

UTILITY VENDING SYSTEM AND METHOD

TECHNICAL FIELD

The present invention relates to a utility vending systems and in particular to an electricity vending system and method for a competitive electricity market.

5 BACKGROUND ART

Electricity consumption for consumer has typically been determined using a meter which records the consumer's electricity usage. The meter of particularly, a small electricity consumer is read periodically, typically monthly or bi-monthly and the consumer is invoiced for their consumption by the
10 electricity retailer. Such processes require an expensive invoicing system. The system has to set up an account for each consumer and the consumer may be required to pay a deposit equal to or greater than their estimated usage for a billing period.

Systems have been introduced to allow consumers to pay in advance for
15 their electricity. Typically the meter is adapted to only permit supply when there is a credit in the meter. Consumers have to purchase the credit from retail outlets or specially adapted point of sale terminals similar to terminals used by banks for cash withdrawals. The credit is typically applied to the meter using magnetic cards, smart cards or special codes to be keyed into the meter. Such systems
20 usually only allow a consumer to purchase from one supplier. If the consumer wishes to change suppliers then they need to arrange for the installation of new meters and arrange to obtain a new card.

EP1148450 Pollock describes a system that allows a consumer to purchase electricity from multiple suppliers and to apply the credit from multiple
25 suppliers to a standard meter. The credit is purchased from a variety of outlets appointed by the electricity suppliers and is applied to the meter via a smart card

or via a wireless link to the meter. The system does not provide for any form of electronic meter reading so that real time data cannot be used for calculating the supply made by the various retailers at various times of the month. Accounting for supply is made solely based on consumer's purchases.

5 EP1052601 Cowburn provides a method for prepayment of electricity that allows consumers to purchase from various suppliers in a competitive market using a smart card. Cowburn provides that the card stores a consumer's electricity usage profile and that the offers made to the consumer by the various electricity retailers will be tailored to the consumer's profile. Cowburn also
10 discussed the possibility of eliminating the smart card and the meter being linked directly to a telephone line. Cowburn does not provide for the consumer's actual usage to be stored in the usage profile for the purposes of charging electricity retailers for the supply made by them to consumers.

Both systems include the possibility of notifying a consumer that the
15 purchased electricity is about to run out. Neither system provides for the suppliers to be charged by the wholesale electricity market based on the real usage of consumers who purchased electricity from them.

SUMMARY OF THE INVENTION

It is an object of the present invention to implement a utility vending
20 system and method that overcomes the disadvantages of existing systems or at least provides the public or industry with a useful choice.

In a first embodiment the present invention consists in a utility vending system having:

a system management server;

25 a plurality of supply meters, each said supply meter having:

a processor;

utility usage measuring means, said usage measuring means communicating utility usage to said processor;

5 a two way communication module allowing said processor to communicate with said system management server,

memory for storing a plurality of supply credits, and time of use data for the consumed utility;

means to allowing the supply of said utility to be cut off by said processor when insufficient supply credits are stored;

10 wherein said processor:

decreases said supply credits in response to use of said utility reported by said measuring means;

stores usage of said utility by time of use;

15 in response to an instruction from said system management server provides time of use data to said system management server; and

in response to an instruction from said system management server increases said supply credits.

20 Preferably said memory further stores supplier identifiers and utility consumption history and said meter further includes:

a display panel for showing the quantity of consumed utility in the current period and a history of credits and consumed utility;

pilot LED indicators for low credits and supply activation or turn-off; and
a speaker for audio alert;

Preferably said meter further includes a start button allowing said utility supply to be turned on.

5 Preferably including an e-payment system, said e-payment system allowing a consumer to purchase supply credits from a variety of utility retailers, said e-payments system communicating said purchase to said system management server for communication to said meter.

10 Preferably said meter has a unique meter identifier and said consumer supplies said unique meter identifier to said e-payment system as part of a purchase, said e-payment system communicating said unique meter identifier to said system management server along with other purchase information including the purchase quantity.

15 Preferably a plurality of utility retailers provide a plurality of utility offers through said e-payment system.

Preferably said e-payment system provides for purchase using a plurality of purchase options, said options including point of sale, automatic teller machines, an internet web site, direct debit standing instruction (GIRO), SMS, telephone.

