DESCRIPTION

Title of Invention: BATTERY-ELECTRICITY PROPULSION SHIP ELECTRIC POWER FEED SYSTEM~~, OFFSHORE ELECTRIC POWER FEED FACILITY, AND BATTERY-ELECTRICITY PROPULSION SHIP~~

Technical Field

[0001] The present invention relates to a battery-electricity propulsion ship electric power feed system. Moreover, the present invention relates to an offshore electric power feed facility and a battery-electricity propulsion ship which are suitably used in the battery-electricity propulsion ship electric power feed system.

Background Art

[0002] Battery-electricity propulsion ships have been known (see PTL 1, for example). The battery-electricity propulsion ship is a ship which does not generate electric power for propulsion in the ship but is propelled by the electric power stored in a storage battery. Since the battery-electricity propulsion ship does not discharge combustion gas unlike a mechanical propulsion ship including an internal combustion engine, it influences environments little.

Citation List

Patent Literature

[0003] PTL 1: Japanese Laid-Open Patent Application Publication No. 2013-14222

Summary of Invention

Technical Problem

[0004] Conventionally, when feeding the electric power to the battery-electricity propulsion ship, the battery-electricity propulsion ship is moored at a quay wall, and a rechargeable battery of the battery-electricity propulsion ship is charged by a land electric power feed apparatus.

[0005] ~~An object~~Embodiments of the present invention ~~is to~~ provide a battery-electricity propulsion ship electric power feed system capable of charging a rechargeable battery of a battery-electricity propulsion ship without mooring the battery-electricity propulsion ship at the quay wall. ~~Another object~~Embodiments of the present invention ~~is to~~ provide an offshore electric power feed facility and a battery-electricity propulsion ship which are suitably used in the battery-electricity propulsion ship electric power feed system.

Solution to Problem

[0006] ~~To solve the above problems, a battery-electricity propulsion ship electric power~~

~~feed system of the present invention includes: at least one battery-electricity propulsion ship; and at least one offshore electric power feed facility configured to charge a storage battery of the battery-electricity propulsion ship.~~

According to a first aspect of the present invention, there is provided a battery-electricity propulsion ship electric power feed system including: at least one battery-electricity propulsion ship; and at least one offshore electric power feed facility configured to charge a storage battery of the battery-electricity propulsion ship, wherein: the offshore electric power feed facility is an offshore electric power generation ship configured to generate electric power by using liquefied gas; the at least one battery-electricity propulsion ship includes a plurality of battery-electricity propulsion ships; the battery-electricity propulsion ship electric power feed system includes a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships and the offshore electric power generation ship; the managing apparatus determines a stand-by position of the offshore electric power generation ship based on sail data received from the plurality of battery-electricity propulsion ships, the stand-by position being most suitable for electric power feed to the plurality of battery-electricity propulsion ships; the managing apparatus transmits the determined stand-by position to the offshore electric power generation ship; and the managing apparatus determines the stand-by position of the offshore electric power generation ship based on machine learning results of the sail data of the plurality of battery-electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers.

[0006a] According to a second aspect of the present invention, there is provided a battery-electricity propulsion ship electric power feed system including: at least one battery-electricity propulsion ship; and at least one offshore electric power feed facility configured to charge a storage battery of the battery-electricity propulsion ship, wherein: the at least one battery-electricity propulsion ship includes a plurality of battery-electricity propulsion ships; the at least one offshore electric power feed facility includes a plurality of offshore electric power feed facilities; the battery-electricity propulsion ship electric power feed system includes a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships; the managing apparatus determines charging schedules of the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships, each of the charging schedules containing a charge timing and information specifying the offshore electric power feed facility by which the battery-electricity propulsion ship should be charged; the managing apparatus transmits the determined charging schedules to the corresponding battery-electricity propulsion ships; and the managing apparatus determines charging schedules of the plurality of battery-electricity propulsion ships based on machine learning results of the sail data of the plurality of battery-

electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers.

[0006b] According to a third aspect of the present invention, there is provided a battery-electricity propulsion ship electric power feed system including: at least one battery-electricity propulsion ship; and at least one offshore electric power feed facility configured to charge a storage battery of the battery-electricity propulsion ship, wherein: the at least one battery-electricity propulsion ship includes a plurality of battery-electricity propulsion ships; the battery-electricity propulsion ship electric power feed system includes a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships; the managing apparatus creates a ship allocation plan for the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships; the managing apparatus determines sailing schedules of the plurality of battery-electricity propulsion ships, each of the sailing schedules containing an operation; the managing apparatus transmits the determined sailing schedules to the corresponding battery-electricity propulsion ships; and the managing apparatus determines the stand-by position of the offshore electric power generation ship, sailing schedules of the plurality of battery-electricity propulsion ships based on machine learning results of the sail data of the plurality of battery-electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers.

[0007] According to the above configuration, the rechargeable battery of the battery-electricity propulsion ship can be charged at sea without mooring the battery-electricity propulsion ship at the quay wall.

[0008] The offshore electric power feed facility may be an offshore electric power generation ship configured to generate electric power by using liquefied gas. According to this configuration, the position of the offshore electric power feed facility can be changed in accordance with situations.

[0009] The liquefied gas may be supplied from a land liquefied gas supply apparatus to the offshore electric power generation ship. According to this configuration, since the land liquefied gas supply apparatus is generally equipped with a plurality of large-capacity tanks for storing the liquefied gas, the liquefied gas can be stably supplied to the offshore electric power generation ship according to need.

[0010] The at least one battery-electricity propulsion ship may include a plurality of battery-electricity propulsion ships. The battery-electricity propulsion ship electric power feed system may include a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships and the offshore electric power generation ship. The managing apparatus may determine a stand-by position of the offshore electric power generation ship based on sail data received from the plurality of battery-electricity propulsion

ships, the stand-by position being most suitable for electric power feed to the plurality of battery-electricity propulsion ships. The managing apparatus may transmit the determined stand-by position to the offshore electric power generation ship. According to this configuration, the offshore electric power generation ship can be moved to the stand-by position most suitable for the electric power feed to the plurality of battery-electricity propulsion ships. With this, the distance that each battery-electricity propulsion ship sails for charging can be shortened.

[0011] The at least one battery-electricity propulsion ship may include a plurality of battery-electricity propulsion ships. The at least one offshore electric power ~~generation~~feed facility may include a plurality of offshore electric power generation facilities. The battery-electricity propulsion ship electric power feed system may include a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships. The managing apparatus may determine charging schedules of the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships, each of the charging schedules containing a charge timing and information specifying the offshore electric power ~~generation~~feed facility by which the battery-electricity propulsion ship should be charged. The managing apparatus may transmit the determined charging schedules to the corresponding battery-electricity propulsion ships. According to this configuration, each battery-electricity propulsion ship can be charged in accordance with the charging schedule and therefore can efficiently perform the operation.

[0012] The at least one battery-electricity propulsion ship may include a plurality of battery-electricity propulsion ships. The battery-electricity propulsion ship electric power feed system may include a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships. The managing apparatus may create a ship allocation plan for the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships. The managing apparatus may determine sailing schedules of the plurality of battery-electricity propulsion ships, each of the sailing schedules containing an operation. The managing apparatus may transmit the determined sailing schedules to the corresponding battery-electricity propulsion ships. According to this configuration, the creation of the ship allocation plan can be automated.

