

TRACEABILITY DATA MANAGEMENT SYSTEM AND MANAGEMENT METHOD FOR HYDROGEN

TECHNICAL FIELD

5 [0001] The present disclosure relates to technology for managing traceability data for hydrogen.

BACKGROUND ART

[0002] Patent Document 1 discloses technology of identifying sources of carbon, for example, industrial, agricultural, or natural sources by simultaneous measurement of
10 isotopes of carbon dioxide.

PRIOR ART DOCUMENTS

PATENT DOCUMENT

[0003] Patent Document 1: Japanese Patent Application Laid-Open No. 2014-211451

SUMMARY

15 PROBLEM TO BE SOLVED BY THE INVENTION

[0004] It is desirable to manage traceability data for hydrogen from a time of production to know greenhouse gas (GHG) and a carbon intensity (CI) due to hydrogen.

[0005] Hydrogen, however, can be supplied through a plurality of histories. It is also desirable to manage traceability data for hydrogen that can include various pieces of history
20 information efficiently and with small data capacity.

[0006] It is thus an object of the present disclosure to manage traceability data for hydrogen efficiently and with small data capacity.

MEANS TO SOLVE THE PROBLEM

[0007] A traceability data management system for hydrogen is a traceability data
25 management system for hydrogen supplied through a plurality of histories and includes: a

history information receiver that receives first history information associated with an intentional change in history of hydrogen and second history information associated with an unintentional change in history of hydrogen; a storage device that stores history data including the first history information, the second history information, and an ID; and a
5 data manager that controls generation and rewriting of the history data, wherein the data manager generates history data including a newly issued ID when the first history information is changed and rewrites the history data while maintaining the ID when the second history information is changed.

[0008] A traceability data management method for hydrogen is a traceability data
10 management method for hydrogen supplied through a plurality of histories and includes: a computer receiving first history information associated with an intentional change in history of hydrogen and second history information associated with an unintentional change in history of hydrogen; storing, in a storage device, history data including a newly issued ID when the first history information is changed; and rewriting the history data
15 stored in the storage device while maintaining the ID when the second history information is changed.

EFFECTS OF THE INVENTION

[0009] According to the present disclosure, traceability data for hydrogen can be managed efficiently and with small data capacity.

20 BRIEF DESCRIPTION OF DRAWINGS

[0010] [FIG. 1] FIG. 1 is an illustration showing one example of a supply route for hydrogen.

[FIG. 2] FIG. 2 is a block diagram showing a traceability data management system for hydrogen.

25 [FIG. 3] FIG. 3 is a diagram showing one example of history data.

[FIG. 4] FIG. 4 is a diagram showing one example of activity amount data.

[FIG. 5] FIG. 5 is a flowchart showing an example of processing performed by a processor of a data management device.

[FIG. 6] FIG. 6 is an illustration showing a relationship between examples of histories of hydrogen and pieces of history data.

[FIG. 7] FIG. 7 is a diagram showing an example of the history data.

[FIG. 8] FIG. 8 is a diagram showing another example of the history data.

[FIG. 9] FIG. 9 is a diagram showing yet another example of the history data.

[FIG. 10] FIG. 10 is a diagram showing examples of pieces of activity amount data.

[FIG. 11] FIG. 11 is a diagram showing examples of pieces of activity amount data.

DESCRIPTION OF EMBODIMENT

[0011] {Embodiment}

A traceability data management system for hydrogen and a management method according to an embodiment will be described below. FIG. 1 is an illustration showing one example of a supply route for hydrogen.

[0012] As shown in the figure, hydrogen produced at a base 100 is transported to a base 120 by a transport vessel 110.

[0013] The base 100 includes a production facility 102 and a storage facility 104 for hydrogen. The base 100 is located on the ground, for example.

[0014] The production facility 102 is a facility that produces hydrogen. Hydrogen is produced by electrolysis of water or is produced by reforming coal or natural gas. That is to say, hydrogen is assumed to originate from any of electrolysis and coal or natural gas.

Hydrogen may be generated from ammonia, and, in this case, hydrogen originates from

ammonia. Coal may be lignite.

[0015] The storage facility 104 is a facility that stores hydrogen. Hydrogen is stored by being liquefied at a low temperature, by being compressed at a high pressure, or by being converted into another substance for storage. In any case, energy is consumed for cooling,
5 compression, or dehydrogenation.

[0016] The transport vessel 110 includes a storage facility 112 that stores hydrogen and sails on the sea. Energy is consumed to store hydrogen in the storage facility 112 as in the above-mentioned storage facility 104. Furthermore, the transport vessel 110 can consume energy for its movement. A source of energy for movement of the transport vessel 110
10 may be fuel loaded mainly for movement or may be hydrogen stored in the storage facility 112 thereof.

[0017] The transport vessel 110 is one example of a transportation device that transports hydrogen. A mechanism to transport hydrogen may be a transport, such as a railroad vehicle and a tank truck, or may be a transfer facility, such as a pipeline.

15 [0018] The base 120 includes a storage facility 122 for hydrogen. Hydrogen stored in the storage facility 122 of the base 120 is consumed by a facility close to the base 120 or is distributed to other hydrogen bases. Energy is consumed to store hydrogen in the storage facility 122 as in the above-mentioned storage facility 104.

[0019] As described above, hydrogen is supplied through the production facility, the
20 storage facility, and a transport device.

[0020] It is desirable to identify the origin of hydrogen as traceability of hydrogen. Hydrogen is supplied through a plurality of histories as described above. Histories are individual processes obtained by segmenting a route from a production site to a supply site of hydrogen. The plurality of histories from the production site to the supply site of
25 hydrogen are identified in a chain, so that traceability of hydrogen present at the supply

site can be known. Traceability of hydrogen may be known by clarifying when and where hydrogen has been produced and who has produced hydrogen and how hydrogen has been supplied, for example. It may be considered that traceability of hydrogen includes information on the amount of produced hydrogen and an environmental value of hydrogen.

5 [0021] The amount of hydrogen can vary, in particular, can be reduced due to leakage, volatilization, and the like during storage. It is thus also desirable to know an amount of variation in hydrogen.

[0022] Furthermore, by identifying, together with the origin of hydrogen, the amount of consumption of a source of the origin, the amount of emission of greenhouse gas (GHG)
10 when hydrogen is produced can be identified.

[0023] GHG can be emitted in each history when hydrogen is transported along the supply route. For example, energy is consumed for storage in each of the storage facilities 104, 112, and 122 as described above, so that GHG can be emitted according to the energy. Furthermore, energy can be consumed for movement in a device to transport hydrogen, for
15 example, in the above-mentioned transport vessel 110, and GHG can be emitted according to the energy. A source of the energy for movement is assumed to be hydrogen stored in the transport vessel 110. Also in this case, when hydrogen has a history of emission of GHG, GHG according to the amount of consumption of hydrogen can be evaluated as the amount of emission of GHG for movement.

20 [0024] It is thus also desirable to know GHG emitted for supply of hydrogen along a route from production to supply.

[0025] Most of greenhouse gas emitted along the supply route for hydrogen is CO₂, so that the amount of emission of greenhouse gas (GHG) may be known as the amount of emission of CO₂. In description made below, the amount of emission of greenhouse gas
25 (GHG) is considered to be the amount of emission of CO₂.