20 Preferably said system management server aggregates the consumption of said plurality of meters by time of use and electricity retailer, said utility vending system further including a wholesale market settlement system, said system calculating payments by retailers based on said consumption by consumers of each retailer in each period.

Preferably said wholesale market settlement system calculates payments due to utility wholesalers.

5 Preferably said system management server aggregates the consumption of said plurality of meters by time of use and electricity retailer, said utility vending system further including a network operator's system, said system calculating network use payments by retailers based on said consumption by consumers of each retailer in each period.

Preferably said network operator's system calculates payments due to network operators.

10 Preferably said utility is electricity.

Preferably there are between 24 and 1440 time of use periods in a 24 hour period and said system management server instructs said meter to provide use data for a 24 hour period.

15 Preferably there are 48 time of use periods in a 24 hour period and said system management server instructs said meter to provide use date for a 24 hour period.

In a second embodiment the present invention consists in a utility vending method comprising the steps of:

at a utility consumers premises:

20 storing a plurality of supply credits for supply of said utility from at least one of a plurality of retailers, said supply credits received from a system management server;

measuring the consumption of said utility by time of use of said utility;

decreasing said stored supply credits as said utility is consumed;

storing said consumption, time of use data and decreased supply credit data;

periodically communicating said consumption, time of use data and decreased supply credit data to a system management server, and

5 wherein said system management server performing the steps of aggregating the consumption of a plurality of consumers' premises by time of use and electricity retailer.

Preferably said system management server further performs the step of communicating said aggregate consumption to a wholesale market settlement
10 system, said wholesale market settlement system performing the step of calculating payments by retailers based on consumption by consumers of each retailer in each period.

Preferably said wholesale market settlement system further performs the step of calculating payments due to utility wholesalers.

15 Preferably said system management server further performs the step of communicating said aggregate consumption to a network operator's system, said network operator's system performing the step of calculating payments by retailers based on consumption by consumers of each retailer in each period.

Preferably said network operator's system further performs the step of
20 calculating payments due to network operators.

Preferably further including the step of receiving and storing at said utility consumers premises at least one supply credit; said supply credit received from an e-payment system via said system management server;

Preferably each utility consumers premises has at least one meter and each
25 said meter has a unique identifier and the consumer supplies said unique meter

identifier to said e-payment system as part of a purchase, said method including said e-payment system communicating said unique meter identifier to said system management server along with other purchase information including the purchase quantity.

- 5 Preferably wherein a plurality of utility retailers provide a plurality of utility offers through said e-payment system.

 Preferably said e-payment system provides for purchase using a plurality of purchase options, said options including point of sale, automatic teller machines, an internet web site, direct debit standing instruction (GIRO), SMS,
10 telephone.

 Preferably said utility is electricity.

 Preferably there are between 24 and 1440 time of use periods and said step of periodically communicating said consumption, time of use data and decreased supply credit data to a system management server communicates data
15 for a 24 hour period.

 Preferably there are 48 time of use periods and said step of periodically communicating said consumption, time of use data and decreased supply credit data to a system management server communicates data for a 24 hour period.

BRIEF DESCRIPTION OF THE DRAWINGS

- 20 One preferred form of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a layer diagram of the electricity vending system of the present invention;

Figure 2 is a schematic diagram of flow process of the electricity vending system of the present invention;

Figure 3 is schematic diagram of the electricity vending system business cycle; and

5 **Figure 4** is schematic diagram of an electricity meter of the present invention.

DETAILED DESCRIPTION

Referring to Figures 1 to 4 at a layer level the system consists of a metering layer 101, a communication layer 102, and an application layer 103
10 integrated with a system integration layer 104. The application layer 103 includes an acquisition and instruction layer 110, a metering data processing layer 111, a purchase data processing layer 112 and a data delivery layer 113.

The metering layer 101 includes the meter used at the premises being supplied. While reference is made to electricity supply it is to be understood that
15 other metered utilities such as water or gas are also included. Referring to Figure 2 the meter 201 is located at or near the consumer's premises 220. A consumer is not to be limited to households but to include any user of utilities including small and large businesses.

