates attribute information of power generated by the solar light generation system. Further, when the power supplied from the storage cell to a charger is fed to an electric vehicle, the charging infrastructure device 130 transmits power-feed data including an amount of power fed to the electric vehicle and the attribute information of the generated power to the charging infrastructure information providing device 110. Also, the solar light generation system and the storage cell may be examples of "dispersed generation" in the present invention.

[0024]

The power company device 150 is a device that is operated by each power company E. More specifically, the power company device 150 is a device that provides attribute information of system power supplied by the power company E.

[0025]

The on-vehicle device 170 is a device that is mounted on the electric vehicle V.

More specifically, the on-vehicle device 170 is provided with information regarding the charging infrastructure S from the charging infrastructure information providing device 110.

[0026]

In the present embodiment, to avoid complication of description, a configuration of the charging infrastructure information providing system 100 including one charging infrastructure information providing device 110 will be described. However, the charging infrastructure information providing system 100 may include a plurality of charging infrastructure information providing devices 110.

[0027]

Fig. 2 is a diagram illustrating an example of a block configuration of the charging infrastructure information providing device 110. The charging infrastructure information providing device 110 includes a power-feed data reception unit 111, a contribution evaluation unit 112, a charging infrastructure information providing unit 113, a power-feed information storage unit 114, and a charging infrastructure information storage unit 115. Hereinafter, a function and an operation of each constituent element will be described.

[0028]

The power-feed data reception unit 111 receives the power-feed data transmitted from each of the charging infrastructure devices 130.

[0029]

The contribution evaluation unit 112 evaluates a contribution to the supply of the power of the predetermined attribute in each charging infrastructure S based on the information regarding the amount of power fed to the electric vehicle V in each charging infrastructure S and the attribute information of the power in each charging infrastructure

S. More specifically, the contribution evaluation unit 112 evaluates a contribution to the supply of the power of the predetermined attribute in each charging infrastructure S based on the information stored in the power-feed information storage unit 114.

[0030]

The charging infrastructure information providing unit 113 preferentially provides the on-vehicle device 170 of the electric vehicle V with the information regarding the charging infrastructure S making the considerable contribution to the supply of the power of the predetermined attribute. More specifically, the charging infrastructure information providing unit 113 preferentially provides the information regarding the charging infrastructure S making the considerable contribution to the supply of the power of the predetermined attribute based on the result evaluated by the contribution evaluation unit 112.

[0031]

Fig. 3 is a diagram illustrating an example of the information stored in the power feed information storage unit 114 in a table form. The power feed information storage unit 114 stores information regarding each of charging infrastructure identifiers (IDs), exhaustible energy (kW), and renewable energy (kW) in association therewith. Here, with regard to the exhaustible energy (kW), information regarding each of nuclear power (kW), thermal power (kW), and others (kW) is stored in association therewith. Also, with regard to the renewable energy (kW), information regarding each of solar light (kW), wind power (kW), and others (kW) is stored in association therewith.

[0032]

The charging infrastructure ID is an identification code for uniquely identifying each charging infrastructure S. The nuclear power (kW) is information regarding an amount of power generated by nuclear power generation among the amounts of power

supplied to the electric vehicle V during a predetermined period in the charging infrastructure S identified by the charging infrastructure ID. The thermal power (kW) is information regarding an amount of power generated by the thermal power generation among the amounts of power supplied to the electric vehicle V during a predetermined period in the charging infrastructure S identified by the charging infrastructure ID. The others (kW) of the exhaustible energy (kW) is information regarding amounts of power generated by power generation methods using exhaustible energy other than the nuclear power generation and the thermal power generation among the amounts of power supplied to the electric vehicle V during a predetermined period in the charging infrastructure S identified by the charging infrastructure ID. The solar light (kW) is information regarding an amount of power generated by the solar light generation among the amounts of power supplied to the electric vehicle V during a predetermined period in the charging infrastructure S identified by the charging infrastructure ID. The wind power (kW) is information regarding an amount of power generated by the wind power generation among the amounts of power supplied to the electric vehicle V during a predetermined period in the charging infrastructure S identified by the charging infrastructure ID. The others (kW) of the renewable energy (kW) are information regarding amounts of power generated by power generation methods using renewable energy other than the solar light generation and the wind power generation among the amounts of power supplied to the electric vehicle V during a predetermined period in the charging infrastructure S identified by the charging infrastructure ID.