[0026] A traceability data management system 10 for hydrogen includes a data management device 20 and a data server 30 to know traceability of hydrogen. The traceability data management system 10 for hydrogen is communicatively connected to terminal devices 60, 70, and 80. For example, data collected through the terminal devices 60, 70, and 80 are stored in the data server 30. The data management device 20 generates and updates traceability data with reference to the data collected in the data server 30 to manage traceability.

[0027] The terminal devices 60, 70, and 80 are terminal devices that receive input of information on histories of hydrogen and the amount of variation in hydrogen or the amount of emission of GHG at the base 100, the transport vessel 110, and the base 120 and transmit the input information to the traceability data management system 10. The terminal devices 60, 70, and 80 may be known as elements outside the traceability data management system 10 or may each be known as one element of the traceability data management system 10.

[0028] For example, the terminal device 60 is disposed in the base 100 and receives input of information on histories of hydrogen and the amount of variation in hydrogen or the amount of emission of GHG at the base 100. For example, the terminal device 70 is disposed in the transport vessel 110 and receives input of information on histories of hydrogen and the amount of variation in hydrogen or the amount of emission of GHG at the transport vessel 110. For example, the terminal device 80 is disposed in the base 120 and receives input of information on a history of hydrogen and the amount of variation in hydrogen or the amount of emission of GHG at the base 120.

[0029] The above-mentioned terminal devices 60, 70, and 80 are not necessarily required to be arranged in the base 100, the base 120, and the transport vessel 110. For example, an input device to input various pieces of information at the base 100, the base 120, or the transport vessel 110 may be disposed outside the base 100, the base 120, or the transport

vessel 110.

[0030] One or more of the various pieces of information at the base 100, the base 120, or the transport vessel 110 may be input via the input device disposed outside the base 100, the base 120, or the transport vessel 110.

5 [0031] The input device may be an input device to input data into the data management device 20 or the data server 30.

[0032] The data management device 20, the data server 30, and the terminal devices 60, 70, and 80 are communicatively connected to one another. For example, the data management device 20, the data server 30, and the terminal devices 60, 70, and 80 are
10 communicatively connected to one another via a communication network 12. Various pieces of information input via the terminal devices 60, 70, and 80 are thus stored in the data server 30. The data management device 20 can generate and update traceability data suitable for management of traceability based on the various pieces of information stored in the data server 30.

15 [0033] The data server 30 may be distributed to data servers. For example, a data server that stores the various pieces of information from the terminal devices 60, 70, and 80 and a data server that stores the traceability data may be different. The various pieces of information from the terminal devices 60, 70, and 80 and the traceability data may be stored in different data servers by region.

20 [0034] The data management device 20 and the data server 30 may be configured as a single computer. For example, the data server 30 may be a cloud server, and a function of the data management device may be implemented on the cloud server.

[0035] The above-mentioned communication network 12 may be a wired or wireless communication network or may be a combination of the wired and wireless communication
25 networks. The communication network 12 may be a public communication network or

may be a communication network using a dedicated line.

[0036] FIG. 2 is a block diagram showing the traceability data management system 10 for hydrogen.

[0037] The traceability data management system 10 for hydrogen includes the data management device 20 and the data server 30. The traceability data management system 10 is connected to the terminal devices 60, 70, and 80 via the communication network 12. The terminal devices 60, 70, and 80 may be connected to the traceability data management system 10 via another system, such as a power management system of a power company.

[0038] The terminal devices 60, 70, and 80 are devices that each include a computer including a processor and memory and a communication circuit, for example.

[0039] A consumption amount sensor 61 for production, a consumption amount sensor 62 for storage, a hydrogen amount sensor 63, and an input unit 64 are connected to the terminal device 60 disposed in the base 100.

[0040] The consumption amount sensor 61 for production is a sensor that detects the amount of consumption of a production resource consumed when hydrogen is produced at the production facility 102, for example.

[0041] When hydrogen is produced by electrolysis, for example, the production resource is power, and the amount of consumption thereof may be the amount of consumption of power. In this case, the consumption amount sensor 61 is a consumed power meter. When consumed power during production and a CO₂ emission factor of the consumed power are identified, the amount of emission of GHG when hydrogen is produced by electrolysis is obtained.

[0042] When hydrogen is produced by reforming coal or natural gas, for example, the production resource is coal or natural gas, and the amount of consumption thereof is the amount of consumption of coal or the amount of consumption of natural gas. In this case,

the consumption amount sensor 61 may be a sensor that detects the weight of coal or may be a sensor that detects the weight or a flow rate of natural gas. In these cases, when the amount of emission of CO₂ relative to a unit amount of consumption of coal or natural gas is known, the amount of emission of GHG when hydrogen is produced from coal or natural gas is obtained based on the amount of consumption of coal or the amount of consumption of natural gas.

[0043] The consumption amount sensor 62 for storage is a sensor that detects the amount of consumption of a storage resource consumed for storage of hydrogen in the storage facility 104. For example, when hydrogen is cooled for storage, the amount of consumption of the storage resource is the amount of consumption of power consumed for cooling. In this case, the consumption amount sensor 62 may be a consumed power meter. When power consumed for storage and a CO₂ emission factor of the consumed power are identified, the amount of emission of GHG when hydrogen is stored is obtained.

[0044] The hydrogen amount sensor 63 is a sensor that detects the amount of hydrogen stored in the storage facility 104. The hydrogen amount sensor 63 may be a sensor that detects a position of a liquid level of hydrogen liquefied by cooling or may be a sensor that detects a flow rate when hydrogen is transferred into another container. Hydrogen might leak or volatilize during storage. The amount of variation in hydrogen during storage can be known by detecting the amount of hydrogen stored in the storage facility 104.

[0045] The input unit 64 is a man-machine interface for an operator to input various pieces of information and is a switch, such as a keyboard, a mouse, or a touch panel, for example. The operator can input various pieces of information on histories of hydrogen via the input unit 64. For example, new production, cargo handling, a location, or an owner of hydrogen can be input via the input unit 64. Existing cargo handling, location, or owner of hydrogen is changed by designating an ID, which will be described below.

[0046] Cargo handling of hydrogen refers to transfer of produced hydrogen from a facility or a device to another facility or another device. For example, cargo handling includes transfer of hydrogen from the storage facility 104 of the base 100 to the storage facility 112 of the transport vessel 110 and transfer of hydrogen from the storage facility 112 of the transport vessel 110 to the storage facility 122 of the base 120.

[0047] A consumption amount sensor 71 for transport, a hydrogen amount sensor 73, and an input unit 74 are connected to the terminal device 70 disposed in the transport vessel 110, for example.

[0048] The consumption amount sensor 71 for transport is a sensor that detects the amount of consumption of a transport resource consumed for sailing of the transport vessel 110 and storage of hydrogen in the transport vessel 110, for example. For example, the consumption amount sensor 71 may be a sensor that detects the amount of consumption of power as the transport resource or may be a sensor that detects the amount of consumption of coal or natural gas. In any case, when the amount of consumption of the transport resource is identified, and the amount of emission of CO₂ per unit amount of consumption is known, the amount of emission of GHG by transport of hydrogen is obtained based on the amount of consumption of the transport resource.

