management apparatus 5, the relationship between the weather data and the quantity of energy consumption is modeled and analyzed.

[0048]

The energy management apparatus 5 is, for example, constituted by at least one personal computer or workstation or the like. The energy management apparatus 5 has functions such as an interface function, a display/operation function, and a function that obtains, generates, manages, verifies, adjusts, and stores various information.

[0049]

The energy management apparatus 5 has facilities/external information interface unit 5a, a GUI display console unit 5b, a first-order information interface unit 5c, a production schedule information acquisition unit 5d, a production schedule information storage unit 5e, facilities energy characteristic generation unit 5f, facilities information acquisition unit 5g, facilities information storage unit 5h, an external fluctuation factor information acquisition unit 5i, an external fluctuation factor information storage unit 5j, facilities energy characteristic adjustment unit 5k, facilities actual performance value storage unit 5m, facilities energy characteristic verification unit 5n, a second-order information interface unit 5p, facilities energy characteristic synthesis unit 5q, and an estimate model storage unit 5r.

[0050]

In the energy management apparatus 5, the facilities external information interface unit Sa has an input/output function that performs exchange processing of various information between the energy management apparatus 5 and external devices and the like, via a communication network 3. The facilities external information interface 5a is connected to a GUI display console unit 5b that has a function that handles input of operations from an operator and a function that displays to the operator. The facilities external information interface unit 5a is connected also to the first-order information interface 5c.

[0051]

Claims

1. An energy management method comprising:

identifying a target of energy management;

monitoring a time-transitionable status of the target of energy management; and

defining at least one estimate model to estimate the quantity of energy consumption and the quantity of energy conversion associated with at least one status of the target of energy management, and the energy consumption and the energy conversion being caused by operation of the target of energy management.

2. The energy management method according to claim 1, wherein defining the estimate model comprises defining a plurality of the estimate models associated with each of a plurality of different statuses of the target of energy management.

3. The energy management method according to claim 2, further comprising estimating, based on the plurality of estimate models, the quantity of energy consumption and the quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of the target of energy management.

4. The energy management method according to claim 1, wherein the target of energy management comprises a device, an instrument, an apparatus, an equipment, a facility, a process line, facilities and a factory.

5. The energy management method according to claim 1, further comprising:

dividing the target of energy management into a plurality of boundaries, wherein

monitoring the time-transitionable status comprises monitoring at least one time-transitionable status of the plurality of boundaries, and

defining the estimate model comprises defining at least one estimate model associated with at least one status of the boundaries.

6. The energy management method according to claim 1, further comprising correcting the estimate model, based on at least one actually measured value of the quantity of energy consumption and the quantity of energy conversion of each of the plurality of different statuses.

7. The energy management method according to claim 6, wherein correcting the estimate model comprises:

selecting one of permissibility and impermissibility to perform automatic estimate model correction; and

storing of a plurality of histories of the estimate model corrections to enable selection of pre-correction version of the estimate model.

8. The energy management method according to claim 2, wherein the estimate model associated with one status of facilities is defined in article name.

9. The energy management method according to claim 1, wherein the estimate model is a compound model that is synthesized by an association between two or more boundaries of different facilities.

10. An energy management apparatus comprising:

a monitoring unit configured to measure the actual quantity of energy consumption and the actual quantity of energy conversion of a target of energy management that either consumes or converts energy by its operation, and to monitor a time-transitionable status of the target of energy management;

an estimate model definition unit configured to define at least one estimate model to estimate the quantity of energy consumption and the quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of the target of energy management associated with at least one status of the target of energy management;

an estimate model storage unit configured to store the estimate model; and

an estimate model correction unit configured to correct and store the estimate model stored in the estimate model storage unit, based on the quantity of energy consumption and the quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of the target of energy management.

11. The energy management apparatus according to claim 10, wherein:

the monitoring unit is configured to measure each a quantity of energy consumption and a quantity of energy conversion of a plurality of boundaries generated

by dividing the target of energy management and to monitor each time-transitionable status of the plurality of boundaries;

the estimate model definition unit is configured to define at least one estimate model to estimate a quantity of energy consumption and a quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of each of the plurality of boundaries associated with at least one status of each of the plurality of boundaries; and

the estimate model correction unit is configured to correct the estimate model based on the quantity of energy consumption and the quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of each of the plurality of boundaries, and to store the estimate model in the estimate model storage unit.