[0033]

Fig. 4 is a diagram illustrating an example of the information stored in the charging infrastructure information storage unit 115 in a table form. The charging infrastructure information storage unit 115 stores information regarding each of charging

infrastructure IDs, charging infrastructure names, and addresses in association therewith.

[0034]

The charging infrastructure ID is an identification code for uniquely identifying each charging infrastructure S. The charging infrastructure name is the name of the charging infrastructure S identified by the charging infrastructure ID. The address is a location of the charging infrastructure S identified by the charging infrastructure ID.

[0035]

Fig. 5 is a diagram illustrating an example of a block configuration of the charging infrastructure device 130a. The charging infrastructure device 130a includes an attribute information acquisition unit 131a, an attribute information generation unit 132a, a power-feed amount data reception unit 133a, a power-feed data transmission unit 134a, and an attribute information storage unit 135a.

[0036]

The charging infrastructure devices 130b, 130c, etc. other than the charging infrastructure device 130a also include the same constituent elements as the constituent elements included in the charging infrastructure device 130a. In the following description, when the constituent elements included in the charging infrastructure device 130 are distinguished from the constituent elements of the other charging infrastructure devices 130, the same suffix (a, b, c, etc.) as that of the charging infrastructure device 130 including each constituent element is suffixed to each constituent element to distinguish the constituent element from the other constituent elements. For example, the attribute information acquisition unit 131a, an attribute information acquisition unit 131b, and an attribute information acquisition unit 131c indicate the constituent elements of the charging infrastructure device 130a, the charging infrastructure device 130b, and the charging infrastructure device 130c, respectively.

[0037]

Also, in the following description, a function and an operation of the constituent element with no suffix indicates a function and an operation of any constituent element with the same number. For example, a function and an operation described with regard to the attribute information acquisition unit 131 indicate functions and operations of the attribute information acquisition unit 131a, the attribute information acquisition unit 131b, the attribute information acquisition unit 131c, etc. Hereinafter, a function and an operation of each constituent element will be described.

[0038]

The attribute information acquisition unit 131 acquires attribute information regarding power supplied from a commercial power supply and a charger installed in the charging infrastructure S.

[0039]

The attribute information generation unit 132 generates attribute information regarding the power generated by a solar light generation system installed in the charging infrastructure S and supplied from the storage cell to the charger.

[0040]

The power-feed amount data reception unit 133 receives data indicating an amount of power fed from the commercial power supply to the charger, from an electricity meter. Also, the power-feed amount data reception unit 133 receives data indicating the amount of power fed from the storage cell to the charger from the electricity meter.

[0041]

The power-feed data transmission unit 134 transmits power-feed data including information regarding an amount of power fed from the charger to an electric vehicle and

attribute information regarding the power to the charging infrastructure information providing device 110. More specifically, when the power supplied from the commercial power supply to the charger is fed to the electric vehicle V, the power-feed data transmission unit 134 transmits power-feed data including information regarding an amount of power fed to the electric vehicle V and attribute information regarding the power acquired by the attribute information acquisition unit 131. Also, when power generated by the solar light generation system and supplied from the storage cell to the charger is fed the electric vehicle V, the power-feed data transmission unit 134 transmits power-feed data including information regarding an amount of power fed to the electric vehicle V and attribute information of the power generated by the attribute information generation unit 132.

