

**A SYSTEM AND METHOD FOR CREDITING AN AMOUNT OF CARBON CREDIT ASSOCIATED WITH AN
APPLIANCE**

Technical Field

[1] The present invention relates to a system and a method for crediting an amount of carbon
5 credit associated with an appliance, for example, an electric cooktop.

Background of Invention

[2] Cooking over open fires or inefficient stoves typically entails burning fuels (such as wood, charcoal, coal, and kerosene) that release harmful, climate-warming emissions.

[3] These emissions of short-lived climate pollutants—such as black carbon and methane
10 (CH₄), as well as other greenhouse gases, such as carbon monoxide (CO) and carbon dioxide (CO₂)—occur because of the incomplete combustion of kerosene and solid fuels during this form of cooking.

[4] As a result, household energy use makes up more than half of all global black carbon emissions, a significant contributor to climate change. Clean cooking is vital to combating global climate change and reducing environmental degradation.

[5] Climate-warming emissions, including carbon emissions, can be substantially reduced
15 through alternative, readily available cooking practices. Many of today's more modern stoves are highly efficient and can reduce fuel use by 30%-60%, resulting in fewer emissions of greenhouse gas and black carbon. However, modern stoves, can be expensive—particularly in the developing world as a proportion of household income, for example.

[6] It would be desirable to provide a system and method which ameliorates or at least
20 alleviates one or more of the above problems or to provide an alternative.

[7] It would also be desirable to provide a system and method that ameliorates or overcomes one or more disadvantages or inconvenience around the affordability of known appliances, particularly modern stoves.

[8] A reference herein to a patent document or other matter which is given as prior art is not
25 to be taken as an admission or a suggestion that the document or matter was known or that the information it contains was part of the common general knowledge as at the priority date of any of the claims.

Summary of Invention

[9] According to an aspect of the present invention, there is provided a system for crediting an amount of carbon credit associated with an appliance, the system comprising: a sensor for measuring at least one electrical property of a power supply, wherein the power supply selectively provides power to the appliance; at least one processor; and a memory coupled to the processor, the memory containing instructions that, when executed by the processor, configure the system to: determine carbon emission reduction data based on the at least one electrical property and the appliance; and credit a user of the system with a credit amount proportional to the carbon emission reduction caused by using only the appliance. Advantageously, the system can determine carbon emission reduction data based on power (e.g., a wattage overtime) used by the appliance, for example a “qualified” clean electric cooktop. The clean electric cooktop can then be monitored under registered carbon emission reduction projects, the aggregated date is verified at the time of occurrence. Verified credits are instantly tradeable on decentralised carbon trading platforms and achieved revenue is shared back to users’ mobile money accounts integrated into a mobile application, for example. The system may also determine carbon emission reduction data for more than one appliance. However, it is envisaged that users will only be credited with a credit amount proportional to the carbon emission reduction caused by using only selected appliances i.e., “qualified” clean electric cooktops and the like.

[10] In one or more embodiments the power supply provides power to only the appliance. For example, the power supply may be configured to recognise an appliance and only power that appliance if it is “qualified”. However, the power supply may supply any appliance, but only apply credit against certain appliances. Advantageously, this means that the system can remain in place in a household and used day-to-day.

[11] In one or more embodiments, the credit amount corresponds to at least one of: currency, fiat currency, digital currency, crypto currency, token, monetary value or number value. Advantageously, the credit amount may be instantly tradeable on decentralised carbon trading platforms and achieved revenue is shared back to users.

[12] In one or more embodiments, the system further comprises: a network interface to establish a network connection with the processor and a user device. The network interface may be used to update carbon credit data and to facilitate communication between a remote firmware update mechanism and the processor. The remote firmware update mechanism together with the processor may be adapted to periodically check for updates from a remote repository, download firmware

updates and to compare downloaded firmware to existing firmware to determine the necessity of installing the downloaded firmware and the like.

[13] In one or more embodiments, the credit amount is sent to the user device via the network connection.