[0049] The hydrogen amount sensor 73 is a sensor that detects the amount of hydrogen stored in the transport vessel 110 as with the above-mentioned hydrogen amount sensor 63. The amount of variation in hydrogen being stored in the transport vessel 110 can be known by detecting the amount of hydrogen stored in the transport vessel 110.

[0050] The input unit 74 is a man-machine interface for the operator to input various pieces of information as with the above-mentioned input unit 64. For example, the operator can input various pieces of information on histories of hydrogen, for example, information on cargo handling of hydrogen via the input unit 74.

[0051] A consumption amount sensor 82 for storage, a hydrogen amount sensor 83, and an input unit 84 are connected to the terminal device 80 disposed in the base 120, for example.

[0052] The consumption amount sensor 82 for storage is a sensor that detects the amount
5 of consumption of a transport resource consumed for storage of hydrogen in the storage facility 122 of the base 120 as with the above-mentioned consumption amount sensor 62, for example.

[0053] The hydrogen amount sensor 83 is a sensor that detects the amount of hydrogen stored in the storage facility 122 as with the above-mentioned hydrogen amount sensor 63.

10 [0054] The input unit 84 is a man-machine interface for the operator to input various pieces of information as with the above-mentioned input unit 64. For example, the operator can input various pieces of information on histories of hydrogen, for example, information on cargo handling of hydrogen via the input unit 84.

[0055] A terminal device 90 different from the above-mentioned terminal devices 60, 70,
15 and 80 may be connected to the traceability data management system 10. An input unit 94 is connected to the terminal device 90. The input unit 94 is a man-machine interface to input information on histories of hydrogen as with the input unit 64. A sensor to detect information on hydrogen may not be connected to the above-mentioned terminal device 90. That is to say, the terminal device 90 may be used not as a device to detect history
20 information but mainly as a device to receive various pieces of information from the operator. The terminal device 90 may be installed at a location different from a location of a facility or a device that handles hydrogen, such as the bases 100 and 120 and the transport vessel 110. For example, it may be installed at a trading management location where trading of hydrogen is managed. The operator can input various pieces of
25 information on histories of hydrogen, for example, information on cargo handling of

hydrogen and information on the location of hydrogen or the owner of hydrogen, via the input unit 94.

[0056] As described above, hydrogen is supplied through the plurality of histories at the bases 100 and 120 and the transport vessel 110. Assume that the amount of hydrogen
 5 varying with handling in each of the plurality of histories at the bases 100 and 120 and the transport vessel 110 is an activity amount. For example, the amount of a resource consumed by storage or transport of hydrogen is one example of the activity amount, and the amount of emission of GHG obtained based on the amount of the consumed resource is also one example of the activity amount.

10 [0057] Assume that information on handling of hydrogen at the bases 100 and 120 and the transport vessel 110 is history information. The history information may preferably include information on production of hydrogen, information on storage of hydrogen, and information on movement of hydrogen. The information on production of hydrogen may preferably include information on a location of production and an owner of hydrogen at a
 15 time of production. The owner at the time of production is typically a producer. The information on storage of hydrogen may preferably include information on a location of storage and an owner at the start of storage of hydrogen. The information on movement of hydrogen may preferably include information on a location of storage and an owner a time of receipt for movement of hydrogen. When the information on production of hydrogen,
 20 the information on storage of hydrogen, and the information on movement of hydrogen described above are known at a time of supply of hydrogen, when and where hydrogen has been produced, who has produced hydrogen, and a storage state and a movement state through which hydrogen has been supplied are clarified. Traceability of hydrogen is thus secured.

25 [0058] When the history information includes the amount of variation in hydrogen, the

amount of production of hydrogen and the amount of supply of hydrogen match each other while the amount of variation in hydrogen is taken into account.

[0059] Furthermore, when the history information includes the amount of emission of GHG due to hydrogen, accuracy of the amount of emission of GHG of supplied hydrogen
5 can be secured.

[0060] The history information and activity amount information are transmitted from each of the above-mentioned terminal devices 60, 70, and 80 to the system 10, and the history information is transmitted from the terminal device 90 to the system 10.

[0061] The data server 30 is a computer that includes a processor 31 and a storage device
10 32. The processor 31 includes an arithmetic circuit. The storage device 32 includes a nonvolatile storage device, such as a hard disk drive (HDD) and a solid-state drive (SSD). A hydrogen stock database 33, a GHG database 34, collected data 32a, and linking data 35 are stored in the storage device 32.

[0062] The storage device 32 and a communication device 39 are connected to the
15 processor 31. The communication device 39 includes a communication circuit. The processor 31 is connected to the terminal devices 60, 70, 80, and 90 via the communication device 39, and data transmitted from the terminal devices 60, 70, 80, and 90 is stored as the collected data 32a in the storage device 32. The hydrogen stock database 33, the GHG database 34, and the linking data 35 are stored in the storage device 32. The hydrogen
20 stock database 33 includes history data 40. The history data 40 includes an ID, first history information 41, second history information 42, and initial state information 43 as will be described below. The storage device 32 is thus one example of a storage device that stores the history data 40 including the first history information 41, the second history information 42, and the ID. The linking data 35 is data to link pieces of history data 40. Pieces of
25 history data 40 are linked based on the linking data 35, so that histories of supplied

hydrogen are known. The GHG database 34 includes activity amount data 50 indicating the amount of activity.

[0063] The history information and the activity amount information from each of the above-mentioned terminal devices 60, 70, and 80 are received by the system 10 via the communication device 39 of the database 33. The communication device 39 is thus one example of a history information receiver that receives the first history information 41 and the second history information 42.

[0064] The collected data 32a may continuously be stored or may be deleted after generation of the history data 40 and the activity amount data 50.

[0065] The data management device 20 includes a computer including a processor 21, such as a CPU, a storage device 22, a communication device 29, and the like.

[0066] The processor 21 includes an arithmetic circuit. The processor 21 is communicatively connected to the data server 30 via the communication device 29. The processor 21 is one example of a data manager that controls generation and rewriting of the history data 40 in the data server 30.

[0067] The storage device 22 includes a nonvolatile storage device, such as a hard disk drive (HDD) and a solid-state drive (SSD), as with the above-mentioned storage device 32. A program 22a is stored in the storage device 22, for example.

[0068] Processing for the processor 21 to implement a function for data management is described in the program 22a. The processor 21 thus performs processing described in the program 22a to perform processing for data management. The number of processors 21 may be one or may be two or more. The two or more processors 21 may be incorporated in a single computer. The two or more processors 21 may be incorporated in two or more computers, and the two or more computers may separately perform processing for data management.

[0069] An input unit 27 and a display device 28 may be connected to the data management device 20. The input unit 27 is a man-machine interface to input various pieces of information and various instructions into the data management device 20. The display device 28 is a device that can display various pieces of information, such as the history data 40 and the activity amount data 50, and is a liquid crystal display or an organic electro-luminescence (EL) display, for example.

[0070] FIG. 3 is a diagram showing one example of the history data 40.

