

## Energy and Flexibility Trading System

The present invention relates to an energy and flexibility trading system. In particular, it relates to a system which permits end-users to compare energy prices to meet their needs.

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Conventionally, end-users are tied into contracts with a single energy provider and only a single energy provider can provide energy to an end-user at any given time.

10 Additionally, end-users that generate or store surplus energy often find it difficult to compare prices that may be available for the energy that they generated or stored.

This results in end-users often paying more than is necessary for their energy needs or securing a lower price for the surplus energy they have stored and/or generated. Additionally, it results in locally produced "green" energy being wasted if it is not used.

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Furthermore, the energy providers are discouraged from offering better energy deals or prices to their customers, whose energy needs are tied to those energy providers.

20 According to a first aspect of the invention, there is provided an energy and flexibility trading system comprising a trading platform; a plurality of end-user energy terminals; and a plurality of energy supplier inputs; wherein the end-user energy terminals are each connected to the trading platform; each end-user energy terminal includes one or more sensors which sense the energy usage of the end user and/or sense the energy generation by the end-user; and data relating to the energy requirements and/or generated or stored energy surplus for each end-user is  
25 transmitted to the trading platform; wherein the energy supplier inputs transmit data to the trading platform relating to an offer price of energy to be supplied for a specific time period and to a bid price for energy generated or stored by an end user; and wherein the trading platform includes a processor which matches energy requirements from an end user with energy available from one or more energy suppliers and/or matches energy generated or stored by an end-user  
30 with energy requirements from an energy supplier.

The present invention allows end-users the option of utilising "green" energy when it is available or sourcing their energy needs from a national grid if it is not.

In the context of the present invention, “green” energy is intended to mean energy which is generated via renewable power sources, such as solar power, wind power, wave power, tidal power, etc.

- 5 Additionally, if the end-user has generated surplus energy or has stored energy, then they are able to determine the value of that energy at a given time.

10 It will be appreciated that the end-user will be able to determine their energy needs, based on data from the or each sensor of the end-user energy terminals. They are then able to determine costs to meet their energy needs via the platform.

15 In the context of the present invention, the term “flexibility” is intended to have the definition “temporary changes made using distributed energy assets to change the way that electrical energy is consumed, generated or stored when requested, to support a more efficient use of the energy network. Usually, this is rewarded financially. For example, modifying generation and/or consumption patterns in reaction to an external signal or event (e.g., a change in energy pricing) to provide a service within the energy system.

20 The trading system comprises a unique “whole systems” approach in relation to optimisation of energy assets; the local distribution network; national; and international markets.

25 It will be appreciated that the “energy assets” include (i) energy consuming assets, such as air handling units, refrigeration apparatus, chillers, pumps, air source heat pumps, water source heat pumps, etc.; (ii) energy generating assets, such as wind-powered generators, solar photovoltaic panels, etc.; and (iii) energy storage assets, such as batteries and other energy storage apparatus.

Thus, the end-user energy terminals measure the energy consumption, energy generation and/or energy storage of the energy assets.

30 Suitably, each end-user energy terminal includes an end-user processor which receives data from the or each energy usage sensor and calculates a total energy requirement for the end-user for a specified period of time. The calculated energy requirement may then be transmitted to the trading platform, where the trading platform processor matches the energy requirements with

one or more energy suppliers. The end user can then select an appropriate energy provider to meet their energy needs for the specific time period.

5 Additionally or alternatively, the end-user may have a surplus of generated energy or stored energy. The energy trading system of the present invention permits the end-user to transmit data relating to the generated surplus energy and/or stored energy to the trading platform, whereupon the trading platform processor matches the available energy from the end-user with suitable energy suppliers or with different end-users.

10 In an embodiment of the invention, each end-user processor and/or the trading platform processor, includes an algorithm which predicts the total energy requirement for a specified period of time in the future. In this way, the end-user is able to predict their future energy needs based on the data from the or each sensor and the algorithm and then determine how best to meet those predicted energy needs via the trading platform.