[0013] The managing apparatus may determine the stand-by position of the offshore electric power generation ship, charging schedules of the plurality of battery-electricity propulsion ships, and/or sailing schedules of the plurality of battery-electricity propulsion ships based on machine learning results of the sail data of the plurality of battery-electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers. According to this configuration, the charging time of each battery-electricity propulsion ship can be minimized, the operation efficiency of each

battery-electricity propulsion ship can be maximized, and/or the life of the storage battery of each battery-electricity propulsion ship can be maximized.

[0014] The battery-electricity propulsion ship electric power feed system may include at least one land electric power feed facility configured to charge the storage battery of the at least one battery-electricity propulsion ship. According to this configuration, the battery-electricity propulsion ship can be charged not only at sea but also on land.

[0015] The battery-electricity propulsion ship electric power feed system may further include a managing apparatus configured to be communicable with the at least one land electric power feed facility and the offshore electric power feed facility. The managing apparatus may acquire electric power price data of the land electric power feed facility every predetermined time. Based on sail data received from the at least one battery-electricity propulsion ship and the electric power price data, the managing apparatus may determine whether the at least one battery-electricity propulsion ship prioritizes reception of electric power feed from the offshore electric power feed facility or the at least one battery-electricity propulsion ship prioritizes reception of electric power feed from the land electric power feed facility. Specifically, when an electric power price of the land electric power feed facility is lower than an electric power feed price of the offshore electric power feed facility, the managing apparatus may generate such an electric power feed command that the reception of the electric power feed from the land electric power feed facility between the offshore electric power feed facility and the land electric power feed facility is prioritized, and the managing apparatus may transmit the generated electric power feed command to the at least one battery-electricity propulsion ship. When the electric power price of the land electric power feed facility is higher than the electric power feed price of the offshore electric power feed facility, the managing apparatus may generate such an electric power feed command that the reception of the electric power feed from the offshore electric power feed facility between the offshore electric power feed facility and the land electric power feed facility is prioritized, and the managing apparatus may transmit the generated electric power feed command to the at least one battery-electricity propulsion ship. According to this configuration, when the electric power price of the land electric power feed facility (commercial system) is lower than the electric power feed price of the offshore electric power generation ship (i.e., the electric power price calculated from an electric power generation unit price of the offshore electric power generation ship), the battery-electricity propulsion ship receives the electric power from the land electric power feed facility. Moreover, when the electric power price of the land electric power feed facility is higher than the electric power feed price of the offshore electric power generation ship, the battery-electricity propulsion ship receives the electric power from the offshore electric power generation ship. Therefore, the running cost can be improved.

[0016] The offshore electric power feed facility may be an offshore electric power generation ship configured to feed surplus electric power to the land electric power feed facility. When an electric power price of the land electric power feed facility is higher than an electric power feed price of the offshore electric power feed facility, the managing apparatus may determine, based on the sail data received from the at least one battery-electricity propulsion ship, a stand-by position of the offshore electric power generation ship, the stand-by position being most suitable for electric power feed to the at least one battery-electricity propulsion ship, and the managing apparatus may transmit the determined stand-by position to the offshore electric power generation ship. When the offshore electric power generation ship has the surplus electric power after the offshore electric power generation ship feeds electric power to the at least one battery-electricity propulsion ship, the managing apparatus may transmit, to the offshore electric power generation ship, such an electric power selling command that the offshore electric power generation ship sells the surplus electric power to the land electric power feed facility. According to this configuration, when the electric power price of the land electric power feed facility is higher than the electric power feed price of the offshore electric power generation ship, the offshore electric power generation ship moves to the position most suitable for the electric power feed to the battery-electricity propulsion ships. Therefore, the distance that each battery-electricity propulsion ship sails for charging can be shortened. Moreover, since the offshore electric power generation ship can sell the surplus electric power to the land electric power feed facility after the offshore electric power generation ship feeds the electric power to the battery-electricity propulsion ships, the running cost can be improved.

[0017] The at least one battery-electricity propulsion ship may include a plurality of battery-electricity propulsion ships. The plurality of battery-electricity propulsion ships may be configured to feed surplus electric power to the land electric power feed facility. When the electric power price of the land electric power feed facility is higher than the electric power feed price of the offshore electric power feed facility, the managing apparatus may transmit, to the battery-electricity propulsion ship having the surplus electric power among the plurality of battery-electricity propulsion ships, such an electric power selling command that the battery-electricity propulsion ship having the surplus electric power sells the surplus electric power to the land electric power feed facility. According to this configuration, when the electric power price of the land electric power feed facility is higher than the electric power feed price of the offshore electric power feed facility, the battery-electricity propulsion ship having the surplus electric power can sell the surplus electric power to the land electric power feed facility. Therefore, the running cost can be improved.

[0018] The at least one battery-electricity propulsion ship may include a plurality of battery-electricity propulsion ships. The at least one offshore electric power feed facility

may include a plurality of offshore electric power feed facilities. The battery-electricity propulsion ship electric power feed system may include a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships. The managing apparatus may acquire electric power price data of the land electric power feed facility every predetermined time. The managing apparatus may determine charging schedules of the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships and the electric power price data, each of the charging schedules containing a charge timing and information specifying the offshore electric power feed facility or the land electric power feed facility by which the battery-electricity propulsion ship should be charged. The managing apparatus may transmit the determined charging schedules to the corresponding battery-electricity propulsion ships. According to this configuration, each battery-electricity propulsion ship can be charged at the most suitable timing by the offshore electric power ~~generation~~feed facility or the land electric power feed facility in accordance with the charging schedule determined based on the sail data and the electric power price data, and therefore, each battery-electricity propulsion ship can economically and efficiently perform the operation.

[0019] The at least one battery-electricity propulsion ship may include a plurality of battery-electricity propulsion ships. The battery-electricity propulsion ship electric power feed system may include a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships. The managing apparatus may acquire electric power price data of the land electric power feed facility every predetermined time. The managing apparatus may create a ship allocation plan for the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships and the electric power price data. The managing apparatus may determine sailing schedules of the plurality of battery-electricity propulsion ships, each of the sailing schedules containing an operation. The managing apparatus may transmit the determined sailing schedules to the corresponding battery-electricity propulsion ships. According to this configuration, the creation of the ship allocation plan can be automated. In addition, since the battery-electricity propulsion ship sails in accordance with the sailing schedule determined based on the sail data and the electric power price data, the running cost can be improved.

[0020] The at least one offshore electric power feed facility may be configured to receive electric power from the land electric power feed facility. Specifically, the offshore electric power feed facility may be an offshore electric power generation ship including a power generator. The battery-electricity propulsion ship electric power feed system may include a managing apparatus configured to be communicable with the at least one land electric power feed facility and the offshore electric power generation ship. The managing apparatus may acquire electric power price data of the land electric power feed facility every predetermined

time. When electric power generated by the offshore electric power generation ship is insufficient, the managing apparatus may ~~acquire electric power price data of the land electric power feed facility every predetermined time and~~ determine, based on sail data received from the offshore electric power generation ship and the electric power price data, whether the offshore electric power generation ship generates the electric power or receives the electric power from the land electric power feed facility. According to this configuration, whether the electric power generated by the offshore electric power generation ship is supplied to the battery-electricity propulsion ship or the electric power fed from the land electric power feed facility is supplied to the battery-electricity propulsion ship is determined based on the electric power price, the running cost can be improved.