- 5 [14] In one or more embodiments, the user device includes a digital wallet for storing the credit amount fixed with respect to at least one of: currency, fiat currency, digital currency, crypto currency, token, monetary value or number value.

[15] In one or more embodiments, the digital wallet participates in a distributed ledger. The distributed ledger may include a database, such as a blockchain. Advantageously, the use of a
10 "distributed ledger" means that any records (e.g., records relating to credit) are authenticated by a federated consensus protocol. A distributed ledger may be a blockchain. Multiple computer systems within the distributed ledger, referred to herein as "nodes" or "compute nodes," each comprise a copy of the entire ledger of records. In some embodiments, the node may also be a "light node" in that it is similar to a node in terms of its functions. However, instead of storing a copy of the entire ledger of
15 records or blockchain in its memory, it only stores parts of the ledger or blockchain that are relevant to the transaction being performed. Nodes may write a data "block" to the distributed ledger, the block comprising data regarding an electronic event, said blocks further comprising data and/or metadata. In some embodiments, only miner nodes may write electronic events to the distributed ledger. In other embodiments, all nodes have the ability to write to the distributed ledger. In some embodiments, the
20 block may further comprise a time stamp and a pointer to the previous block in the chain (e.g., a "hash"). In some embodiments, the block may further comprise metadata indicating the node that was the originator of the electronic event. In this way, the entire record of electronic events is not dependent on a single database which may serve as a single point of failure; the distributed ledger will persist so long as the nodes on the distributed ledger persist.

25 [16] In one or more embodiments, the digital wallet participates in a distributed ledger hosted by a plurality of computing nodes for a financial institution and/or a clearing house; the distributed ledger stores one or more transaction blocks representing transactions relating to the credit amount; and each computing node in the plurality of computing nodes stores and maintains a copy of the private distributed ledger.

30 [17] In one or more embodiments, the digital wallet includes software in the form of an application installed locally on the user device. The application may run on the Android platform. Android is a registered trademark of Google, Inc. Android is typically a mobile computing system

operating system. It is based on the Linux kernel. User devices that support the Android platform/OS are also known as Android user devices. Other user device platforms include Apple IOS, Windows Phone, Raspberry Pi, and Linux, in examples.

[18] In one or more embodiments, the application is configured to provide balance information
5 for the credit amount including: the credit amount; the carbon emissions reduction data; the credit amount fixed with respect to a fiat currency; and/or the credit amount applied against a number relating to the appliance. The balance may be presented in a list or shown on a graph.

[19] In one or more embodiments, the number relating to the appliance is indicative of a
balance remaining for the user to own the appliance. Advantageously, this provides users with an
10 indication as to when they may own the appliance thereby encouraging users to use the appliance, for example a clean electric cooktop, over “stove-stacking” meaning using existing cooking methods e.g., for habitual reasons leading to a low or no usage of the clean cooking solution. Households may use stove-stacking to provide indoor heat and light, repel mosquitos, or because the traditional stoves serve a socio-cultural purpose.

15 [20] In one or more embodiments, the network interface includes communication circuitry that permits wireless communications in accordance with an IEEE 802 standard.

[21] In one or more embodiments, the IEEE 802 standard is Wi-Fi or Bluetooth or Bluetooth
Low Energy. However, it will be appreciated that the communication can be carried out using any
suitable communication protocols, including, but not limited to Wi-Fi 802.11, 6LowPan/ZIGBEE™
20 802.15, Ethernet 802.3, 802.11 and 802.15.4.

[22] In one or more embodiments, the system further comprises: a housing; a male plug
extending from the housing, the male plug configured to electrically connect to the power supply; a
socket in the housing, the socket configured to electrically connect to the appliance and to deliver
electrical energy from the power supply to the appliance, wherein the processor is further configured
25 to communicate with the appliance via a communications protocol.

[23] In one of more embodiments, the communications protocol is used to determine whether
to supply power to only the appliance and/or credit the user for using the appliance.