[0071] The history data 40 includes the first history information 41, the second history information 42, and the ID. In the present embodiment, the history data 40 includes a static field fs and a variable field fv. The static field is a range including items determined when the history data 40 is newly issued. The items determined when the history data 40 is newly issued include not only an item identified when the history data 40 is newly issued but also an item replenished after the history data 40 is newly issued as the item is determined to have a certain value when the history data 40 is newly issued but the value is identified after the history data 40 is newly issued. The variable field includes items that can vary after the history data 40 is newly issued.

[0072] In the present embodiment, the static field fs includes the ID, the first history information 41, and the initial state information 43.

[0073] The ID is a sign for identification and is described by a number, an alphabet, or a combination of them, for example. The ID is only required to be a sign that is identifiable by a computer. The ID is used to identify the issued history data 40 and to distinguish among pieces of history data 40.

[0074] The first history information 41 is information recorded with an intentional change in history of hydrogen. More specifically, information recorded when an entity involved in supply of hydrogen intentionally changes handling of hydrogen is the first history

information. The change includes a change from nothing to something.

[0075] For example, new production of hydrogen is a history of newly generating a history of hydrogen with the intention of producing hydrogen. Information relating to new production of hydrogen is thus one example of the first history information 41. Information
5 indicating new production of hydrogen is one example of information received through the terminal device 60 when hydrogen is produced, for example. Cargo handling of hydrogen is a history of transferring hydrogen from a storage facility as a transport source to a device or a facility for transport or a history of transferring hydrogen from a device or a facility for transport to a storage facility as a transport destination with the intension of transporting
10 hydrogen. Information relating to cargo handling of hydrogen is thus one example of the first history information 41. Information relating to cargo handling of hydrogen is one example of information received through each of the terminal devices 60, 70, and 80 when hydrogen is cargo handled, for example. Furthermore, a change in owner of hydrogen is a history of changing ownership of hydrogen with the intension of transferring hydrogen.
15 Information relating to the change in owner of hydrogen is thus one example of the first history information 41.

[0076] To record the information relating to new production of hydrogen, the information on cargo handling, and the information relating to the change in owner of hydrogen, the first history information 41 may include items of a trading date and time, details of trading,
20 the location, and the owner, for example. As the details of trading, information on new registration indicating new production of hydrogen, receipt or delivery indicating cargo handling, the change in owner or consumption of hydrogen, and the like can be registered, for example. A date and time of the occurrence of trading is registered as the trading date and time. The location of hydrogen after the occurrence of trading is registered as the
25 location. The owner after the occurrence of trading is registered as the owner. Information

included in the above-mentioned first history information 41 is one example, and the information is not limited to that in the above-mentioned example. One or more items may be omitted, and another item may be added in the first history information 41.

[0077] The initial state information 43 is information indicating an initial state of hydrogen determined when the history data 40 is newly issued. The initial state information 43 is information when the ID is issued as the ID is newly issued when the history data 40 is newly issued as will be described below. For example, the initial state information 43 includes the amount of hydrogen and the environmental value. The amount of hydrogen indicates the amount of hydrogen when the history data 40 is newly issued. For example, the amount of hydrogen is the amount of hydrogen produced at a time of new production, the amount of hydrogen at a time of cargo handling, or the amount of hydrogen at a time of the change in owner. The environmental value is an environmental value when the history data 40 is newly issued and may be evaluated by the amount of emission of GHG attributable to hydrogen, for example, the amount of emission of CO₂, for example. The amount of emission of CO₂ may be registered as the amount of emission per registered unit amount of hydrogen or may be registered as the amount of emission relative to the registered total amount of hydrogen. While the initial state information 43 includes a value already determined when the history data 40 is newly issued, determination of information for calculation thereof might be delayed, and, as a result, the value can be replenished after the history data 40 is newly issued.

[0078] The variable field fv is a range including items that are not determined when the history data 40 is newly issued and thus can be changed after the history data 40 is newly issued.

[0079] In the present embodiment, the variable field fv includes the second history information 42. The second history information 42 is information associated with an

unintentional change in history of hydrogen. The second history information 42 may be information indicating a state accompanied by handling of hydrogen.

[0080] In the present embodiment, the second history information 42 includes the amount of variation in hydrogen and the amount of variation in environmental value and may
5 include any other information on hydrogen. Information on hydrogen other than the amount of variation in hydrogen and the amount of variation in environmental value may include a temperature relating to storage of hydrogen and pressure or purity of hydrogen relating to storage of hydrogen, for example.

[0081] The amount of variation in hydrogen is the amount of variation in hydrogen caused
10 in a history time period identified by the first history information 41. That is to say, the amount of stored hydrogen can vary due to leakage, volatilization, and the like during storage of hydrogen. The amount of variation in hydrogen indicates the amount of variation in hydrogen in the history time period.

[0082] The amount of variation in environmental value is the amount of variation in
15 environmental value caused through a history in a history time period. The environmental value may be evaluated by the amount of emission of GHG, for example, the amount of emission of CO₂ as described above. For example, the amount of variation in environmental value may be the amount of variation in CO₂ in the history time period. For example, energy, such as power, is consumed for storage in a time period in which
20 hydrogen is stored. Energy is consumed as a source of power for transport by transport of hydrogen. The amount of emission of CO₂ for generation of the energy is registered as the amount of variation in environmental value.

[0083] The temperature is a temperature of a facility that stores hydrogen, that is, a storage temperature, for example. The information included in the above-mentioned
25 second history information 42 is one example, and the information is not limited to that in

the above-mentioned example. One or more items may be omitted, and another item may be added in the second history information 42.

[0084] In a template of the history data 40, each of the above-mentioned items is blank and is set to “null”. When the history data 40 is newly issued, the ID is provided, and the items of the first history information 41 and the initial state information 43 are registered. The initial state information 43 can be replenished after the history data 40 is newly issued. The second history information 42 is identified after the history data 40 is newly issued, so that the items of the second history information 42 are registered after the second history information 42 is identified.

[0085] The above-mentioned history data 40 may be stored in a single table or may be stored in tables in a distributed manner with the ID as a main key.

[0086] The amount of variation in hydrogen, the amount of variation in environmental value, and the temperature relating to the above-mentioned second history information 42 can vary from moment to moment over time. The information on the amount of variation in hydrogen, the amount of variation in environmental value, and the change in temperature relating to the second history information 42 may each be stored as log information. The log information may be omitted or may be deleted after generation.

[0087] FIG. 4 is a diagram showing one example of the activity amount data 50.

[0088] The activity amount data 50 is data on which the amount of activity varying with handling of hydrogen is registered in each history time period.

[0089] In the present embodiment, the activity amount data includes orgID as an initial ID, a current ID, a target date and time, and the amount of emission of GHG due to power, the amount of emission of GHG due to coal, and the amount of emission of GHG due to natural gas as breakdowns of the amount of emission of GHG. The amount of emission of GHG is one example of GHG generation information associated with histories of hydrogen.

The amount of emission of GHG due to power, the amount of emission of GHG due to coal, and the amount of emission of GHG due to natural gas as the breakdowns of the GHG generation information are examples of the GHG generation information associated with histories of hydrogen. Information relating to the breakdowns of the GHG generation information may be omitted, and a total amount of emission of GHG may be recorded as the GHG generation information.