[0042]

Fig. 6 is a diagram illustrating an example of the information stored in the attribute information storage unit 135 in a table form. The attribute information storage unit 135 stores information regarding each of power, exhaustible energy (%), and renewable energy (%) in association therewith. With regard to the exhaustible energy (%), information regarding each of nuclear power (%), thermal power (%), and others (%) is be stored in association therewith. Also, with regard to the renewable energy (%), information regarding each of solar light (%), wind power (%), and others (%) is stored in association therewith.

[0043]

The power supply is information indicating a power supply that supplies power to the charger. The nuclear power (%) is a ratio of power generated by nuclear power generation to the amount of power supplied from the power supply. The thermal power (%) is a ratio of power generated by thermal power generation to the amount of power

supplied from the power supply. The others (%) of the exhaustible energy (%) are ratios of power generated by power generation methods using exhaustible energy other than the nuclear power generation and the thermal power generation to the amount of power supplied from the power supply. The solar light (%) is a ratio of power generated by solar light generation to the amount of power supplied from the power supply. The wind power (%) is a ratio of power generated by wind power generation to the amount of power supplied from the power supply. The others (%) of the renewable energy (%) are ratios of power generated by power generation methods using renewable energy other than the solar light generation and the wind power generation to the amount of power supplied from the power supply.

[0044]

Fig. 7 is a diagram illustrating an example of an operation sequence of the charging infrastructure information providing device 110, the charging infrastructure device 130, the power company device 150, and the on-vehicle device 170. This operation sequence represents operations of evaluating a contribution to supply of power of a predetermined attribute with reference to the absolute value of a supply amount of power generated by solar light generation and preferentially providing the on-vehicle device 170 of the electric vehicle V with information of the charging infrastructure S making a considerable contribution to the supply of the power generated by the solar light generation. In this operation sequence, FIGS. 1 to 6 are all referred to.

[0045]

A commercial power supply is assumed to be installed in the charging infrastructure S as a power supply. Further, the commercial power supply is assumed to be supplied with system power generated by the power companies E contracted with the operator of the charging infrastructure S. Furthermore, the attribute information of the

system power generated by each power company E is assumed to be publicly available. For example, each power company E is assumed to allow the power company device 150 to release the attribute information of the system power it has generated to the World Wide Web (WWW). In this case, the attribute information acquisition unit 131 of the charging infrastructure device 130 acquires the attribute information of the system power released by the power company device 150 (S101). For example, when power generated by a plurality of kinds of power generation methods is mixed and supplied as system power, the attribute information of the system power is considered as information indicating a ratio of the amounts of power generated by each power generation method. Then, the attribute information acquisition unit 131 stores the acquired attribute information of the system power in the attribute information storage unit 135 (S102). Thus, the attribute information of the system power generated by the contracted power companies E and supplied from the commercial power supply to the charger is stored in the attribute information storage unit 135 of the charging infrastructure device 130, as illustrated in FIG. 6.

[0046]

Also, a solar light generation system and a storage cell are further installed as power supplies in the charging infrastructure S in some cases. In this case, the attribute information generation unit 132 of the charging infrastructure device 130 generates attribute information of the power generated by the solar light generation system and supplied from the storage cell to the charger (S103). For example, the attribute information generation unit 132 generates information indicating solar light generation 100 (%) as the attribute information of the power. Then, the attribute information generation unit 132 stores the generated attribute information of the power in the attribute information storage unit 135 (S104). Thus, the attribute information of the

power generated by the solar light generation system and supplied from the storage cell to the charger is stored in the attribute information storage unit 135, as illustrated in FIG. 6.