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It will be appreciated that the predictive capability of the processor running the algorithm will increase with time such that the predictions will become more accurate.

20 In addition to providing data to the end-users from the energy suppliers, the trading platform may further be capable of enabling contracts to be agreed between energy suppliers and end-users, whereby energy suppliers agree to supply a predetermined amount of energy for a predetermined period of time. In such cases, the predetermined amount of energy may be sufficient to meet the energy needs of the end-user for the agreed period of time, as determined by the end-user energy terminal.

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In this way, end-users can determine the periods of time for which they wish to be contracted or tied to a specific energy supplier. Additionally, they know how much they are going to spend on energy for this period, which allows them to control better their energy costs.

30 Suitably, the trading platform may be capable of managing electrical energy connections between energy suppliers and each end-user. For example, a number of energy suppliers may be connected to each end-user and the connections may be managed by the trading platform. Thus, if an end-user agrees to a supply contract with a specific energy supplier, the trading platform may manage the agreed supply of energy to the end-user.

5 Additionally, the trading platform may manage the transfer of energy from the end-user to an energy supplier or to a separate end-user. Accordingly, an end-user with surplus generated energy or stored energy may also act as an energy supplier on the platform, where they may be able to supply energy to other end-users.

10 A commission may be charged for use of the trading platform. In order to store data relating to agreements between energy suppliers and end-users, the trading platform may further include a memory component.

Two or more of the end-users may be related entities or may wish to act together. In such cases, the trading platform may permit two or more end-users to combine their energy requirements.

15 Additionally or alternatively, two or more end-users who have surplus generated energy and/or stored energy may be permitted to combine their generated and/or stored energy to meet minimum energy supply restrictions. For example, local rules may require that energy must be provided having a minimum threshold value. In order to meet this minimum threshold value, two or more end-users may combine or pool their energy resources.

20 According to a second aspect of the invention, there is provided a method of trading energy and flexibility, the method including transmitting to a trading platform data relating to energy requirements of an end-user and/or data relating to surplus generated energy and/or stored energy; and matching the energy requirements and/or the energy surplus with energy suppliers; wherein the energy requirements are determined via one or more end-user sensors.

25 In an embodiment of the invention, the step of determining the energy requirements includes inputting data from the or each end-user sensor into a processor which runs an algorithm to determine the energy requirement for a given period of time.

30 Suitably, the algorithm calculates a predicted energy requirement for a future period of time based on previous data from the sensors.

The method of the second aspect of the invention may further include the step of permitting the end-user to select a specific energy supply offer from an energy supplier. As a further optional

step, the method may permit the end-user to contract with the selected energy supplier for a supply of energy for a predetermined period of time at a predetermined cost.

5 The trading platform may store details of each energy supply contract. This may be supply of energy from an energy supplier to an end-user or it may be supply of surplus energy or stored energy from the end-user to an energy supplier or to a different end-user.

The method may further include the step of managing the connection of each end-user with respective energy suppliers, based on the agreed energy supply contracts.

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The skilled person will appreciate that the features described and defined in connection with the aspects of the invention and the embodiments thereof may be combined in any combination, regardless of whether the specific combination is expressly mentioned herein. Thus, all such combinations are considered to be made available to the skilled person.

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An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

20 Figure 1 is a schematic representation of an energy trading system according to the first aspect of the invention.

Figure 1 shows an energy and flexibility trading system 2, which comprises a trading platform 4, three end-users 6; an energy supplier 8 who supplies energy from the National Grid 10; and an energy supplier 12 who supplies energy generated by a windfarm 14.

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Each of the end-users 6 includes an end user energy terminal which comprises a number of energy usage sensors 16 and a processor 18. The energy usage sensors 16 are each associated with a respective energy asset. Each processor 18 receives data from the energy usage sensors 16 and calculates from the data a predicted energy requirement for a future period of time.