[0090] The activity amount data 50 is data on which the amount of activity varying with handling of hydrogen is registered in a single history time period, for example. In the present embodiment, the activity amount data includes orgID as the initial ID, the current ID, the target date and time, and the amount of emission of GHG as the amount of activity. The amount of emission of GHG may be divided into the amount of emission of GHG due to power, the amount of emission of GHG due to coal, and the amount of emission of GHG due to natural gas. Handling of hydrogen is handling relating to maintenance and supply of hydrogen, for example, and is storage or transportation of hydrogen, for example. The amount of activity may thus be greenhouse gas generation information resulting from storage or transportation of hydrogen.

[0091] The activity amount data 50 is associated with an ID of a history as a source of generation of the amount of activity by being associated with an ID in each of the terminal devices 60, 70, and 80 as a source of transmission of data or being associated with an ID based on a location, a time, and the like of generation of data. The orgID indicates an ID associated with a history when the activity amount data 50 is newly created. That is to say, the activity amount data 50 indicates the amount of activity in a single history time period, for example. The orgID corresponding to an initial history is recorded on the activity amount data 50, so that a history as a target of the amount of activity indicated by the activity amount data can be identified. The activity amount data 50 may be data associated

with history time periods. In this case, the activity amount data 50 may preferably store information related to the amount of activity so that histories can be distinguished from one another.

[0092] The current ID is an ID associated with current hydrogen linked to the activity amount data 50. That is to say, hydrogen is supplied through the above-mentioned histories. The activity amount data 50 is linked to a new history by the current ID each time hydrogen is supplied through a history. The activity amount data 50 for each of the histories through which hydrogen is supplied is thus associated in the last history of the supply route.

[0093] The target date and time indicates a target time period in which GHG is emitted.

[0094] The amount of emission of GHG due to power, the amount of emission of GHG due to coal, and the amount of emission of GHG due to natural gas as the amount of activity each indicate the amount of emission at the target date and time. As described above, when the amount of emission of GHG per unit amount of consumption of a production resource is known, the amount of emission of GHG can be obtained based on an actual amount of consumption of the production resource. The GHG generation information may thus be the amount of consumption of the production resource. As described above, the amount of activity may not be divided by the production resource.

[0095] The above-mentioned activity amount data 50 may sequentially be generated and updated based on the collected data 32a asynchronously with the history data 40.

[0096] FIG. 5 is a flowchart showing an example of processing performed by the processor 21 of the data management device 20.

[0097] In step S1, history information is received. The history information is collected from each of the terminal devices 60, 70, 80, and 90 into the data server 30 and is stored as the collected data 32a as described above. The history information is received when the data management device 20 refers to the collected data 32a stored in the data server 30,

and there is a change in history information in the collected data 32a. The data management device 20 may refer to the collected data 32a at timings at predetermined regular time intervals or at a timing when the data server 30 provides notification of a change in history information in the collected data 32a. When the data management device 20 receives the
 5 history information, processing proceeds to next step S2.

[0098] In step S2, whether there is the change in the first history information 41 is determined. As described above, the first history information 41 includes information on the details of trading. It is thus determined that there is the change in the first history information 41 when the information on new registration indicating new production of
 10 hydrogen, receipt or delivery indicating cargo handling, the change in owner or consumption of hydrogen, and the like is registered. Processing proceeds to step S3 when it is determined that there is the change in the first history information 41 in step S2 and proceeds to step S5 when it is determined that there is not the change in the first history information 41 in step S2.

15 [0099] In step S3, the data management device 20 generates history data 40 including a newly issued ID. The generated history data 40 is stored in the storage device 32 of the data server 30. In addition to the newly issued ID, the trading date and time, the details of trading, the location, and the owner can be registered in the history data 40. When the change in history information is not new production of hydrogen but midway alteration of
 20 a history of hydrogen, a relationship between the original ID and the newly issued ID may preferably be registered in the linking data 35.

[0100] In next step S4, the initial state information 43 is registered in the history data 40. When the change in the first history information 41 in step S3 is new production, for example, the amount of hydrogen in the initial state information 43 may be the amount of
 25 production of hydrogen at a time of new production, and the amount of emission of GHG

may be the amount of emission of GHG when hydrogen is produced. The amount of emission of GHG when hydrogen is produced is obtained based on the amount of consumption of the production resource acquired by the terminal device 60, for example. The amount of emission of GHG is thus sometimes replenished after the amount of consumption of the production resource is determined after the history data 40 is issued.

[0101] When the change in the first history information 41 in step S3 is receipt or delivery indicating cargo handling and the change in owner or consumption of hydrogen, for example, the amount of hydrogen in the initial state information 43 may be the amount of production of hydrogen at a time of the change in the first history information 41, and the amount of emission of GHG may be the amount of emission of GHG at the time of the change. The amount of hydrogen at the time of the change in the first history information 41 is obtained by subtracting the amount of variation in hydrogen registered as the second history information 42 from the amount of hydrogen registered as the initial state information 43 in the original history data 40. The amount of hydrogen at the time of the change in the first history information 41 is obtained by subtracting the amount of emission corresponding to the amount of emission of GHG registered as the second history information 42 from the amount of emission of GHG registered as the initial state information 43 in the history data 40 to be changed.

[0102] While the amount of emission of GHG may be the amount of emission of GHG of hydrogen as a target as a whole or may be the amount of emission of GHG per unit hydrogen, calculation is performed based on a uniform standard when the amounts of emission of GHG are calculated.

[0103] Processing proceeds to step S5 after step S4 and when it is not determined that there is the change in the first history information 41 in step S2.

[0104] In step S5, whether there is variation in amount of hydrogen in the second history

information 42 is determined. As described above, the second history information 42 includes the amount of variation in hydrogen. Thus, when the amount of variation in hydrogen is newly registered, it is determined that there is a change in the second history information 42 relating to the amount of variation in hydrogen, and processing proceeds to next step S6. When it is not determined that there is the change in the second history information 42 relating to the amount of variation in hydrogen, processing proceeds to step S7.

[0105] In step S6, the amount of variation in hydrogen is registered in the second history information 42 to rewrite the history data 40. In this case, the ID of the history data 40 is not changed.

[0106] In step S7, whether there is a change in amount of emission of GHG in the second history information 42 is determined. As described above, the second history information 42 includes the amount of variation in amount of emission of GHG as the amount of variation in environmental value. Thus, when the amount of variation in environmental value is newly registered, it is determined that there is the change in the second history information 42 relating to the amount of emission of GHG, and processing proceeds to next step S8. When it is not determined that there is the change in the second history information 42 relating to the amount of emission of GHG, processing returns to step S1 to repeat the above-mentioned processing.

[0107] In step S6, the amount of emission of GHG is registered in the second history information 42 to rewrite the history data 40. In this case, the ID of the history data 40 is not changed.

[0108] Due to the above-mentioned processing, the data management device 20 can perform processing of generating the history data 40 including the newly issued ID when the first history information 41 is changed and rewriting the history data 40 while

maintaining the ID when the second history information 42 is changed.

[0109] Description of a more specific example of the processing focuses on details of data.