[0021] Moreover, the offshore electric power ~~generation~~feed facility of the present invention is an offshore electric power ~~generation~~feed facility configured to charge a storage battery of a battery-electricity propulsion ship. The offshore electric power ~~generation~~feed facility includes: a power generator; a storage battery configured to store electric power generated by the power generator; and an electric power feed apparatus connected to the storage battery. This offshore electric power ~~generation~~feed facility can be suitably used in the above battery-electricity propulsion ship electric power feed system.

[0022] For example, the offshore electric power ~~generation~~feed facility may further include: a tank configured to store liquefied gas; and an internal combustion engine coupled to the power generator and configured to combust the liquefied gas or vaporized gas of the liquefied gas.

[0023] Moreover, a battery-electricity propulsion ship of the present invention includes a communication apparatus configured to transmit sail data of the battery-electricity propulsion ship. This battery-electricity propulsion ship can be suitably used in the above battery-electricity propulsion ship electric power feed system.

Advantageous Effects of Invention

[0024] According to the present invention, the rechargeable battery of the battery-electricity propulsion ship can be charged without mooring the battery-electricity propulsion ship at the quay wall.

Brief Description of Drawings

[0025] FIG. 1 is a schematic configuration diagram showing a battery-electricity propulsion ship electric power feed system according to Embodiment 1 of the present invention.

FIG. 2 is a graph showing one example of an electric power supply-demand situation in a land electric power feed facility.

FIG. 3 is a schematic configuration diagram showing the battery-electricity propulsion ship electric power feed system according to Embodiment 2 of the present invention.

FIG. 4 is a diagram showing a situation where an electric power feed facility is specified in accordance with a charging schedule.

FIG. 5 is a graph showing one example of a sailing schedule of the battery-electricity propulsion ship.

FIG. 6 is a diagram showing one example of a route corresponding to the sailing schedule.

Description of Embodiments

[0026] **Embodiment 1**

FIG. 1 shows a battery-electricity propulsion ship electric power feed system 1 according to Embodiment 1 of the present invention. The electric power feed system 1 includes a plurality of battery-electricity propulsion ships 2, a plurality of offshore electric power generation ships 3 (corresponding to offshore electric power feed facilities of the present invention), and a managing apparatus 5. It should be noted that the number of battery-electricity propulsion ships 2 may be one, and the number of offshore electric power generation ships 3 may be one.

[0027] In FIG. 1, the electric power feed system 1 is constructed for a single gulf 11 including two ports 12 and 13. However, the electric power feed system 1 may be constructed for a plurality of gulfs.

[0028] In the present embodiment, each battery-electricity propulsion ship 2 is a domestic ship which sails in a domestic sea area. The domestic sea area may denote a domestic sea area of Japan or a domestic sea area of a foreign country. Or, when a plurality of countries are adjacent to each other, the domestic sea area may denote domestic sea areas of those countries. Moreover, each battery-electricity propulsion ship 2 may be an international ship which is engaged in international voyage.

[0029] Examples of the battery-electricity propulsion ship 2 include tugboats, ferries, and various ships for physical distribution (such as container ships, oil tankers, general cargo ships, and chemical ships). For example, the tugboat performs an operation of towing a large ship, and the container ship performs an operation of transporting containers between ports. The operation of each battery-electricity propulsion ship 2 is changed every day.

[0030] Specifically, although not shown, each battery-electricity propulsion ship 2 includes: a propeller drive motor which drives a propeller; and a storage battery which supplies electric power to the propeller drive motor. The storage battery is charged by being connected to a below-described electric power feed apparatus of the offshore electric power

generation ship 3.

[0031] Each offshore electric power generation ship 3 is a ship which generates electric power by using liquefied gas and can charge the storage battery of the battery-electricity propulsion ship 2. Examples of the liquefied gas include LNG (Liquefied Natural Gas) and liquefied hydrogen. In the present embodiment, the offshore electric power generation ship 3 feeds the electric power to the battery-electricity propulsion ship 2 to charge the storage battery of the battery-electricity propulsion ship 2. It should be noted that the storage battery of the battery-electricity propulsion ship 2 does not necessarily have to be charged on the battery-electricity propulsion ship 2. One example may be such that: while the battery-electricity propulsion ship 2 is sailing, a storage battery for replacement is charged on the offshore electric power generation ship 3; and when the battery-electricity propulsion ship 2 is moored at the offshore electric power generation ship 3, the storage battery of the battery-electricity propulsion ship 2 is replaced with the charged storage battery.

[0032] Specifically, although not shown, each offshore electric power generation ship 3 includes: a tank storing the liquefied gas; an internal combustion engine which combusts the liquefied gas or vaporized gas of the liquefied gas; a power generator coupled to the internal combustion engine; a storage battery storing electric power generated by the power generator; and an electric power feed apparatus connected to the storage battery.

[0033] The internal combustion engine of the offshore electric power generation ship 3 may be a reciprocating engine or a gas turbine engine. Or, a gas fired boiler and a steam turbine may be adopted instead of the internal combustion engine. Moreover, when the liquefied gas is the liquefied hydrogen, the offshore electric power generation ship 3 may include a fuel cell which generates electric power by a reaction between hydrogen and oxygen.

[0034] In the present embodiment, the electric power feed system 1 further includes a plurality of liquefied gas supply apparatuses 4 provided on land. Each liquefied gas supply apparatus 4 supplies the liquefied gas to the offshore electric power generation ship 3. For example, the liquefied gas supply apparatus 4 includes a plurality of large-capacity tanks which store the liquefied gas.

[0035] In FIG. 1, two liquefied gas supply apparatuses 4 are provided at the respective ports 12 and 13, and another liquefied gas supply apparatus 4 is provided at a quay wall, not at a port. In the vicinity of the liquefied gas supply apparatus 4, the offshore electric power generation ship 3 is moored at the quay wall.

[0036] Moreover, there is the offshore electric power generation ship 3 arranged at a position away from the quay wall (in FIG. 1, this offshore electric power generation ship 3 is located at the lowermost position). This offshore electric power generation ship 3 may be moored at the above position by an anchor or may be held at the above position by a thruster without using an anchor. The supply of the liquefied gas to this offshore electric power

generation ship 3 is realized by replacing this offshore electric power generation ship 3 with a different offshore electric power generation ship 3.

[0037] In the present embodiment, the managing apparatus 5 is provided on land. However, for example, the managing apparatus 5 may be provided on a floating body type offshore base. Or, the managing apparatus 5 may be mounted on one of the offshore electric power generation ships 3. Or, the managing apparatus 5 may be mounted on each of the plurality of battery-electricity propulsion ships 2 or each of the offshore electric power generation ships 3. Moreover, an information sharing system by which the managing apparatuses 5 mounted on the respective ships mutually share information may be constructed, and each ship on which the managing apparatus 5 is mounted may autonomously perform management based on the shared information.