12. An energy management system GUI method, comprising:

identifying a plurality of targets of energy management from among energy generation facilities, energy allocation facilities, and energy demand facilities;

monitoring a time-transitionable status of the targets of energy management;

defining an estimate model associated with one status of the targets of energy management; and

estimating, based on the defined estimate model, a quantity of energy consumption and a quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of the targets of energy management;

displaying first and second boundaries in association with one another, the first boundary including the energy demand facilities and the second boundary including at least one of the energy generation facilities and the energy allocation facilities.

13. The energy management system GUI method according to claim 12, wherein

displaying the first and second boundaries comprises displaying first-order information of a past facilities energy value, and second-order information, which is processed or generated based on the first-order information, the first-order information and the second-order information distinguished from each other.

14. The energy management system GUI method according to claim 13, wherein displaying the first and second boundaries comprises displaying discriminately a first display/operation window screen handling only the first-order information and a second display/operation window screen handling only the second-order information.

15. The energy management system GUI method according to claim 12, wherein displaying the first and second boundaries comprises displaying the status in the form of a dynamic state transition diagram.

16. The energy management system GUI method according to claim 15, wherein the dynamic state transition diagram is a hierarchically structured bubble chart with correspondence to facilities within boundaries of the targets of energy management.

17. The energy management system GUI method according to claim 15, wherein the bubble chart includes:

bubbles performing input definition and/or output display associated with each of the facilities statuses that transition along the time axis, caused by operation of the target of energy management; and

a state transition route providing a connection between arbitrary bubbles and specifying a transition path between facilities statuses,

wherein the state transition route defines, as a boundary condition, a state during transition between the arbitrary facilities statuses.

18. An energy management method according to claim 1, wherein the target of energy management operates based on production schedule information,

the energy management method further comprises:

estimating the quantity of energy consumption and the quantity of energy conversion in the future, based on the estimate model and the production schedule information.

19. An energy management system, comprising:

energy management facilities being operable based on a production schedule and consuming and converting energy by operation;

a monitoring unit configured to monitor the time-transitionable status, the quantity of energy consumption, and the quantity of energy conversion of the energy management facilities;

an external information input unit configured to obtain and output external information; and

an energy management apparatus configured to manage the quantity of energy consumption and the quantity of energy conversion of the energy management facilities, based on the external information,

wherein, in the energy management system:

the energy management apparatus comprises:

a production schedule information storage unit that stores the production schedule information,

a facilities information storage unit that stores facilities information of the energy management facilities,

an external fluctuation factor information storage unit that stores the external information obtained by the external information input unit,

a facilities actual performance value storage unit that receives as facilities actual performance values from the monitoring unit and stores a quantity of energy consumption and a quantity of energy conversion of the energy management facilities,

a boundary setting unit configured to divide targets of energy management into a plurality of boundaries,

an estimate model definition unit configured to define a plurality of estimate models to estimate a quantity of energy consumption and a quantity of energy conversion associated with at least one status in each of the plurality of boundaries, based on the production schedule information, the facilities information, and the facilities actual performance value,

an estimate model correction unit configured to correct the plurality of estimate models, based on the facilities actual performance value and the external information, and

a GUI display unit configured to synthesize and display by a GUI the plurality of estimate models corrected by the estimate model correction unit.

20. The energy management system according to claim 19, wherein the GUI display unit configured to estimate and display the quantity of energy consumption and the quantity of energy conversion in the future, based on the estimate models and the production schedule information.

21. The energy management system according to claim 19, wherein the GUI display unit is configured to display a performance index that compares first and second relationships, the first relationship being defined by between the quantity of energy consumption and the quantity of energy conversion of an arbitrary boundary and a variable related to the energies in a baseline time period serving as the reference for comparison, and the second relationship being defined by between the quantity of energy consumption and the quantity of energy conversion of the boundary and a variable related to the energies of the boundary in a reporting time period.

management apparatus 5, the relationship between the weather data and the quantity of energy consumption is modeled and analyzed.