[0110] Considered is a case where hydrogen is supplied through histories shown in FIG.

5 6. First, hydrogen is produced and stored at a production base A. Assume that produced hydrogen is divided so that a portion of hydrogen is received by a transport vessel B and the other portion remains at the production base A as a source of delivery. Hydrogen is stored in the transport vessel B and is transported toward a storage base C. The owner is changed in the middle of transport by the transport vessel B. At the storage base C, the
10 total amount of hydrogen stored in the transport vessel B is received by the storage base C.

[0111] In this case, hydrogen is produced at the production base A and information on new production is received, so that it is determined that there is the change in the first history information 41, and the history data 40 to which a new ID has been provided is issued. For example, the history data 40 to which a new ID “001” has been provided is
15 issued. The history data 40 includes the static field fs and the variable field fv.

[0112] FIG. 7 is a diagram showing an example of the history data 40 immediately after being issued by new production. As shown in the figure, the new ID “001”, a trading date and time “2023/01/01 00:00:00”, details of trading “new registration”, a location “base A”, an owner “company A”, the amount of hydrogen “100”, and an environmental value
20 (amount of CO₂) “5” are registered in the static field fs. A storage temperature “-260” is registered in the variable field fv.

[0113] FIG. 8 is a diagram showing an example of the history data 40 rewritten by registering the variable field fv as a result of determination that there is the change in the second history information 42. As shown in the figure, the amount of variation in hydrogen
25 and the amount of variation in environmental value (amount of CO₂) in the variable field

fv are the amounts of activity occurring during storage and are thus identified after the history data 40 is issued. Thus, at a point in time when the amount of variation in hydrogen or the amount of variation in environmental value is identified, a corresponding item is registered while the ID is maintained. When the amount of variation in hydrogen or the amount of variation in environmental value sequentially changes, the amount of variation in hydrogen or the amount of variation in environmental value may sequentially be registered with the change, and a history of the change may be registered as log information.

[0114] One or more items in the static field fs are also sometimes registered at a point in time when the information is identified after the history data 40 is issued. The variable field fv is sometimes registered after a next ID is issued.

[0115] As for another piece of the history data 40 described below, a portion of the static field fs and the variable field fv are sometimes similarly registered later.

[0116] Produced hydrogen is divided so that a portion of hydrogen is received by the transport vessel B and the other portion remains at the production base A as the source of delivery. Division and transfer to another location of hydrogen are intentional changes in histories of hydrogen. Information on division, receipt, and the like is received, so that the history data 40 to which the new ID has been provided is issued for each of the received hydrogen and the remaining hydrogen as the source of delivery. For example, the history data 40 to which a new ID “002” has been provided is issued for the received hydrogen. The history data 40 to which a new ID “003” has been provided is issued for the hydrogen as the source of delivery.

[0117] FIG. 9 is a diagram showing an example in which hydrogen associated with the history data 40 including the ID “001” is divided into the above-mentioned ID “002” and the above-mentioned ID “003”.

[0118] As for the history data 40 for hydrogen received by the transport vessel B, a new

ID “002”, a trading date and time “2023/01/01 12:00:00”, details of trading “receipt”, a location “vessel B”, an owner “company A”, the amount of hydrogen “40”, and an environmental value (the amount of CO₂) “10” are registered in the static field fs. A storage temperature “-258” is registered in the variable field fv. An ID of the previous history data 40 may preferably be registered in the history data 40 to show a relationship with the previous history data 40. A previous ID “001” is herein registered. An item of the previous ID may preferably be prepared as a blank (null) item in the data shown in FIG. 3.

[0119] As for the history data 40 for hydrogen remaining at the base A as the source of delivery, a new ID “003”, a trading date and time “2023/01/01 12:00:00”, details of trading “delivery”, a location “base A”, an owner “company A”, the amount of hydrogen “55”, and an environmental value (the amount of CO₂) “10” are registered in the static field fs. A storage temperature “-258” is registered in the variable field fv. Similarly to the above, an ID of the previous history data 40 may preferably be registered in the history data 40 to show the relationship with the previous history data 40. The previous ID “001” is herein registered. A connection relationship between pieces of history data 40 may be known based on the above-mentioned ID and the previous ID.

[0120] The sum of the amount of hydrogen associated with the ID “002” and the amount of hydrogen associated with the ID “003” has a value obtained by subtracting the amount of variation in hydrogen from the amount of hydrogen in the initial state associated with the ID “001”. That is to say, hydrogen remaining at the base A is divided into hydrogen stored in the transport vessel B and hydrogen left at the base A at a point in time of receipt and delivery of hydrogen. Leaking and volatilizing hydrogen may be provided with another ID as vaporizing hydrogen data and stored.

[0121] The amount of variation in environmental value (the amount of CO₂) associated with the ID “002” and the amount of variation in environmental value (the amount of CO₂)

associated with the ID “003” are obtained based on the environmental value (the amount of CO₂) and the amount of variation in environmental value (the amount of CO₂) in the initial state associated with the ID “001”.

[0122] When the environmental value (the amount of CO₂) and the amount of variation in environmental value (the amount of CO₂) are values per unit hydrogen, the amount of variation in environmental value (the amount of CO₂) associated with the ID “002” and the amount of variation in environmental value (the amount of CO₂) associated with the ID “003” may be the sum of the environmental value (the amount of CO₂) and the amount of variation in environmental value (the amount of CO₂) in the initial state associated with the ID “001”.

[0123] When the environmental value (the amount of CO₂) and the amount of variation in environmental value (the amount of CO₂) are a total amount of the environmental value (the amount of CO₂) and a total amount of variation in environmental value (the amount of CO₂) originating from stored hydrogen, the amount of variation in environmental value (the amount of CO₂) associated with the ID “002” and the amount of variation in environmental value (the amount of CO₂) associated with the ID “003” may be values obtained by proportionally dividing the environmental value (the amount of CO₂) and the amount of variation in environmental value (the amount of CO₂) in the initial state associated with the ID “001” by a ratio of the amount of divided hydrogen.

[0124] As shown in the figure, the amount of variation in hydrogen and the amount of variation in environmental value (amount of CO₂) in the variable field fv are registered after the history data 40 is issued.

[0125] As shown in FIG. 6, when the owner is changed in the middle of transport by the transport vessel B, the change in owner is an intentional change in history of hydrogen. The history data 40 to which a new ID has been provided is thus issued for hydrogen stored

in the transport vessel B. For example, the history data 40 to which a new ID “004” has been provided is issued for hydrogen whose owner has been changed.

[0126] A total amount of hydrogen stored in the transport vessel B is received by the storage base C. The receipt is an intentional change in history of hydrogen. The history data 40 to which a new ID has been provided is thus issued for hydrogen stored in the storage base C. For example, the history data 40 to which a new ID “005” has been provided is issued for hydrogen received by the storage base C.

[0127] FIGs. 10 and 11 are each a diagram showing examples of pieces of the activity amount data 50 in an example of histories shown in FIG. 6 described above.

[0128] The activity amount data 50 for production at the base A is generated to correspond to the history data 40 associated with the ID “001”. In the activity amount data 50, an orgID “001”, a current ID “001”, and a target date and time “2023/01/01 0:00-1:00” are registered. When breakdowns of the amount of emission of GHG are not determined when the activity amount data 50 is generated, the amount of emission of GHG is “null”.