[24] In one or more embodiments, the communications protocol is an PLC protocol. The PLC
protocol may include an X10 communication protocol that uses either RF signals to communicate
30 among devices in the network, or it uses powerline technology, which enables communication signals

to be imparted onto standard AC power lines within buildings. An X10 protocol exists, which defines a data packet structure that allows data to be transmitted and received among devices. This protocol may be used to let the processor determine whether to apply credits to the appliance usage or not.

[25] In one or more embodiments, the system uses at least one pin used to determine whether
5 to supply power to only the appliance and/or credit the user for using the appliance.

[26] In one or more embodiments, the least one pin includes a pogo pin or spring-loaded pin. Spring loaded pins may electrically connect the appliance with the processor for example via a one wire interface systems where power, synchronisation, payload information i.e., a unique identifier relating to the appliance, and address information are all delivered to the processor on the bus line such that
10 no other wires or lines are provided between the appliance and the processor.

[27] According to an aspect of the present invention, there is provided a pass-through wall power plug, comprising: a housing; a male plug extending from the housing, the male plug configured to electrically connect to a power supply; a socket in the housing, the socket configured to electrically connect to an appliance and to selectively deliver electrical energy from the power supply to the
15 appliance; a sensor for measuring at least one electrical property of the power supply, wherein the power supply selectively provides power the appliance; at least one processor; and a memory coupled to the processor, the memory containing instructions that, when executed by the processor, configure the system to: determine carbon emission reduction data based on the at least one electrical property and the appliance; and credit a user of the system with a credit amount proportional to the carbon
20 emission reduction caused by using only the appliance. Advantageously, in this particular form of the invention, the system can be easily distributed to users as a pass-through wall power plug of relatively small dimensions.

[28] In one or more embodiments, the power supply provides power to only the appliance.

[29] In one or more embodiments, the processor is further configured to communicate with
25 the appliance via a communications protocol.

[30] In one or more embodiments, the communications protocol is a PLC protocol.

[31] According to an aspect of the present invention, there is provided a method for crediting an amount of carbon credit associated with an appliance, the method comprising: measuring, via a sensor, at least one electrical property of a power supply, wherein the power supply selectively
30 provides power to the appliance; determining carbon emission reduction data based on the at least

one electrical property and the appliance; and crediting a user of the system with a credit amount proportional to the carbon emission reduction caused by using only the appliance.

Brief Description of Drawings

[32] The invention will now be described in further detail by reference to the accompanying
5 drawings. It is to be understood that the particularity of the drawings does not superseded the
generality of the preceding description of the invention.

[33] Figure 1 shows a block diagram of a system for crediting an amount of carbon credit
associated with an electric cooktop;

[34] Figure 2 shows a block diagram of how a user is credited the amount of carbon credit
10 associated with an electric cooktop via a mobile device;

[35] Figure 3 shows a block diagram of a PLC protocol that may be used in accordance with an
embodiment of the present invention; and

[36] Figure 4 shows a flow chart for a method of crediting an amount of carbon credit
associated with an appliance.

15 Detailed Description

[37] The invention is suitable for crediting a user with an amount of carbon credit associated
with an electric cooktop and it will be convenient to describe the invention in relation to that
exemplary, but non-limiting, application.

[38] Figure 1 shows an overall block diagram 100 of a system for crediting a user with an
20 amount of carbon credit associated with an appliance 102, such as an electric cooktop. The electric
cooktop may include an inductive, infrared, EPC cooktop due to efficiency and may be “qualified” in
relation to tests carried out on safety, reliability, efficiency and the like (e.g., by CLASP who focus on
appliance and equipment energy performance and quality, to mitigate and adapt to climate change and
expand access to clean energy). However, it will be appreciated that the invention is not limited to
25 electric cooktops. For example, the invention is also suitable for slow cookers, which allow a user to
assemble all the ingredients then just leave them to cook while they do other things. A slow cooker,
also known as a Crock-Pot (a trademark), is an electrical cooking appliance that is used for simmering,
which requires maintaining a relatively low temperature (compared to other cooking methods).