[0038] The managing apparatus 5 is communicable with the battery-electricity propulsion ships 2 and the offshore electric power generation ships 3. Although not shown, in addition to the above-described configurations, the battery-electricity propulsion ship 2 further includes a communication apparatus and a processing apparatus. Similarly, each of the offshore electric power generation ships 3 and the managing apparatus 5 includes a communication apparatus and a processing apparatus. For example, the processing apparatus is a computer including a memory (such as a ROM and a RAM), a storage (such as a HDD), and a CPU, and programs stored in the ROM or the HDD are executed by the CPU.

[0039] A ship operator of the battery-electricity propulsion ship 2 inputs operation information of the battery-electricity propulsion ship 2 to the processing apparatus every day. The operation information contains a departure port, a departure time, an arrival port, an arrival time, operation contents, and the like.

[0040] The communication apparatus of the battery-electricity propulsion ship 2 transmits the operation information, input to the processing apparatus, as sail data to the managing apparatus 5. Moreover, the communication apparatus of the battery-electricity propulsion ship 2 also transmits the capacity and remaining amount of the storage battery of the battery-electricity propulsion ship 2 as the sail data to the managing apparatus 5. Furthermore, the sail data may contain a propulsion electric power load of the battery-electricity propulsion ship 2, an inboard electric power load of the battery-electricity propulsion ship 2 other than the propulsion electric power load, a ship speed of the battery-electricity propulsion ship 2, and the like.

[0041] Moreover, the communication apparatus of the battery-electricity propulsion ship 2 may transmit operating state data of the storage battery, the propeller drive motor, and the propeller to the managing apparatus 5 together with the sail data of the battery-electricity propulsion ship 2.

[0042] The sail data transmitted from the battery-electricity propulsion ship 2 is received

by the communication apparatus of the managing apparatus 5. Based on the sail data of the battery-electricity propulsion ships 2, the processing apparatus of the managing apparatus 5 determines stand-by positions of the offshore electric power generation ships 3, the stand-by positions being most suitable for electric power feed to all the battery-electricity propulsion ships 2. The communication apparatus of the managing apparatus 5 transmits the stand-by positions of the offshore electric power generation ships 3, determined by the processing apparatus, to the offshore electric power generation ships 3.

[0043] Each stand-by position transmitted from the managing apparatus 5 is received by the communication apparatus of the offshore electric power generation ship 3 and is output to, for example, a monitor by the processing apparatus. A ship operator of the offshore electric power generation ship 3 moves the offshore electric power generation ship 3 to the stand-by position.

[0044] Moreover, the processing apparatus of the managing apparatus 5 determines charging schedules of the battery-electricity propulsion ships 2 based on the sail data of all the battery-electricity propulsion ships 2. Each charging schedule contains a charge timing and information specifying the offshore electric power generation ship 3 by which the battery-electricity propulsion ship 2 should be charged. The communication apparatus of the managing apparatus 5 transmits the charging schedules of the battery-electricity propulsion ships 2, determined by the processing apparatus, to the corresponding battery-electricity propulsion ships 2.

[0045] Each charging schedule transmitted from the managing apparatus 5 is received by the communication apparatus of the battery-electricity propulsion ship 2 and is output to, for example, a monitor by the processing apparatus. The ship operator of the battery-electricity propulsion ship 2 controls the battery-electricity propulsion ship 2 between the operations in accordance with the charging schedule so as to be charged by the specified offshore electric power generation ship 3.

[0046] Moreover, the processing apparatus of the managing apparatus 5 acquires offshore weather data containing wave information and wind information from an outside agency, such as the Meteorological Agency, through the Internet, for example. Then, the processing apparatus of the managing apparatus 5 determines based on the offshore weather data whether electric power feed from the offshore electric power generation ship 3 to the battery-electricity propulsion ship 2 is possible or not.

[0047] According to the electric power feed system 1 configured as above, a rechargeable battery of the battery-electricity propulsion ship 2 can be charged at sea without mooring the battery-electricity propulsion ship 2 at the quay wall.

[0048] Moreover, in the present embodiment, since the managing apparatus 5 determines the stand-by positions most suitable for electric power feed to all the battery-electricity

propulsion ships 2, the offshore electric power generation ships 3 can be moved to the stand-by positions. With this, the distance that each battery-electricity propulsion ship 2 sails for charging can be shortened.

[0049] Moreover, in the present embodiment, since the managing apparatus 5 determines the charging schedule of each battery-electricity propulsion ship 2, the battery-electricity propulsion ship 2 can be charged in accordance with the charging schedule. Therefore, the battery-electricity propulsion ship 2 can efficiently perform the operation.

[0050] **Modified Example**

The present invention is not limited to the above embodiment, and various modifications may be made within the scope of the present invention.

[0051] For example, the offshore electric power ~~generation~~feed facility of the present invention does not necessarily have to be the offshore electric power generation ship 3 which generates electric power by using the liquefied gas and may be a floating body type electric power ~~generation~~feed facility which generates electric power by offshore wind power and is fixed at a certain position. It should be noted that when the offshore electric power ~~generation~~feed facility is the offshore electric power generation ship 3 as in the above embodiment, the position of the offshore electric power ~~generation~~feed facility can be changed in accordance with situations. Moreover, when the offshore electric power ~~generation~~feed facility is the offshore electric power generation ship 3 which generates electric power by using the liquefied gas, the offshore electric power ~~generation~~feed facility can deal with recent severe environmental regulations unlike a case where oil, such as heavy oil, is used as fuel.

[0052] Moreover, the offshore electric power generation ship 3 does not necessarily have to be supplied with the liquefied gas from the liquefied gas supply apparatus 4 provided on land and may be supplied with the liquefied gas from a liquefied gas supply apparatus provided at sea. Examples of such liquefied gas supply apparatus provided at sea include a floating body type liquefied gas base and a liquefied gas transport ship. It should be noted that when the liquefied gas supply apparatus 4 provided on land supplies the liquefied gas to the offshore electric power generation ship 3 as in the above embodiment, the liquefied gas supply apparatus 4 provided on land is generally equipped with a plurality of large-capacity tanks storing the liquefied gas, and therefore, the liquefied gas can be stably supplied to the offshore electric power generation ship 3 according to need.

[0053] Moreover, every day, the managing apparatus 5 may create a ship allocation plan for all the battery-electricity propulsion ships 2 based on the sail data of all the battery-electricity propulsion ship 2, determine the sailing schedules containing the operations of the battery-electricity propulsion ships 2, and transmit the determined sailing schedules to the corresponding battery-electricity propulsion ships 2. According to this configuration, the

creation of the ship allocation plan can be automated.

[0054] Moreover, the managing apparatus 5 may determine the stand-by positions of the offshore electric power generation ships 3, the charging schedules of the battery-electricity propulsion ships 2, and/or the sailing schedules of the battery-electricity propulsion ships 2 based on machine learning results of the sail data of all the battery-electricity propulsion ships 2 and the operating state data of the storage batteries, the propeller drive motors, and the propellers. According to this configuration, a charging time of the battery-electricity propulsion ship 2 can be minimized, operation efficiency of the battery-electricity propulsion ship 2 can be maximized, and/or the life of the storage battery of the battery-electricity propulsion ship 2 can be maximized.