[0129] When one or more breakdowns of the amount of emission of GHG are determined, the determined amount of emission of GHG, for example, the amount of emission of GHG due to power “1000” is registered. As described above, the amount of activity may be the amount of emission of GHG itself or may be the amount of consumption of the resource based on which the amount of emission of GHG is calculated.

[0130] When hydrogen is produced at the base A, the activity amount data 50 for storage in the base A is generated to correspond to the history data 40 associated with the ID “001”. In the activity amount data 50, an orgID “001”, a current ID “001”, and a target date and time “2023/01/01 1:00-null” are registered. When breakdowns of the amount of emission of GHG are not determined when the activity amount data 50 is generated, the amount of emission of GHG is “null”.

[0131] When the remaining production resource is determined, the determined amount of emission of GHG, for example, the amount of emission of GHG due to coal “100” is registered. DETERMINED may preferably be registered as for the determined activity amount data 50.

5 [0132] When hydrogen from the base A is received by the transport vessel B, the above-mentioned activity amount data 50 is inherited. For example, as for each of the activity amount data 50 for production at the base A and the activity amount data 50 for storage in the base A, the current ID is rewritten into the ID “002” as a destination of inheritance. The amount of emission of GHG is rewritten to be proportionally divided by a ratio of the
10 amount of hydrogen remaining at the base A to the amount of hydrogen received by the transport vessel B.

[0133] When hydrogen is received by the transport vessel B, the activity amount data 50 for storage in the transport vessel B is generated to correspond to the history data 40 associated with the ID “002”. In the activity amount data 50, an orgID “002”, a current ID
15 “002”, and a target date and time “2023/01/01 12:00-null” are registered. When breakdowns of the amount of emission of GHG are not determined when the activity amount data 50 is generated, the amount of emission of GHG is “null”. When the ID is newly issued, a correspondence with an original ID is registered in the linking data 35.

[0134] When the amount of emission of GHG is identified for each piece of the activity
20 amount data 50, the amount of emission is registered, and the activity amount data 50 is registered to be DETERMINED at a point in time of determination. As described above, stored hydrogen is sometimes consumed as the amount of activity at the transport vessel B. In this case, the amount of emission of GHG according to the amount of consumption of hydrogen is written into the activity amount data 50. The amount of consumption of
25 hydrogen is reflected in the amount of variation in hydrogen associated with the ID “002”

or the ID “004”.

[0135] As for each history, the amount of variation in environmental value (the amount of CO₂) is calculated by referring to the associated activity amount data 50.

[0136] According to the traceability data management system 10 for hydrogen and a
5 traceability data management method for hydrogen configured as described above, the data management device 20 generates the history data 40 including the newly issued ID when the first history information 41 associated with the intentional change in history of hydrogen is changed. The history data 40 is rewritten while the ID is maintained when the second history information 42 associated with the unintentional change in history of
10 hydrogen is changed. The ID is thus not required to be newly issued each time the history information is changed. This can simplify management of the ID and reduce the amount of data for management of the traceability data.

[0137] When a history of hydrogen is intentionally changed, an actual environment, for example, a storage environment of the history is highly likely to be greatly changed. Pieces
15 of history data 40 having different actual environments are managed by different IDs, so that traceability of hydrogen can efficiently be managed while being distinguished by a difference in actual environment. Traceability data for hydrogen can thus be managed while being distinguished by a history preferred for management efficiently and with small data capacity.

20 [0138] When the first history information 41 is information received when hydrogen is produced or cargo handled, for example, information on new production, receipt, and delivery, a new ID is issued when hydrogen is produced or when the storage facility is changed by cargo handling of hydrogen, so that the history data is easily managed by the storage facility.

25 [0139] When the second history information 42 is the amount of variation in hydrogen or

the amount of variation in GHG caused through histories of hydrogen, the amount of variation in hydrogen or the amount of variation in GHG caused through histories of hydrogen is easily managed for each change in the first history information 41.

[0140] In particular, when the first history information 41 is information received when hydrogen is produced or cargo handled and the second history information 42 is the amount of variation in hydrogen or the amount of variation in GHG caused through histories of hydrogen, the amount of variation in hydrogen or the amount of variation in greenhouse gas caused through histories of hydrogen can be rewritten for each storage facility to easily manage the amount of variation. Volatility of hydrogen and the origin of the resource for storage can vary for each storage facility. The second history information 42 is easily properly managed for each storage facility.

[0141] When the history data 40 includes the amount of hydrogen or the amount of greenhouse gas when the ID is issued, GHG or a carbon intensity (CI) is easily managed based on the traceability data.

[0142] The second history information 42 is the amount of variation in hydrogen or the amount of variation in GHG caused through histories of hydrogen, and the history data 40 includes the amount of hydrogen or the amount of GHG when the ID is issued. The data management device 20 registers, when the ID is issued, the amount of hydrogen or the amount of greenhouse gas based on the amount of hydrogen or the amount of greenhouse gas when the ID included in the history data 40 before the ID is issued is issued and the amount of variation in hydrogen or the amount of variation in GHG. The amount of hydrogen or the amount of greenhouse gas can thus be registered based on the previous history data each time the ID is issued.

[0143] The second history information 42 includes the amount of variation in GHG caused through histories of hydrogen, and the storage device 32 stores the activity amount

data 50 including the GHG generation information associated with histories of hydrogen. The data management device 20 rewrites the amount of variation in GHG based on the GHG generation information. The activity amount data 50 including GHG based on which the amount of GHG is calculated can be managed separately from the history data 40. The amount of the history data 40 to know traceability can thus be reduced.

[0144] When the activity amount data 50 includes the GHG generation information due to storage or transportation of hydrogen, emission of GHG due to storage or transportation of hydrogen is easily known.

[0145] Configurations described in the embodiment and the modifications described above can be combined as appropriate unless any contradiction occurs.

[0146] The present disclosure provides the following aspects.

[0147] A first aspect is a traceability data management system for hydrogen supplied through a plurality of histories, the traceability data management system including: a history information receiver that receives first history information associated with an intentional change in history of hydrogen and second history information associated with an unintentional change in history of hydrogen; a storage device that stores history data including the first history information, the second history information, and an ID; and a data manager that controls generation and rewriting of the history data, wherein the data manager generates history data including a newly issued ID when the first history information is changed and rewrites the history data while maintaining the ID when the second history information is changed.

[0148] According to the traceability data management system for hydrogen, the data manager generates the history data including the newly issued ID when the first history information associated with the intentional change in history of hydrogen is changed. The history data is rewritten while the ID is maintained when the second history information

associated with the unintentional change in history of hydrogen is changed. The ID is thus not required to be newly issued each time the history information is changed. When a history of hydrogen is intentionally changed, an actual environment of the history is highly likely to be greatly changed. Pieces of history data having different actual environments
5 are managed by different IDs, so that traceability of hydrogen can efficiently be managed while being distinguished by a difference in actual environment. Traceability data for hydrogen can thus be managed efficiently and with small data capacity.