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Data relating to the predicted energy requirement is transmitted to the trading platform 4, where a trading platform processor matches the predicted energy requirement with offers to supply energy from the National Grid energy supplier 8 and the windfarm energy supplier 12.

If the weather forecast is for optimum wind energy harvesting, the windfarm energy supplier may offer a lower price for their energy for a period of time. Thus, the end-user 6 may contract with the windfarm energy supplier 12 for energy supply to meet their predicted energy demands.

5 Alternatively, if the weather forecast is unfavourable for energy generation from the windfarm, the National Grid energy supplier 8 may be able to offer better terms for energy supply. In such cases, the end-user 6 may instead contract with the National Grid energy supplier 8 to meet their predicted energy needs.

10 Additionally, if one of the end-users 6 has the capability to generate energy locally and has a surplus of generated energy or stored energy, then may market that surplus/stored energy via the trading platform 4. In this case, the National Grid energy supplier 8 or the windfarm energy supplier 12 may agree to purchase this surplus/stored energy in order to balance their supply, or one of the other end-users 6 may contract with the first end-user 6 for the supply of the  
15 surplus/stored energy.

It will be appreciated that in practice, the trading platform 4 will include significantly more than three end-users and significantly more than two energy suppliers, such that energy trading between the energy suppliers and end-users will be managed by the trading platform at a much  
20 greater scale.

Claims

1. An energy and flexibility trading system comprising a trading platform; a plurality of end-user energy terminals; and a plurality of energy supplier inputs; wherein the end-user energy terminals are each connected to the trading platform; each end-user energy terminal includes one or more sensors which sense the energy usage of the end user and/or sense the energy generation by the end-user; and data relating to the energy requirements and/or generated or stored energy surplus for each end-user is transmitted to the trading platform; wherein the energy supplier inputs transmit data to the trading platform relating to an offer price of energy to be supplied for a specific time period and to a bid price for energy generated or stored by an end user; and wherein the trading platform includes a processor which matches energy requirements from an end user with energy available from one or more energy suppliers and/or matches energy generated or stored by an end-user with energy requirements from an energy supplier.
2. An energy and flexibility trading system according to Claim 1, wherein each end-user energy terminal includes an end-user processor which receives data from the or each energy usage sensor and calculates a total energy requirement for the end-user for a specified period of time.
3. An energy and flexibility trading system according to Claim 2, wherein the end-user processor includes an algorithm which predicts the total energy requirement for a specified period of time in the future.
4. An energy and flexibility trading system according to any of Claims 1 to 3, wherein the trading platform permits an end-user to select an offer price or a bid price provided to the platform by an energy supplier and to contract with the energy supplier to supply or acquire the energy.
5. An energy and flexibility trading system according to Claim 4, wherein the platform further includes a memory component which stores the details of each contract agreed between an end-user and an energy supplier.

6. An energy and flexibility trading system according to any of Claims 1 to 5, wherein the trading platform permits two or more end-users to combine their energy requirements and/or their generated energy.

5 7. An energy and flexibility trading system according to any of Claims 1 to 6, wherein a plurality of energy suppliers are electrically connected to an end-user and the connection of each supplier to the end-user is managed by the platform.

10

Abstract

**Energy and Flexibility Trading System**

5 An energy and flexibility trading system comprising a trading platform; a plurality of end-user energy terminals; and a plurality of energy supplier inputs; wherein the end-user energy terminals are each connected to the trading platform; each end-user energy terminal includes one or more sensors which sense the energy usage of the end user and/or sense the energy generation by the end-user; and data relating to the energy requirements and/or generated or stored energy surplus  
10 for each end-user is transmitted to the trading platform; wherein the energy supplier inputs transmit data to the trading platform relating to an offer price of energy to be supplied for a specific time period and to a bid price for energy generated or stored by an end user; and wherein the trading platform includes a processor which matches energy requirements from an end user with energy available from one or more energy suppliers and/or matches energy generated or  
15 stored by an end-user with energy requirements from an energy supplier.