[0047]

The power fed from the charger to the electric vehicle V is supplied from the commercial power supply or the storage cell. Here, a first electricity meter that measures an amount of power supplied from the commercial power supply to the charger and a second electricity meter that measures an amount of power supplied from the storage cell to the charger are assumed to be installed in the charging station S. When the power is supplied from the commercial power supply to the charger, the first electricity meter measures the amount of supplied power and transmits power-feed amount data indicating the measured value to the charging infrastructure device 130. Likewise, when the power is supplied from the storage cell to the charger, the second electricity meter measures the amount of supplied power and transmits power-feed amount data indicating the measured value to the charging infrastructure device 130. When the power-feed amount data reception unit 133 of the charging infrastructure device 130 receives the power-feed amount data transmitted from the first electricity meter or the second electricity meter (S105), the power-feed amount data reception unit 133 transmits data including information regarding the measured value of the amount of power indicated by the power-feed amount data and information indicating the electricity meter performing the measurement to the power-feed data transmission unit 134.

[0048]

When the power-feed data transmission unit 134 of the charging infrastructure device 130 receives the data transmitted from the power-feed amount data reception unit 133, the power-feed data transmission unit 134 reads the information stored in the

attribute information storage unit 135.

For example, when the data received from the power-feed amount data reception unit 133 includes information indicating that the electricity meter measuring the amount of power is the first electricity meter, the power-feed data transmission unit 134 reads the attribute information stored in association with the power supply "commercial power supply." Also, when the data received from the power-feed amount data reception unit 133 includes information indicating that the electricity meter measuring the amount of power is the second electricity meter, the power-feed data transmission unit 134 reads the attribute information stored in association with the power supply "solar light generation system." Then, the power-feed data transmission unit 134 transmits, to the charging infrastructure information providing device 110, power-feed data including the charging infrastructure ID, the information regarding the measured value of the amount of power included in the data received from the power-feed amount data reception unit 133, and the attribute information read from the attribute information storage unit 135 (S106).

[0049]

Whenever the power is fed to the electric vehicle V in the charging infrastructure S, the charging infrastructure device 130 of each charging infrastructure S repeats the same processes as steps S101 to S106 described above.

[0050]

Whenever the power-feed data reception unit 111 of the charging infrastructure information providing device 110 receives the power-feed data transmitted from the charging infrastructure device 130, the power-feed data reception unit 111 stores the information regarding the amount of power fed to the electric vehicle V in the charging infrastructure S and the attribute information of the power in association therewith based on the information included in the power-feed data in the power-feed information storage

unit 114 (S107). For example, when information regarding the charging infrastructure ID "Sa," an amount of power "10 (kW)," and solar light "100 (%)" is included in the power-feed data, the power-feed data reception unit 111 stores values obtained by adding nuclear power "0 (kW)," thermal power "0 (kW)," and the others "0 (kW)" of the exhaustible energy, and solar light "10 (kW)," wind power "0 (kW)," and the others "0 (kW)" of the renewable energy to values of the respective information stored in association with the charging infrastructure ID "Sa" among the information stored in the power-feed information storage unit 114. Thus, whenever power is fed to the electric vehicle V in the charging infrastructure S, the information regarding the amount of power of each attribute fed in this charging infrastructure S is integrated and stored in the power-feed information storage unit 114.

[0051]

Thus, when the information stored in the power-feed information storage unit 114 is updated, the contribution evaluation unit 112 of the charging infrastructure information providing device 110 evaluates the contribution to the supply of the power of the predetermined attribute in each charging infrastructure S based on the information stored in the power-feed information storage unit 114 (S108). In the case of this example, the contribution evaluation unit 112 evaluates the contribution to the supply of the power generated by a power generation method using the renewable energy. In the case of this example, the contribution evaluation unit 112 evaluates the absolute value of the solar light (kW) associated with each charging infrastructure ID. Then, the contribution evaluation unit 112 transmits, as the evaluation result, data indicating a predetermined number of charging infrastructure IDs to the charging infrastructure information providing unit 113 in order from the larger absolute value of the solar light (kW).