[0055] Moreover, the above embodiment is described on the basis that the ship operator boards the battery-electricity propulsion ship 2. However, the battery-electricity propulsion ship 2 may be an unmanned ship. In this case, the battery-electricity propulsion ship 2 is automatically controlled based on the charging schedule, the sailing schedule, and the like transmitted from the managing apparatus 5. Similarly, the offshore electric power generation ship 3 may also be an unmanned ship.

[0056] **Embodiment 2**

The present inventors have diligently studied in order to improve the efficiency of the running cost of the electric power feed system 1. In recent years, the utilization of nuclear energy is being significantly restricted, but renewable energy, such as solar power, is started to be positively utilized. Therefore, the present inventors have focused on such electric power feed facility on land and studied the applicability thereof.

[0057] FIG. 2 is a graph showing one example of an electric power supply-demand situation in a land electric power feed facility. The graph in FIG. 2 shows the electric power supply-demand situation of one day in summer. This land electric power feed facility performs thermal power generation, solar power generation, wind power generation, and water power generation but does not perform nuclear power generation. As shown in FIG. 2, since the land electric power feed facility depends on the thermal power generation and the solar power generation, electric power is in excess on land in a daytime (6:00 to 18:00), and the price of the electric power of the land electric power feed facility lowers. In contrast, in a nighttime (18:00 to 6:00), electric power becomes insufficient on land, and the price of the electric power of the land electric power feed facility rises. Therefore, the present inventors have compared and studied the electric power price of the land electric power feed facility which changes depending on time, weather condition, and the like and the electric power price calculated from an electric power generation unit price of the offshore electric power generation ship. As a result, the present inventors have found that: from which one of the electric power feed facilities the battery-electricity propulsion ship should be supplied with

electric power is determined in accordance with the sail data received from the battery-electricity propulsion ship, the electric power feed price of the offshore electric power feed facility, and the electric power price of the land electric power feed facility; and with this, the running cost of the entire electric power feed system can be improved.

[0058] In order to stably supply the electric power generated by the land electric power feed facility shown in FIG. 2, the land electric power feed facility needs to continuously operate while realizing the highest electric power generation efficiency. Moreover, a problem in which the necessary amount of electric power cannot be secured occurs when the thermal power generation stops, when in a nighttime in which the solar power generation is not performed, or when the expected amount of solar power is not obtained due to a sunshine condition even in a daytime. Therefore, the present inventors have studied cost effectiveness when surplus electric power of the offshore electric power feed ship and the battery-electricity propulsion ship at the time of the system operation is assumed; and such surplus electric power is sold to the land electric power feed facility. As a result, the present inventors have found that: when both the offshore electric power feed ship and the battery-electricity propulsion ship have the surplus electric power, the surplus electric power is sold to the land electric power feed facility in accordance with the electric power feed price of the offshore electric power feed facility and the electric power price of the land electric power feed facility; and with this, the running cost of the entire electric power feed system can be further improved.

[0059] The present inventors have arrived at the present invention based on the above findings. Hereinafter, the embodiment of the present invention will be described with reference to the attached drawings.

[0060] FIG. 3 shows a battery-electricity propulsion ship electric power feed system 1A according to Embodiment 2 of the present invention. As shown in FIG. 3, the electric power feed system 1A of the present embodiment is different from Embodiment 1 (FIG. 1) in that the electric power feed system 1A includes a land electric power feed facility 20 provided on land. In FIG. 3, the single land electric power feed facility 20 capable of charging the storage battery of the battery-electricity propulsion ship 2 is provided at the port 13. It should be noted that the number of land electric power feed facilities 20 may be plural.

[0061] The land electric power feed facility 20 is, for example, a commercial system. The land electric power feed facility 20 includes an electric power supply station 21, a thermal power generation system 22, a solar power generation system 23, a wind power generation system 24, and a hydroelectric power generation system 25. It should be noted that the land electric power feed facility 20 may include an electric power generation system which utilizes the other natural energy. The electric power supply station 21 can feed the electric power, generated by the power generation systems 22 to 25, to the battery-electricity

propulsion ship 2 to charge the storage battery of the battery-electricity propulsion ship 2. It should be noted that the storage battery of the battery-electricity propulsion ship 2 does not necessarily have to be charged by the electric power supply station 21. One example may be such that: while the battery-electricity propulsion ship 2 is sailing, a storage battery for replacement is charged by the electric power supply station 21; and when the battery-electricity propulsion ship 2 is moored at the port 13, the storage battery of the battery-electricity propulsion ship 2 is replaced with the charged storage battery. It should be noted that although not shown, the electric power supply station 21 includes a communication apparatus and a processing apparatus in addition to the above-described configurations.

[0062] Moreover, the surplus electric power of the storage battery of the battery-electricity propulsion ship 2 and the surplus electric power of the storage battery of the offshore electric power generation ship 3 can be sold to the land electric power feed facility 20. To be specific, the battery-electricity propulsion ship 2 can feed the surplus electric power to the land electric power feed facility 20 (electric power supply station 21). Similarly, the offshore electric power generation ship 3 can feed the surplus electric power to the land electric power feed facility 20.

[0063] The managing apparatus 5 is communicable with the land electric power feed facility 20 and can acquire electric power price data of the land electric power feed facility 20 from the land electric power feed facility 20 every predetermined time. The managing apparatus 5 may directly receive the electric power price data from the land electric power feed facility 20 or may indirectly receive the electric power price data from the other facility through a network.

[0064] In the present embodiment, the managing apparatus 5 acquires the electric power price data of the land electric power feed facility 20 every predetermined time and compares the electric power price of the land electric power feed facility 20 with the electric power feed price of the offshore electric power generation ship 3. It should be noted that the electric power feed price of the offshore electric power generation ship 3 denotes an electric power price calculated from the electric power generation unit price of the offshore electric power generation ship 3. When the electric power price of the land electric power feed facility 20 is lower than the electric power feed price of the offshore electric power generation ship 3, the managing apparatus 5 generates, based on the sail data received from all the battery-electricity propulsion ships 2, such an electric power feed command that the reception of the electric power feed from the land electric power feed facility 20 between the offshore electric power generation ship 3 and the land electric power feed facility 20 is prioritized. Then, the managing apparatus 5 transmits the generated electric power feed command to the battery-electricity propulsion ships 2. The electric power feed command transmitted from the managing apparatus 5 is received by the communication apparatus of each battery-electricity

propulsion ship 2 and is output to, for example, the monitor by the processing apparatus. The ship operator of each battery-electricity propulsion ship 2 controls the battery-electricity propulsion ship 2 between the operations in accordance with the electric power feed command such that the battery-electricity propulsion ship 2 is charged by the land electric power feed facility 20.