The meter 201 of the present invention includes the functionalities of a
20 standard meter. That is the meter 201 can record electricity consumption. Additionally the meter 201 of the present invention can record consumption based on time of use period. In the preferred embodiment these period can be set by the system, but the periods could also be preprogrammed when the meter 201 is installed. The period would typically be half hour periods but could be shorter
25 or longer. For example the time of use period could be between 24 and 1440 periods over 24 hours. The meter 201 of the present invention is able to accept

an electricity credit from a real time signal to top up the amount of credit available to be supplied.

Referring to Figure 4 the meter 201 includes a CPU 401, memory 402, a communication module 403 including at least one communication port 404. The meter 201 also includes a user interface 405; the user interface includes an LCD panel 406 a plurality of buttons 407 and a plurality of LEDs 408. Further included in the meter 201 is a speaker 409. To control the supply of electricity the meter 201 also includes a circuit breaker 410. While not illustrated the meter 201 may also include a wired or wireless network port allowing a user to connect to the meter 201 over a local network.

In the preferred embodiment the meter 201 will allow multiple credits to be stored. The credits may be for the supply of different time of use rates. For example a retailer may charge different rates for use in the middle of the night compared to use in the evening. The credits can be stored either as a monetary value or as units of electricity to be consumed. If the credits are stored as a monetary value then the rates to be applied at different times of the days are included with the credit when the credit is transferred to the meter 201.

If the credits are stored as units of electricity the value that a user purchases is converted to credits based either on a standard usage profile or a profile to be entered by the consumer at the time of purchase. The consumer will have the option to request to top up when the threshold (not cut-off point) of period, say day time period, is reached. If the consumer does not top up, their usage during the particular usage period will be curtailed.

The use of credit from the meter 201 will be based on the order that the credit was applied to the meter 201. In an alternative but less preferred option the consumer will have the option of altering the order in which the credits stored in the meter 201 are consumed.

As previously mentioned the meter 201 will provide a user interface to allow consumers to at least view the credits that they have available. In a preferred embodiment the user interface will be incorporated into the meter 201. In an alternative embodiment the meter 201 will allow a user to communicate
5 using a personal computer, PDA or other device to view and select available options.

The meter 201 also features a start button to allow the consumer to turn supply on. Importantly the meter 201 will include communication means to enable the meter to receive information from the electricity vending system and
10 to send information to the electricity vending system 206. Communication may be made utilizing a power line carrier, GPRS, GSM, RF or other communication systems such as Wi-Fi, Wi-Max, etc.

In another embodiment the communication system of the meter 201 will be able to act as a gateway device for other household devices such as personal
15 computers.

As with known systems the meter 201 will communicate to a consumer when the available prepaid credits are running low, usually this takes the form of a visual and audio alert from the meter 201. Because the meter 201 includes a two-way communication module 403 the notification that credit is low may also
20 be via email, SMS or voice message. The meter 201 will communicate with the electricity vending system 206 and the electricity vending system 206 communicating with the consumer.

In the preferred embodiment the meters 201 of a plurality of consumers are connected to the electricity vending system 206 via a data concentrator 202.
25 A plurality of data concentrators 202 are connected to the electricity vending system 206, which includes a meter data management 203 and automated meter reading system 205. The connection between the data concentrators 202 and the

electricity vending system 206 is via a network 204 and the automated meter reading system 205. This network may be any suitable networking system but will typically be wireless or fiber-optics.

5 The automated meter reading system 205 will read each meter regularly; in the preferred embodiment each meter will be read at the end of each 24 hour period. The automated meter reading system 205 will obtain the usage from each meter for every period recorded during the last 24 hours. The information will include the number of units consumed, for each time of use period and the electricity retailer 208 supplying those units. The reporting period, while
10 typically 24 hours, will depend on system requirements, and may for example be 12 hourly or weekly.

 The meter 201, when it receives a credit, receives the electricity retailer's 208 name or the code of the retailer 208 supplying the credits and will record the name of the retailer 208 of the consumed credits.

15 The automated meter reading system 205 reads the data from the meter 201 via the data concentrator 202. In one embodiment the data concentrator 202 may read each meter 201 connected to the data concentrator 202 and forward the data to the automated meter reading system 205. In an alternative embodiment the automated meter reading system 205 may read each individual meter 201.

20 The electricity vending system 206 is connected via a network 211 to various other computer systems including an electronic payment system 207, various electricity retailers' systems 208, the wholesale market operator's system 209 and the electricity network operator's system 210.