[0052]

When the charging infrastructure information providing unit 113 of the charging infrastructure information providing device 110 receives the data transmitted from the contribution evaluation unit 112, the charging infrastructure information providing unit 113 reads the information stored in the charging infrastructure information storage unit 115. For example, the charging infrastructure information providing unit 113 reads the charging infrastructure name and the address stored in association with each charging infrastructure ID indicated by the data received by the contribution evaluation unit 112. Then, the charging infrastructure information providing unit 113 provides the read information to the on-vehicle device 170 by releasing the information to, for example, the WWW (S109).

[0053]

Thus, the on-vehicle device 170 can acquire the information regarding the charging infrastructure S released by the charging infrastructure information providing device 110. Depending on the information, the information regarding the charging infrastructure S making a considerable contribution to the supply of the power generated by the solar light generation is preferentially introduced. Of course, an increase in attraction of customers in the introduced charging infrastructure S can be expected. Accordingly, this can be predicted to encourage operators of the charging infrastructures S to actively supply the power generated by the solar light generation when they wish to introduce their charging infrastructures S to the users of the electric vehicles V.

[0054]

As described above, the charging infrastructure information providing system 100 can encourage the operators of the charging infrastructures S to actively supply the power of the predetermined attribute to the electric vehicles V.

[0055]

Fig. 8 is a diagram illustrating an example of a hardware configuration when the charging infrastructure information providing device 110 and the charging infrastructure device 130 are configured by electronic information processing devices such as computers. The charging infrastructure information providing device 110 and the charging infrastructure device 130 include a central processing unit (CPU) peripheral unit, an input and output unit, and a legacy input and output unit. The CPU peripheral unit includes a CPU 802, a random access memory (RAM) 803, a graphic controller 804, and a display device 805 connected to each other by a host controller 801. The input and output unit includes a communication interface 807, a hard disk drive 808, and a compact disk read-only memory (CD-ROM) drive 809 connected to the host controller 801 by an input and output controller 806. The legacy input and output unit includes a read-only memory (ROM) 810, a flexible disk drive 811, and an input and output chip 812 connected to the input and output controller 806.

[0056]

The host controller 801 connects the RAM 803 to the CPU 802 and the graphic controller 804 accessing the RAM 803 at a high transmission rate. The CPU 802 operates based on programs stored in the RAM 810 and the RAM 803 and controls each unit. The graphic controller 804 acquires image data generated on a frame buffer formed in the RAM 803 by the CPU 802 or the like and displays the image data on the display device 805. Instead, the graphic controller 804 may include a frame buffer storing the image data generated by the CPU 802 or the like therein.

[0057]

The input and output controller 806 connects the host controller 801 to the communication interface 807, the CD-ROM drive 809, and the hard disk drive 808 which

are relatively high speed input and output devices. The hard disk drive 808 stores a program and data used by the CPU 802. The communication interface 807 connects to a network communication device 891 to transmit and receive a program and data. The CD-ROM drive 809 reads a program or data from the CD-ROM 892 and provides the program or the data to the hard disk drive 808 and the communication interface 807 via the RAM 803.

[0058]

The ROM 810R and relatively low speed input and output devices of the flexible disk drive 811 and the input and output chip 812 are connected to the input and output controller 806. The ROM 810 stores, for example, boot programs executed at the time of activation of the charging infrastructure information providing device 110 and the charging infrastructure device 130 or a program dependent on hardware of the charging infrastructure information providing device 110 and the charging infrastructure device 130. The flexible disk drive 811 reads a program or data from a flexible disk 893 and provides the program or the data to the hard disk drive 808 and the communication interface 807 via the RAM 803. The input and output chip 812 connects various input and output devices via the flexible disk drive 811, a parallel port, a serial port, a keyboard port, a mouse port, or the like.