[0065] On the other hand, when the electric power price of the land electric power feed facility 20 is higher than the electric power feed price of the offshore electric power generation ship 3, the managing apparatus 5 generates, based on the sail data received from all the battery-electricity propulsion ships 2, such an electric power feed command that the reception of the electric power feed from the offshore electric power generation ship 3 between the offshore electric power generation ship 3 and the land electric power feed facility 20 is prioritized. Then, the managing apparatus 5 transmits the generated electric power feed command to the battery-electricity propulsion ships 2. The electric power feed command transmitted from the managing apparatus 5 is received by the communication apparatus of each battery-electricity propulsion ship 2 and is output to, for example, the monitor by the processing apparatus. The ship operator of each battery-electricity propulsion ship 2 controls the battery-electricity propulsion ship 2 between the operations in accordance with the electric power feed command such that the battery-electricity propulsion ship 2 is charged by the specified offshore electric power generation ship 3. It should be noted that the managing apparatus 5 may transmit, to the battery-electricity propulsion ship 2 having the surplus electric power, such an electric power selling command that the battery-electricity propulsion ship 2 having the surplus electric power sells the surplus electric power to the land electric power feed facility 20 between the operations.

[0066] At this time, the managing apparatus 5 determines the stand-by position of the offshore electric power generation ship 3 based on the sail data received from all the battery-electricity propulsion ships 2, the stand-by position being most suitable for the electric power feed to all the battery-electricity propulsion ships 2. Then, the managing apparatus 5 transmits the determined stand-by position to the offshore electric power generation ship 3. The stand-by position transmitted from the managing apparatus 5 is received by the communication apparatus of the offshore electric power generation ship 3 and is output to, for example, the monitor by the processing apparatus. The ship operator of the offshore electric power generation ship 3 moves the offshore electric power generation ship 3 to the stand-by position. Moreover, when the offshore electric power generation ship 3 has the surplus electric power after the offshore electric power generation ship 3 feeds the electric power to all the battery-electricity propulsion ships 2, the managing apparatus 5 transmits, to the offshore electric power generation ship 3, such an electric power selling command that the offshore electric power generation ship 3 sells the surplus electric power to the land electric

power feed facility 20.

[0067] In the electric power feed system 1A having the above-described configuration, when the electric power price of the land electric power feed facility 20 is lower than the electric power feed price of the offshore electric power generation ship 3, the battery-electricity propulsion ship 2 can receive the electric power from the land electric power feed facility 20. Moreover, when the electric power price of the land electric power feed facility 20 is higher than the electric power feed price of the offshore electric power generation ship 3, the battery-electricity propulsion ship 2 can receive the electric power from the offshore electric power generation ship 3. Therefore, the running cost can be improved.

[0068] In the present embodiment, when the electric power price of the land electric power feed facility 20 is higher than the electric power feed price of the offshore electric power generation ship 3, the offshore electric power generation ship 3 moves to a position most suitable for the electric power feed to the respective battery-electricity propulsion ships 2. Therefore, the distance that each battery-electricity propulsion ship 2 sails for charging can be shortened. Moreover, after the offshore electric power generation ship 3 feeds the electric power to the battery-electricity propulsion ships 2, the offshore electric power generation ship 3 can sell the surplus electric power to the land electric power feed facility 20. Therefore, the running cost can be improved.

[0069] Moreover, in the present embodiment, when the electric power price of the land electric power feed facility 20 is higher than the electric power feed price of the offshore electric power generation ship 3, the battery-electricity propulsion ship 2 having the surplus electric power among the plurality of battery-electricity propulsion ships 2 feeds the surplus electric power to the land electric power feed facility 20. With this, even in a nighttime or even when the expected amount of solar power is not obtained due to a sunshine condition, the land electric power feed facility 20 can secure the necessary amount of electric power. Therefore, the running cost can be improved.

[0070] **Modified Example**

The present invention is not limited to the above-described embodiments, and various modifications may be made within the scope of the present invention.

[0071] For example, the managing apparatus 5 may acquire the electric power price data of the land electric power feed facility 20 every predetermined time and determine the charging schedules of the battery-electricity propulsion ships 2 based on the sail data received from all the battery-electricity propulsion ships 2 and the electric power price data. It should be noted that each charging schedule contains the charge timing and the information specifying the offshore electric power generation ship 3 or the land electric power feed facility 20 by which the battery-electricity propulsion ship 2 should be charged. The communication apparatus of the managing apparatus 5 transmits the charging schedules,

determined by the processing apparatus, to the corresponding battery-electricity propulsion ships 2.

[0072] FIG. 4 shows a situation where the electric power feed facility is specified in accordance with the charging schedule. For convenience of explanation, only one battery-electricity propulsion ship 2 which needs to be charged and only one offshore electric power generation ship 3 are shown at sea. In FIG. 4, a movement path 30 is a path from the battery-electricity propulsion ship 2 to the offshore electric power generation ship 3, and a path 31 is a path from the battery-electricity propulsion ship 2 to the land electric power feed facility 20. The movement distance of the path 30 and the movement distance of the path 31 are equal to each other. Since the charging schedule reflects the electric power price data, the electric power feed facility (for example, the offshore electric power generation ship 3) having the low electric power price is specified as the electric power feed facility by which the battery-electricity propulsion ship 2 should be fed with the electric power. According to this configuration, in accordance with the charging schedule determined based on the sail data and the electric power price data, each battery-electricity propulsion ship 2 can be charged by the offshore electric power generation ship 3 or the land electric power feed facility 20 at the most suitable timing. Therefore, each battery-electricity propulsion ship 2 can economically and efficiently perform the operation.

[0073] Moreover, every day, the managing apparatus 5 may create the ship allocation plan for all the battery-electricity propulsion ships 2 based on the sail data received from all the battery-electricity propulsion ships 2 and the electric power price data, determine the sailing schedules containing the operations of the battery-electricity propulsion ships 2, and transmit the determined sailing schedules to the corresponding battery-electricity propulsion ships 2.

[0074] FIG. 5 is a graph showing one example of a one-day sailing schedule of the battery-electricity propulsion ship 2. In FIG. 5, a vertical axis denotes electric power necessary for each operation of the battery-electricity propulsion ship 2. FIG. 6 is a diagram showing one example of a route 32 corresponding to the sailing schedule. For convenience of explanation, one battery-electricity propulsion ship 2 and one offshore electric power generation ship 3 are shown, and the route 32 corresponding to a schedule in the morning. First, as shown in FIG. 6, the battery-electricity propulsion ship 2 departs from the port 12 early in the morning in accordance with the sailing schedule (TRANSIT). Then, the battery-electricity propulsion ship 2 stands by at an offshore position in the vicinity of an entrance of the gulf 11. Next, the battery-electricity propulsion ship 2 escorts the large ship 6, which has arrived at the offshore position, to the port 13. Finally, the battery-electricity propulsion ship 2 positions and moors the large ship 6 at the quay wall of the port 13 (BOLLARD). Thus, the operation in the morning terminates. The battery-electricity propulsion ship 2 restarts the

operation in the afternoon after the mooring at the port 13 for a certain period of time. The battery-electricity propulsion ship 2 needs to be charged several times a day due to the restriction of the capacity of the storage battery. In a time period between the operations, such as before or after the departure from the port 12 or 13, or during the stand-by at sea, the battery-electricity propulsion ship 2 can receive the electric power from the offshore electric power generation ship 3 or the land electric power feed facility 20 based on the electric power feed price of the offshore electric power generation ship 3 and the electric power price of the land electric power feed facility 20 in accordance with the sailing schedule.