[0149] A second aspect is the traceability data management system for hydrogen according to the first aspect, wherein the first history information includes information
10 received when hydrogen is produced or cargo handled.

[0150] As described above, when the first history information is information received when hydrogen is produced or cargo handled, the new ID is issued when hydrogen is produced or when the storage facility is changed by cargo handling of hydrogen, so that the history data is easily managed by the storage facility.

15 [0151] A third aspect is the traceability data management system for hydrogen according to the first or the second aspect, wherein the second history information includes an amount of variation in hydrogen or an amount of variation in greenhouse gas caused through a history of hydrogen.

[0152] As described above, the amount of variation in hydrogen or the amount of
20 variation in greenhouse gas caused through the history of hydrogen allows for easy management of the amount of variation in hydrogen or the amount of variation in greenhouse gas caused through the history of hydrogen for each change in the first history information.

[0153] A fourth aspect is the traceability data management system for hydrogen
25 according to any one of the first to the third aspects, wherein the history data includes an

amount of hydrogen or an amount of greenhouse gas when the ID is issued.

[0154] In this case, the history data includes the amount of hydrogen or the amount of greenhouse gas when the ID is issued, so that GHG or CI is easily managed based on the traceability data.

5 [0155] A fifth aspect is the traceability data management system for hydrogen according to the first or the second aspect, wherein the second history information includes an amount of variation in hydrogen or an amount of variation in greenhouse gas caused through a history of hydrogen, the history data includes an amount of hydrogen or an amount of greenhouse gas when the ID is issued, and the data manager registers, when the ID is issued,
10 the amount of hydrogen or the amount of greenhouse gas based on an amount of hydrogen or an amount of greenhouse gas when the ID is issued included in history data before the ID is issued and the amount of variation in hydrogen or the amount of variation in greenhouse gas.

[0156] The amount of hydrogen or the amount of greenhouse gas can thus be registered
15 based on the previous history data each time the ID is issued.

[0157] A sixth aspect is the traceability data management system for hydrogen according to any one of the first to the fifth aspects, wherein the second history information includes an amount of variation in greenhouse gas caused through a history of hydrogen, the storage device stores activity amount data including greenhouse gas generation information
20 associated with a history of hydrogen, and the data manager rewrites the amount of variation in greenhouse gas based on the greenhouse gas generation information.

[0158] The activity amount data including greenhouse gas generation information based on which the amount of greenhouse gas is calculated can be managed separately from the history data. The amount of the history data can thus be reduced.

25 [0159] A seventh aspect is the traceability data management system for hydrogen

according to the sixth aspect, wherein the activity amount data includes greenhouse gas generation information resulting from storage or transportation of hydrogen.

[0160] Greenhouse gas due to storage or transportation of hydrogen is thus easily known.

[0161] An eighth aspect is a traceability data management method for hydrogen supplied
5 through a plurality of histories, the traceability data management method including: a computer receiving first history information associated with an intentional change in history of hydrogen and second history information associated with an unintentional change in history of hydrogen; storing, in a storage device, history data including a newly issued ID when the first history information is changed; and rewriting the history data
10 stored in the storage device while maintaining the ID when the second history information is changed.

[0162] According to the traceability data management method for hydrogen, the history data including the newly issued ID is generated when the first history information associated with the intentional change in history of hydrogen is changed. The history data
15 is rewritten while the ID is maintained when the second history information associated with the unintentional change in history of hydrogen is changed. The ID is thus not required to be newly issued each time the history information is changed. When a history of hydrogen is intentionally changed, an actual environment of the history is highly likely to be greatly changed. Pieces of history data having different actual environments are managed by
20 different IDs, so that traceability of hydrogen can efficiently be managed while being distinguished by a difference in actual environment. Traceability data for hydrogen can thus be managed efficiently and with small data capacity.

[0163] The functionality of the elements disclosed herein may be implemented using circuitry or processing circuitry which includes general purpose processors, special
25 purpose processors, integrated circuits, ASICs (Application Specific Integrated Circuits),

conventional circuitry and/or combinations thereof which are configured or programmed to perform the disclosed functionality. Processors are considered to be processing circuitry or circuitry as they include transistors and other circuitry therein. In the disclosure, the circuitry, units, or means are hardware that carry out or are programmed to carry out the

5 recited functionality. The hardware may be any hardware disclosed herein or otherwise known which is programmed or configured to carry out the recited functionality. When the hardware is a processor which may be considered a type of circuitry, the circuitry, means, or units are a combination of hardware and software, the software being used to configure the hardware and/or processor.

10 [0164] The foregoing description is in all aspects illustrative and does not restrict the present invention. It is understood that numerous unillustrated modifications can be devised without departing from the scope of the present invention.

CLAIMS

[Claim 1] A traceability data management system for hydrogen supplied through a plurality of histories, the traceability data management system comprising:

5 a history information receiver that receives first history information associated with an intentional change in history of hydrogen and second history information associated with an unintentional change in history of hydrogen;

a storage device that stores history data including the first history information, the second history information, and an ID; and

10 a data manager that controls generation and rewriting of the history data, wherein the data manager generates history data including a newly issued ID when the first history information is changed and rewrites the history data while maintaining the ID when the second history information is changed.

[Claim 2] The traceability data management system for hydrogen according to claim 1, wherein

15 the first history information includes information received when hydrogen is produced or cargo handled.

[Claim 3] The traceability data management system for hydrogen according to claim 1 or 2, wherein

20 the second history information includes an amount of variation in hydrogen or an amount of variation in greenhouse gas caused through a history of hydrogen.

[Claim 4] The traceability data management system for hydrogen according to claim 1 or 2, wherein

the history data includes an amount of hydrogen or an amount of greenhouse gas when the ID is issued.

25 [Claim 5] The traceability data management system for hydrogen according to

claim 1 or 2, wherein

the second history information includes an amount of variation in hydrogen or an amount of variation in greenhouse gas caused through a history of hydrogen,

the history data includes an amount of hydrogen or an amount of greenhouse gas

5 when the ID is issued, and

the data manager registers, when the ID is issued, the amount of hydrogen or the amount of greenhouse gas based on an amount of hydrogen or an amount of greenhouse gas when the ID is issued included in history data before the ID is issued and the amount of variation in hydrogen or the amount of variation in greenhouse gas.

10 [Claim 6] The traceability data management system for hydrogen according to claim 1 or 2, wherein

the second history information includes an amount of variation in greenhouse gas caused through a history of hydrogen,

the storage device stores activity amount data including greenhouse gas generation
15 information associated with a history of hydrogen, and

the data manager rewrites the amount of variation in greenhouse gas based on the greenhouse gas generation information.

[Claim 7] The traceability data management system for hydrogen according to claim 6, wherein

20 the activity amount data includes greenhouse gas generation information resulting from storage or transportation of hydrogen.

[Claim 8] A traceability data management method for hydrogen supplied through a plurality of histories, the traceability data management method comprising:

a computer

25 receiving first history information associated with an intentional change

in history of hydrogen and second history information associated with an unintentional change in history of hydrogen;

storing, in a storage device, history data including a newly issued ID when the first history information is changed; and

- 5 rewriting the history data stored in the storage device while maintaining the ID when the second history information is changed.