[0048]

The energy management apparatus 5 is, for example, constituted by at least one personal computer or workstation or the like. The energy management apparatus 5 has functions such as an interface function, a display/operation function, and a function that obtains, generates, manages, verifies, adjusts, and stores various information.

[0049]

The energy management apparatus 5 has facilities external information interface unit 5a, a GUI display console unit 5b, a first-order information interface unit 5c, a production schedule information acquisition unit 5d, a production schedule information storage unit 5e, facilities energy characteristic generation unit 5f, facilities information acquisition unit 5g, facilities information storage unit 5h, an external fluctuation factor information acquisition unit 5i, an external fluctuation factor information storage unit 5j, facilities energy characteristic adjustment unit 5k, facilities actual performance value storage unit 5m, facilities energy characteristic verification unit 5n, a second-order information interface unit 5p, facilities energy characteristic synthesis unit 5q, and an estimate model storage unit 5r.

[0050]

In the energy management apparatus 5, the facilities external information interface unit Sa has an input/output function that performs exchange processing of various information between the energy management apparatus 5 and external devices and the like, via a communication network 3. The facilities external information interface 5a is connected to a GUI display console unit 5b that has a function that handles input of operations from an operator and a function that displays to the operator. The facilities external information interface unit 5a is connected also to the first-order information interface 5c.

[0051]

Claims

1. An energy management method comprising:

defining a plurality of boundaries for targets of energy management;

monitoring a time-transitionable status of at least one of the plurality of boundaries; and

defining at least one estimate model to estimate the quantity of energy consumption and the quantity of energy conversion associated with at least one status in each of the plurality of boundaries, and the energy consumption and the energy conversion being caused by operation of the targets of energy management.

2. The energy management method according to claim 1, wherein defining the estimate model comprises defining a plurality of the estimate models associated with each of a plurality of different statuses in each of the plurality of boundaries.

3. The energy management method according to claim 2, further comprising estimating, based on the plurality of estimate models, the quantity of energy consumption and the quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of the targets of energy management.

4. The energy management method according to claim 1, wherein the targets of energy management comprise a device, an instrument, an apparatus, an equipment, a facility, a process line, facilities and a factory.

5. The energy management method according to claim 1, wherein defining the plurality of boundaries for the targets of energy management comprises defining a boundary for a target of energy management, the quantity of energy usage of which is relatively large, and defining a boundary for targets of energy management, the quantity of energy usage of which is relatively small.

6. The energy management method according to claim 1, further comprising correcting the estimate model, based on at least one actually measured value of the quantity of energy consumption and the quantity of energy conversion of each of the plurality of different statuses.

7. The energy management method according to claim 6, wherein correcting the estimate model comprises:

selecting one of permissibility and impermissibility to perform automatic estimate model correction; and

storing of a plurality of histories of the estimate model corrections to enable selection of pre-correction version of the estimate model.

8. The energy management method according to claim 2, wherein the estimate model associated with one status of facilities is defined in article name.

9. The energy management method according to claim 1, wherein the estimate model is a compound model that is synthesized by an association between two or more boundaries of different facilities.

10. An energy management apparatus comprising:

a monitoring unit configured to measure the actual quantity of energy consumption and the actual quantity of energy conversion of each of a plurality of boundaries, and to monitor a time-transitionable status of each of the plurality of boundaries, the plurality of boundaries being defined for targets of energy management that either consume or convert energy by their operations;

an estimate model definition unit configured to define at least one estimate model to estimate the quantity of energy consumption and the quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of each of the plurality of boundaries associated with at least one status of each of the

plurality of boundaries;

an estimate model storage unit storing the estimate model; and

an estimate model correction unit configured to correct the estimate model stored in the estimate model storage unit, based on the quantity of energy consumption and the quantity of energy conversion and to store the corrected estimate model in the estimate model storage unit, the energy consumption and the energy conversion being caused by operation of each of the plurality of boundaries.