[0075] According to this configuration, the creation of the ship allocation plan can be automated. In addition, since the battery-electricity propulsion ship 2 sails in accordance with the sailing schedule determined based on the sail data and the electric power price data, the running cost can be improved.

[0076] In the above embodiments, the offshore electric power generation ship 3 simply supplies the electric power, generated by the power generator, to the battery-electricity propulsion ship 2 and the land electric power feed facility 20. However, the offshore electric power generation ship 3 may be configured to receive electric power from the land electric power feed facility 20. For example, the electric power generated by the power generation systems 22 to 25 of the land electric power feed facility 20 may be fed to the offshore electric power generation ship 3, and this may charge the storage battery of the offshore electric power generation ship 3 (see FIG. 3).

[0077] The managing apparatus 5 is communicable with the offshore electric power generation ship 3 and receives the operation information of the offshore electric power generation ship 3 and the sail data containing, for example, the capacity and remaining amount of the storage battery of the offshore electric power generation ship 3.

[0078] The managing apparatus 5 receives the electric power price data of the land electric power feed facility 20 every predetermined time. When the electric power generated by the offshore electric power generation ship 3 is insufficient, whether to generate the electric power by the offshore electric power generation ship 3 or receive the electric power from the land electric power feed facility 20 is determined based on the sail data received from the offshore electric power generation ship 3 and the electric power price data. Specifically, when the electric power price of the land electric power feed facility 20 is lower than the electric power feed price of the offshore electric power generation ship 3, the managing apparatus 5 generates such a command that the reception of the electric power feed from the land electric power feed facility 20 is prioritized. Then, the managing apparatus 5 transmits the generated electric power feed command to the offshore electric power generation ship 3. In contrast, when the electric power price of the land electric power feed facility 20 is higher than the electric power feed price of the offshore electric power

generation ship 3, the managing apparatus 5 generates such a command that the electric power generation by the offshore electric power generation ship 3 is prioritized. Then, the managing apparatus 5 transmits the generated command to the offshore electric power generation ship 3. As above, since it is determined based on the electric power price that the electric power generated by the offshore electric power generation ship 3 is supplied to battery-electricity propulsion ship 2 or the electric power fed from the land electric power feed facility 20 is supplied to the battery-electricity propulsion ship 2, the running cost can be improved.

[0079] Moreover, in the above embodiments, the offshore electric power generation ship 3 generates the electric power by using the liquefied gas. However, the offshore electric power generation ship 3 may generate the electric power by using LPG (Liquefied Petroleum Gas), biofuel, or hydrogen. Furthermore, the "offshore electric power feed facility" of the present invention does not necessarily have to include an electric power ~~generation~~feed facility. For example, a charged storage battery for replacement may be loaded on a surface ship in advance, and the storage battery of the battery-electricity propulsion ship 2 may be replaced with the charged storage battery when the battery-electricity propulsion ship 2 is moored at the surface ship. Or, the electric power charged in a storage battery of the surface ship may be fed to the storage battery of the battery-electricity propulsion ship 2 through a cable.

Reference Signs List

[0080]
1, 1A battery-electricity propulsion ship electric power feed system
2 battery-electricity propulsion ship
3 offshore electric power generation ship (offshore electric power feed facility)
4 liquefied gas supply apparatus
5 managing apparatus
6 large ship
20 land electric power feed facility
21 electric power supply station
22 thermal power generation system
23 solar power generation system
24 wind power generation system
25 hydroelectric power generation system
30, 31 path
32 route

CLAIMS

1. A battery-electricity propulsion ship electric power feed system comprising:

at least one battery-electricity propulsion ship; and

at least one offshore electric power feed facility configured to charge a storage battery of the battery-electricity propulsion ship,~~,~~ wherein:

the offshore electric power feed facility is an offshore electric power generation ship configured to generate electric power by using liquefied gas;

the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;

the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships and the offshore electric power generation ship;

the managing apparatus determines a stand-by position of the offshore electric power generation ship based on sail data received from the plurality of battery-electricity propulsion ships, the stand-by position being most suitable for electric power feed to the plurality of battery-electricity propulsion ships;

the managing apparatus transmits the determined stand-by position to the offshore electric power generation ship; and

the managing apparatus determines the stand-by position of the offshore electric power generation ship based on machine learning results of the sail data of the plurality of battery-electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers.

2. A battery-electricity propulsion ship electric power feed system comprising:

at least one battery-electricity propulsion ship; and

at least one offshore electric power feed facility configured to charge a storage battery of the battery-electricity propulsion ship, wherein:

the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;

the at least one offshore electric power feed facility comprises a plurality of offshore electric power feed facilities;

the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity

propulsion ships;

the managing apparatus determines charging schedules of the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships, each of the charging schedules containing a charge timing and information specifying the offshore electric power feed facility by which the battery-electricity propulsion ship should be charged;

the managing apparatus transmits the determined charging schedules to the corresponding battery-electricity propulsion ships; and

the managing apparatus determines charging schedules of the plurality of battery-electricity propulsion ships based on machine learning results of the sail data of the plurality of battery-electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers.

3. A battery-electricity propulsion ship electric power feed system comprising:

at least one battery-electricity propulsion ship; and

at least one offshore electric power feed facility configured to charge a storage battery of the battery-electricity propulsion ship, wherein:

the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;

the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships;

the managing apparatus creates a ship allocation plan for the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships;

the managing apparatus determines sailing schedules of the plurality of battery-electricity propulsion ships, each of the sailing schedules containing an operation;

the managing apparatus transmits the determined sailing schedules to the corresponding battery-electricity propulsion ships; and

the managing apparatus determines the stand-by position of the offshore electric power generation ship, sailing schedules of the plurality of battery-electricity propulsion ships based on machine learning results of the sail data of the plurality of battery-electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers.

42. The battery-electricity propulsion ship electric power feed system according to claim 2 or 31, wherein the offshore electric power feed facility is an offshore electric power generation ship configured to generate electric power by using liquefied gas.

53. The battery-electricity propulsion ship electric power feed system according to claim 1 or 42, wherein the liquefied gas is supplied from a land liquefied gas supply apparatus to the offshore electric power generation ship.