 On a daily basis the electricity vending system 206 aggregates for each
25 time period the total units consumed by consumers of each electricity retailer. This information is used by the wholesale electricity market operator 209 and the electricity network operator 210 to charge each retailer for the consumption and

the use of electricity network by the retailers' consumers respectively. The advantage of the system is that the retailers 208 know the exact consumption of their consumers, rather than charging based on consumption profiles of the entire network or a limited sample over the past 24 hours.

5 Referring to Figure 3 the business cycle of the electricity vending system 206 will be described. A consumer 301 using an e-payment system 207 purchases electricity. The e-payment 207 system deducts the payment from the consumer's bank 212 or other account and credits the payment to the electricity retailer 208. As part of the purchase the consumer 301 provides their unique
10 meter identifier. The consumer 301 may also set up using the e-payment system a standing order to top up their meter 201 when the electricity vending system 206 notifies the e-payment system 207 of the need to top up the meter 201.

 The electronic payment system 207 allows consumers 301 to purchase electricity using a variety of channels. These include point of sale, website,
15 telephone, bank ATM machines, SMS, payment kiosks or any method that a consumer may purchase other items or make payment. The consumer will be provided with a choice of retailers 208 and a choice of electricity supply plans. So for example, retailer A may offer a 24 hour rate and retailer B a day rate and a night rate. The retailer 208 provides their offering to the e-payment system 207
20 via the electricity vending system 206. Once a consumer 301 has made a choice the e-payment system 207 notifies the electricity vending system 206 of the value of the purchase, the name of the retailer 208 and the meter number to credit the purchase to.

 The electricity vending system 206 then credits the meter 201 via the
25 automated meter reading system 205 with the purchase and the consumer 301 may use the purchase as discussed above.

The electricity vending system 206 using the automatic meter reading system 205 reads the consumptions of all meters 201 and aggregates the consumption for each time period and for each retailer 208. The information is sent to the electricity network operator 210, the wholesale electricity market operator 209 and the retailers 208.

The retailers 208 then settle with the wholesale electricity market operator 209 and the electricity network operator 210 based on the consumption of electricity by consumers 301 using credits provided by the retailer 208.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, since many modifications or variations thereof are possible in the light of the above teaching. All such modifications and variations are within the scope of the invention. The embodiments described herein were chosen and described in order best to explain the principles of the invention and its practical application, thereby to enable others skilled in the art to utilise the invention in various embodiments and with various modifications as are suited to the particular use contemplated thereof. It is intended that the scope of the invention be defined by the claims appended hereto, when interpreted in accordance with the full breadth to which they are legally and equitably suited.

CLAIMS

1. A utility vending system having:

a system management server;

a plurality of supply meters, each said supply meter having:

5 a processor;

utility usage measuring means, said usage measuring means communicating utility usage to said processor;

a two way communication module allowing said processor to communicate with said system management server,

10 memory for storing a plurality of supply credits, and time of use data for the consumed utility;

means to allowing the supply of said utility to be cut off by said processor when insufficient supply credits are stored;

wherein said processor:

15 decreases said supply credits in response to use of said utility reported by said measuring means;

stores usage of said utility by time of use;

in response to an instruction from said system management server provides time of use data to said system management server; and
20

in response to an instruction from said system management server increases said supply credits.

2. A utility vending system as claimed in claim 1 wherein said memory further stores supplier identifiers and utility consumption history and said meter further includes:

5 a display panel for showing the quantity of consumed utility in the current period and a history of credits and consumed utility;

pilot LED indicators for low credits and supply activation or turn-off; and

a speaker for audio alert;

3. A utility vending system as claimed in claim 1 wherein said meter
10 further includes a start button allowing said utility supply to be turned on.

4. A utility vending system as claimed in any one of claims 1 to 3 including an e-payment system, said e-payment system allowing a consumer to purchase supply credits from a variety of utility retailers, said e-payments system communicating said purchase to said system management server for
15 communication to said meter.

5. A utility vending system as claimed in claim 4 wherein said meter has a unique meter identifier and said consumer supplies said unique meter identifier to said e-payment system as part of a purchase, said e-payment system communicating said unique meter identifier to said system
20 management server along with other purchase information including the purchase quantity.

6. A utility vending system as claimed in claim 4 or claim 5 wherein a plurality of utility retailers provide a plurality of utility offers through said e-payment system.