[0059]

A program executed by the CPU 802 is stored in a recording medium such as the flexible disk 893, the CD-ROM 892, an integrated circuit (IC) card, or the like to be provided to users. The program stored in the recording medium may or may not be compressed. The program is installed from the recording medium to the hard disk drive 808, is read to the RAM 803, and is executed by the CPU 802. The program executed by the CPU 802 causes the charging infrastructure information providing device 110 to

function as the power-feed data reception unit 111, the contribution evaluation unit 112, the charging infrastructure information providing unit 113, the power-feed information storage unit 114, and the charging infrastructure information storage unit 115 described with reference to FIGS. 1 to 7 and causes the charging infrastructure device 130 to function as the attribute information acquisition unit 131, the attribute information generation unit 132, the power-feed amount data reception unit 133, the power-feed data transmission unit 134, and the attribute information storage unit 135 described with reference to FIGS. 1 to 7.

[0060]

The above-described programs may be stored in an external storage medium. Examples of available storage media include not only the flexible disk 893 and the CD-ROM 892 but also an optical storage medium such as a digital versatile disk (DVD) or a phase disk (PD), a magneto-optical storage medium such as a mini disk (MD), a tape medium, and a semiconductor memory such as an IC card. Also, a storage medium such as a hard disk or a RAM provided in a server system connected to a dedicated communication network or the Internet may be used as the storage medium and the above program may be provided as a program via a network.

[0061]

The preferred embodiments of the present invention have been described above, but the present invention is not limited to the foregoing embodiments. Additions, omissions, substitutions, and other changes of the configuration can be made without departing from the gist of the present invention. The present invention is not limited to the above description and is limited only by the appended claims.

## INDUSTRIAL APPLICABILITY

[0062]

The present invention relates to a charging infrastructure information providing system configured to provide information regarding each charging infrastructure to users of electric vehicles. According to the present invention, it is possible to encourage operators of the charging infrastructures to actively supply power of a predetermined attribute to the electric vehicles.

## DESCRIPTION OF THE REFERENCE SYMBOLS

[0063]

100 Charging infrastructure information providing system

110 Charging infrastructure information providing device

111 Power-feed data reception unit

112 Contribution evaluation unit

113 Charging infrastructure information providing unit

114 Power-feed information storage unit

115 Charging infrastructure information storage unit

130 Charging infrastructure device

131 Attribute information acquisition unit

132 Attribute information generation unit

133 Power-feed amount data reception unit

134 Power-feed data transmission unit

135 Attribute information storage unit

150 Power company device

170 On-vehicle device

801 Host controller

802 CPU

803 RAM

804 Graphic controller

805 Display device

806 Input and output controller

807 Communication interface

808 Hard disk drive

809 CD-ROM drive

810 ROM

811 Flexible disk drive

812 Input and output chip

891 Network communication device

892 CD-ROM

893 Flexible disk

E Power company

N Communication line

S Charging infrastructure

V Electric vehicle

# CLAIMS

[Claim 1]

A charging infrastructure information providing system providing information regarding charging infrastructures to a user of an electric vehicle, the charging infrastructure information providing system comprising:

a charging infrastructure information providing device configured to provide the information regarding each charging infrastructure to the user of the electric vehicle,

wherein the charging infrastructure information providing device includes a charging infrastructure information providing unit configured to preferentially provide information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle,

wherein the charging infrastructure information providing device further includes a contribution evaluation unit configured to evaluate a contribution to supply of the power of the predetermined attribute in each charging infrastructure based on information regarding an amount of power fed to the electric vehicle in each charging infrastructure and attribute information of the power, and

wherein the charging infrastructure information providing unit of the charging infrastructure information providing device preferentially provides the information regarding the charging infrastructure making the considerable contribution to the supply of the power of the predetermined attribute based on a result evaluated by the contribution evaluation unit.

[Claim 2]

The charging infrastructure information providing system according to claim 1,

wherein the charging infrastructure information providing device further includes a power-feed information storage unit configured to sequentially store the information regarding the amount of power fed to the electric vehicle in each charging infrastructure and

the attribute information of the power in association therewith, and

wherein the contribution evaluation unit of the charging infrastructure information providing device evaluates the contribution to the supply of the power of the predetermined attribute in each charging infrastructure based on the information stored in the power-feed information storage unit.