~~4. The battery-electricity propulsion ship electric power feed system according to claim 2 or 3, wherein:~~

~~the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;~~

~~the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships and the offshore electric power generation ship;~~

~~the managing apparatus determines a stand-by position of the offshore electric power generation ship based on sail data received from the plurality of battery-electricity propulsion ships, the stand-by position being most suitable for electric power feed to the plurality of battery-electricity propulsion ships; and~~

~~the managing apparatus transmits the determined stand-by position to the offshore electric power generation ship.~~

~~5. The battery-electricity propulsion ship electric power feed system according to any one of claims 1 to 4, wherein:~~

~~the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;~~

~~the at least one offshore electric power feed facility comprises a plurality of offshore electric power feed facilities;~~

~~the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships;~~

~~the managing apparatus determines charging schedules of the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships, each of the charging schedules containing a charge timing and information~~

~~specifying the offshore electric power generation facility by which the battery-electricity propulsion ship should be charged; and~~

~~the managing apparatus transmits the determined charging schedules to the corresponding battery-electricity propulsion ships.~~

~~6. The battery-electricity propulsion ship electric power feed system according to any one of claims 1 to 5, wherein:~~

~~the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;~~

~~the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships;~~

~~the managing apparatus creates a ship allocation plan for the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships;~~

~~the managing apparatus determines sailing schedules of the plurality of battery-electricity propulsion ships, each of the sailing schedules containing an operation; and~~

~~the managing apparatus transmits the determined sailing schedules to the corresponding battery-electricity propulsion ships.~~

~~7. The battery-electricity propulsion ship electric power feed system according to any one of claims 4 to 6, wherein:~~

~~the managing apparatus determines the stand-by position of the offshore electric power generation ship, charging schedules of the plurality of battery-electricity propulsion ships, and/or sailing schedules of the plurality of battery-electricity propulsion ships based on machine learning results of the sail data of the plurality of battery-electricity propulsion ships and machine learning results of operating state data of the storage batteries, propeller drive motors, and propellers.~~

6~~8~~. The battery-electricity propulsion ship electric power feed system according to any one of claims 1 to 5~~3~~, further comprising at least one land electric power feed facility configured to charge the storage battery of the at least one battery-electricity propulsion ship.

79. The battery-electricity propulsion ship electric power feed system according to claim 68, further comprising a managing apparatus configured to be communicable with the at least one land electric power feed facility and the offshore electric power feed facility, wherein:

the managing apparatus acquires electric power price data of the land electric power feed facility every predetermined time; and

based on sail data received from the at least one battery-electricity propulsion ship and the electric power price data, the managing apparatus determines whether the at least one battery-electricity propulsion ship prioritizes reception of electric power feed from the offshore electric power feed facility or the at least one battery-electricity propulsion ship prioritizes reception of electric power feed from the land electric power feed facility.

810. The battery-electricity propulsion ship electric power feed system according to claim 79, wherein:

when an electric power price of the land electric power feed facility is lower than an electric power feed price of the offshore electric power feed facility, the managing apparatus generates such an electric power feed command that the reception of the electric power feed from the land electric power feed facility between the offshore electric power feed facility and the land electric power feed facility is prioritized, and the managing apparatus transmits the generated electric power feed command to the at least one battery-electricity propulsion ship; and

when the electric power price of the land electric power feed facility is higher than the electric power feed price of the offshore electric power feed facility, the managing apparatus generates such an electric power feed command that the reception of the electric power feed from the offshore electric power feed facility between the offshore electric power feed facility and the land electric power feed facility is prioritized, and the managing apparatus transmits the generated electric power feed command to the at least one battery-electricity propulsion ship.

911. The battery-electricity propulsion ship electric power feed system according to claim 7 or 8 ~~9 or 10~~, wherein:

the offshore electric power feed facility is an offshore electric power generation ship configured to feed surplus electric power to the land electric power feed facility;

when an electric power price of the land electric power feed facility is higher than an electric power feed price of the offshore electric power feed facility, the managing apparatus determines, based on the sail data received from the at least one battery-electricity propulsion

ship, a stand-by position of the offshore electric power generation ship, the stand-by position being most suitable for electric power feed to the at least one battery-electricity propulsion ship, and the managing apparatus transmits the determined stand-by position to the offshore electric power generation ship; and

when the offshore electric power generation ship has the surplus electric power after the offshore electric power generation ship feeds electric power to the at least one battery-electricity propulsion ship, the managing apparatus transmits, to the offshore electric power generation ship, such an electric power selling command that the offshore electric power generation ship sells the surplus electric power to the land electric power feed facility.

10~~12~~. The battery-electricity propulsion ship electric power feed system according to claim 8~~10~~, wherein:

the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;

the plurality of battery-electricity propulsion ships are configured to feed surplus electric power to the land electric power feed facility; and

when the electric power price of the land electric power feed facility is higher than the electric power feed price of the offshore electric power feed facility, the managing apparatus transmits, to the battery-electricity propulsion ship having the surplus electric power among the plurality of battery-electricity propulsion ships, such an electric power selling command that the battery-electricity propulsion ship having the surplus electric power sells the surplus electric power to the land electric power feed facility.

11~~13~~. The battery-electricity propulsion ship electric power feed system according to any one of claims 6 to 10~~ 8 to 12~~, wherein:

the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;

the at least one offshore electric power feed facility comprises a plurality of offshore electric power feed facilities;

the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships;

the managing apparatus acquires electric power price data of the land electric power feed facility every predetermined time;

the managing apparatus determines charging schedules of the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships and the electric power price data, each of the charging schedules containing a charge timing and information specifying the offshore electric power feed facility or the land electric power feed facility by which the battery-electricity propulsion ship should be charged; and

the managing apparatus transmits the determined charging schedules to the corresponding battery-electricity propulsion ships.

12~~14~~. The battery-electricity propulsion ship electric power feed system according to any one of claims 6 to 11 ~~8 to 13~~, wherein:

the at least one battery-electricity propulsion ship comprises a plurality of battery-electricity propulsion ships;

the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the plurality of battery-electricity propulsion ships;

the managing apparatus acquires electric power price data of the land electric power feed facility every predetermined time;

the managing apparatus creates a ship allocation plan for the plurality of battery-electricity propulsion ships based on sail data received from the plurality of battery-electricity propulsion ships and the electric power price data;

the managing apparatus determines sailing schedules of the plurality of battery-electricity propulsion ships, each of the sailing schedules containing an operation; and

the managing apparatus transmits the determined sailing schedules to the corresponding battery-electricity propulsion ships.

13~~15~~. The battery-electricity propulsion ship electric power feed system according to any one of claims 6 to 12 ~~8 to 14~~, wherein the at least one offshore electric power feed facility is configured to receive electric power from the land electric power feed facility.

14~~16~~. The battery-electricity propulsion ship electric power feed system according to claim 13~~15~~, wherein:

the offshore electric power feed facility is an offshore electric power generation ship including a power generator;

the battery-electricity propulsion ship electric power feed system comprises a managing apparatus configured to be communicable with the at least one land electric power feed facility and the offshore electric power generation ship;

the managing apparatus acquires electric power price data of the land electric power feed facility every predetermined time; and

when electric power generated by the offshore electric power generation ship is insufficient, the managing apparatus determines, based on sail data received from the offshore electric power generation ship and the electric power price data, whether the offshore electric power generation ship generates the electric power or receives the electric power from the land electric power feed facility.

~~17. An offshore electric power feed facility configured to charge a storage battery of a battery-electricity propulsion ship,~~

~~the offshore electric power feed facility comprising:~~

~~a power generator;~~

~~a storage battery configured to store electric power generated by the power generator; and~~

~~an electric power feed apparatus connected to the storage battery.~~

~~18. The offshore electric power feed facility according to claim 17, further comprising:~~

~~a tank configured to store liquefied gas; and~~

~~an internal combustion engine coupled to the power generator and configured to combust the liquefied gas or vaporized gas of the liquefied gas.~~

~~19. A battery-electricity propulsion ship comprising a communication apparatus configured to transmit sail data of the battery-electricity propulsion ship.~~