12. An energy management system GUI method, comprising:

defining a plurality of boundaries for targets of energy management;

monitoring a time-transitionable status of at least one of the plurality of boundaries;

defining an estimate model associated with at least one status in each of the plurality of boundaries;

estimating, based on the defined estimate model, a quantity of energy consumption and a quantity of energy conversion, the energy consumption and the energy conversion being caused by operation of the targets of energy management; and

displaying first and second boundaries in association with one another, the first boundary including energy demand facilities as the targets of energy management and the second boundary including at least one of energy generation facilities and energy allocation facilities as the targets of energy management.

13. The energy management system GUI method according to claim 12, wherein

displaying the first and second boundaries comprises displaying first-order information of a past facilities energy value, and second-order information, which is processed or generated based on the first-order information, the first-order information and the second-order information distinguished from each other.

14. The energy management system GUI method according to claim 13, wherein

displaying the first and second boundaries comprises displaying discriminately a first display/operation window screen handling only the first-order information and a second display/operation window screen handling only the second-order information.

15. The energy management system GUI method according to claim 12, wherein

displaying the first and second boundaries comprises displaying the status in the form of a dynamic state transition diagram.

16. The energy management system GUI method according to claim 15, wherein the dynamic state transition diagram is a hierarchically structured bubble chart with correspondence to facilities within boundaries of the targets of energy management.

17. The energy management system GUI method according to claim 16, wherein

the bubble chart includes:

bubbles performing input definition and/or output display associated with each of statuses of each of the targets of energy management that transition along the time axis, caused by operation of the targets of energy management; and

a state transition route providing a connection between arbitrary bubbles and specifying a transition path between the statuses of each of the targets of energy management,

wherein the state transition route defines, as a boundary condition, a state during transition between the arbitrary statuses of each of the targets of energy management.

18. An energy management method according to claim 1, wherein the targets of energy management operate based on production schedule information,

the energy management method further comprises:

estimating the quantity of energy consumption and the quantity of energy conversion in the future, based on the estimate model and the production schedule information.

19. An energy management system, comprising:

energy management facilities being operable based on a production schedule information and consuming and converting energy by operation;

a monitoring unit configured to monitor the time-transitionable status, the quantity of energy consumption, and the quantity of energy conversion of the energy management facilities;

an external information input unit configured to obtain and output external information; and

an energy management apparatus configured to manage the quantity of energy consumption and the quantity of energy conversion of the energy management facilities, based on the external information,

wherein, in the energy management system:

the energy management apparatus comprises:

a production schedule information storage unit that stores the production schedule information,

a facilities information storage unit that stores facilities information of the energy management facilities,

an external fluctuation factor information storage unit that stores the external information obtained by the external information input unit,

a facilities actual performance value storage unit that receives as facilities actual performance values from the monitoring unit and stores a quantity of energy consumption and a quantity of energy conversion of the energy management facilities,

a boundary setting unit configured to define a plurality of boundaries for the energy management facilities,

an estimate model definition unit configured to define a plurality of estimate models to estimate a quantity of energy consumption and a quantity of energy conversion associated with at least one status in each of the plurality of boundaries, based on the production schedule information, the facilities information, and the facilities actual performance value,

an estimate model correction unit configured to correct the plurality of estimate models, based on the facilities actual performance value and the external information, and

a GUI display unit configured to synthesize and display by a GUI the plurality of estimate models corrected by the estimate model correction unit.

20. The energy management system according to claim 19, wherein the GUI display unit is configured to estimate and display the quantity of energy consumption and the quantity of energy conversion in the future, based on the estimate models and the production schedule information.

21. The energy management system according to claim 19, wherein the GUI display unit is configured to display a performance index that compares first and second relationships, the first relationship being defined by between the quantity of energy consumption and the quantity of energy conversion of an arbitrary boundary and a variable related to the energies in a baseline time period serving as the reference for comparison, and the second relationship being defined by between the quantity of energy consumption and the quantity of energy conversion of the boundary and a variable related to the energies of the boundary in a reporting time period.