[Claim 3]

The charging infrastructure information providing system according to claim 2, further comprising:

a plurality of charging infrastructure devices configured to be installed in the plurality of charging infrastructures, respectively, and manage information regarding power fed from a charger of the charging infrastructure to the electric vehicle,

wherein each of the charging infrastructure devices includes a power-feed data transmission unit configured to transmit power-feed data including the information regarding the amount of power fed from the charger to the electric vehicle and attribute information of the power to the charging infrastructure information providing device,

wherein the charging infrastructure information providing device further includes a power-feed data reception unit that receives the power-feed data transmitted from each of the charging infrastructure devices, and

wherein the power-feed information storage unit of the charging infrastructure information providing device sequentially stores the information regarding the amount of power and the attribute information included in the power-feed data received by the power-feed data reception unit in association therewith.

[Claim 4]

The charging infrastructure information providing system according to claim 3,

wherein each of the charging infrastructure devices further includes an attribute

information acquisition unit configured to acquire attribute information of power supplied from a commercial power supply installed in the charging infrastructure to the charger, and

wherein, when the power supplied from the commercial power supply to the charger is fed to the electric vehicle, the power-feed data transmission unit of each of the charging infrastructure devices transmits power-feed data including information regarding an amount of power fed to the electric vehicle and the attribute information of the power acquired by the attribute information acquisition unit.

[Claim 5]

The charging infrastructure information providing system according to claim 3,

wherein each of the charging infrastructure devices further includes an attribute information generation unit configured to generate attribute information of power supplied from distributed generation installed in the charging infrastructure to the charger, and

wherein, when the power supplied from the distributed generation to the charger is fed to the electric vehicle, the power-feed data transmission unit of each of the charging infrastructure devices transmits power-feed data including information regarding an amount of power fed to the electric vehicle and the attribute information of the power generated by the attribute information generation unit.

[Claim 6]

A charging infrastructure information providing device providing information regarding charging infrastructures to a user of an electric vehicle, the charging infrastructure information providing device comprising:

a charging infrastructure information providing unit configured to preferentially provide information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle

wherein the charging infrastructure information providing unit further includes a contribution evaluation unit configured to evaluate a contribution to supply of the power of the predetermined attribute in each charging infrastructure based on information regarding an amount of power fed to the electric vehicle in each charging infrastructure and attribute information of the power, and

wherein the charging infrastructure information providing unit preferentially provides the information regarding the charging infrastructure making the considerable contribution to the supply of the power of the predetermined attribute based on a result evaluated by the contribution evaluation unit.

[Claim 7]

A control method of controlling a charging infrastructure information providing device providing information regarding charging infrastructures to a user of an electric vehicle, the control method comprising:

preferentially providing information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle;

evaluating a contribution to supply of the power of the predetermined attribute in each charging infrastructure based on information regarding an amount of power fed to the electric vehicle in each charging infrastructure and attribute information of the power; and

preferentially providing the information regarding the charging infrastructure making the considerable contribution to the supply of the power of the predetermined attribute based on a result evaluated by the contribution evaluation unit.

[Claim 8]

A program for a charging infrastructure information providing device providing

information regarding charging infrastructures to a user of an electric vehicle, the program causing the charging infrastructure information providing device to function as a charging infrastructure information providing unit configured to preferentially provide information regarding a charging infrastructure making a considerable contribution to supply of power of a predetermined attribute to a user terminal of the user of the electric vehicle,

wherein the charging infrastructure information providing unit further includes a contribution evaluation unit configured to evaluate a contribution to supply of the power of the predetermined attribute in each charging infrastructure based on information regarding an amount of power fed to the electric vehicle in each charging infrastructure and attribute information of the power, and

wherein the charging infrastructure information providing unit preferentially provides the information regarding the charging infrastructure making the considerable contribution to the supply of the power of the predetermined attribute based on a result evaluated by the contribution evaluation unit.