7. A utility vending system as claimed any one of claims 4 to 6 wherein said e-payment system provides for purchase using a plurality of purchase options, said options including point of sale, automatic teller machines, an internet web site, direct debit standing instruction (GIRO), SMS, telephone.
- 5 8. A utility vending system as claimed in any one of claims 1 to 7 wherein said system management server aggregates the consumption of said plurality of meters by time of use and electricity retailer, said utility vending system further including a wholesale market settlement system, said system calculating payments by retailers based on said consumption by consumers of
10 each retailer in each period.
9. A utility vending system as claimed in claim 8 wherein said wholesale market settlement system calculates payments due to utility wholesalers.
10. A utility vending system as claimed in any one of claims 1 to 9 wherein said system management server aggregates the consumption of said plurality
15 of meters by time of use and electricity retailer, said utility vending system further including a network operator's system, said system calculating network use payments by retailers based on said consumption by consumers of each retailer in each period.
11. A utility vending system as claimed in claim 10 wherein said network
20 operator's system calculates payments due to network operators.
12. A utility vending system as claimed in any one of claims 1 to 11 wherein said utility is electricity.
13. A utility vending system as claimed in any one of claims 1 to 12 wherein there are between 24 and 1440 time of use periods in a 24 hour period
25 and said system management server instructs said meter to provide use data for a 24 hour period.

14. A utility vending system as claimed in any one of claims 1 to 12 wherein there are 48 time of use periods in a 24 hour period and said system management server instructs said meter to provide use data for a 24 hour period.

5 15. A utility vending method comprising the steps of:

at a utility consumers premises:

storing a plurality of supply credits for supply of said utility from at least one of a plurality of retailers, said supply credits received from a system management server;

10 measuring the consumption of said utility by time of use of said utility;

decreasing said stored supply credits as said utility is consumed;

storing said consumption, time of use data and decreased supply credit data;

15 periodically communicating said consumption, time of use data and decreased supply credit data to a system management server, and

wherein said system management server performing the steps of aggregating the consumption of a plurality of consumers' premises by time of use and electricity retailer.

20 16. A utility vending method as claimed in claim 15 wherein said system management server further performs the step of communicating said aggregate consumption to a wholesale market settlement system, said wholesale market settlement system performing the step of calculating payments by retailers based on consumption by consumers of each retailer in each period.

17. A utility vending method as claimed in claim 16 wherein said wholesale market settlement system further performs the step of calculating payments due to utility wholesalers.

18. A utility vending method as claimed in any one of claims 15 to 17
5 wherein said system management server further performs the step of communicating said aggregate consumption to a network operator's system, said network operator's system performing the step of calculating payments by retailers based on consumption by consumers of each retailer in each period.

19. A utility vending method as claimed in claim 18 wherein said network
10 operator's system further performs the step of calculating payments due to network operators.

20. A utility vending method as claimed in any one of claims 15 to 19
further including the step of receiving and storing at said utility consumers
premises at least one supply credit; said supply credit received from an e-
15 payment system via said system management server;

21. A utility vending method as claimed in claim 20 wherein each utility
consumers premises has at least one meter and each said meter has a unique
identifier and the consumer supplies said unique meter identifier to said e-
payment system as part of a purchase, said method including said e-payment
20 system communicating said unique meter identifier to said system
management server along with other purchase information including the
purchase quantity.

22. A utility vending method as claimed in claim 20 or claim 21 wherein a
plurality of utility retailers provide a plurality of utility offers through said
25 e-payment system.

23. A utility vending method as claimed in any one of claims 20 to 22 wherein said e-payment system provides for purchase using a plurality of purchase options, said options including point of sale, automatic teller machines, an internet web site, direct debit standing instruction (GIRO), SMS,
5 telephone.

24. A utility vending method as claimed in any one of claims 15 to 23 wherein said utility is electricity.

25. A utility vending method as claimed in any one of claims 15 to 24 wherein there are between 24 and 1440 time of use periods and said step of
10 periodically communicating said consumption, time of use data and decreased supply credit data to a system management server communicates data for a 24 hour period.

26. A utility vending method as claimed in any one of claims 15 to 24 wherein there are 48 time of use periods and said step of periodically
15 communicating said consumption, time of use data and decreased supply credit data to a system management server communicates data for a 24 hour period.