[39] The appliance 102 is electrically connected to a smart plug 104. In one or more embodiments, the smart plug 104 includes a housing and has a male plug extending from the housing, the male plug configured to electrically connect to a power supply, for example, an electric mains, solar inverter or battery. The housing may also include a socket configured to electrically connect to the
5 appliance 102 so as to selectively deliver electrical energy from the power supply to the appliance 102.

[40] A smart plug 104 may also be referred to as a pass-through power point, power point, socket, outlet, wall outlet, wall mounted socket etc., and include one or more sockets for supplying electrical power, via a removable plug, to one or more loads. Sockets are generally used to supply AC electric power (e.g., 220V to 240V, 50Hz; 120V, 60Hz - unless otherwise indicated, references to AC
10 voltages are understood to refer to substantially sinusoidal voltages, and voltage amplitudes are understood to refer to root mean square (RMS) values) via three apertures adapted to receive pins of the plug. Each aperture is separately connected to an active line, a neutral (returning) line and ground wire of a primary power source (e.g., mains power), although in some cases the ground connection may be omitted. Typically, sockets have three apertures to accommodate either two pin or three pin plugs.

[41] Generally, the plug is the movable connector attached to a load, and the socket is a fixture on equipment or a building structure (e.g., a wall) or in the case of a pass-through plug, plugged into another socket on a wall. Plugs have male circuit contacts, while sockets have female contacts. The plug has pins that fit into matching apertures in the socket. The geometrical arrangement of the socket and plugs varies from country to country according to the relevant national standard. For example, Australia
15 New Zealand Standard AS/3112 defines two flat current-carrying blades orientated at 30° to the vertical to form an upside-down V-shape and a flat vertical grounding blade.

[42] The smart plug 104 may also be fitted with a switch for switching or toggling the supply state of power to a socket (and plug) between on and off states. Inclusion of a switch (or switches) allows a user to selectively control power to the appliance 102, independent of any power switch
25 contained within the device. The use of switches in “smart plugs” 104 is common. However, in some embodiments, the switch may not be accessible and operable by the processor. In this way the processor can control the power supply to the appliance without user interaction.

[43] The smart plug 104 also includes a sensor for measuring at least one electrical property of the power supply disposed within a housing, for example. The sensor is electrically connected to a
30 processor and powered by the power supply. Suitable AC-to-DC transformers may be employed, as necessary to deliver DC power at a specified voltage to the processor and sensor. For example, step-down transformers may transform AC power from high voltage levels suitable for transmission to levels

that can be substantially directly applied to the processor. The sensor is also electrically connected to the socket to monitor electrical usage associated with the appliance 102 i.e., the load.

[44] In a number of embodiments, the sensor is a current sensor coupled to the socket so as to be operable to determine the current being drawn from the socket by the load. A current amplifier may be used to amplify the output signal of the current sensor. The amplified signal is then received by the processor and is compared with a threshold level. The threshold level will typically be set as a range of ampere, so that the current drawn by the appliance 102 will be above the threshold only when the appliance 102 is in use. When the appliance 102 enters a state of use, the current drawn will rise above the threshold level, and the processor may record a timestamp or similar against the activity in memory. While the appliance 102 is in use, the processor continues to compare current draw with the threshold value. When the appliance 102 enters a state of non-use, the current will fall below the threshold and the processor will similarly record the event in memory.

[45] In a number of embodiments, the sensor includes class 2 power meter capabilities, enabled by an integrated circuit (IC) that can monitor voltage, current, power factor and the like. Those skilled in the art will recognise suitable ICs for providing those capabilities. For example, an MCP39F511 by Microchip™ is a highly integrated, complete single-phase power-monitoring IC designed for real-time measurement of input power for AC/DC power supplies, power distribution units, consumer and industrial applications. It includes dual-channel Delta-Sigma ADCs, a 16-bit calculation engine, EEPROM and a flexible 2-wire interface.

[46] The processor is configured to resolve from at least a portion of signals from the sensor into one or more components relating to the appliance 102. For example, the processor may resolve from the signals by way of a Fourier transform one or more frequency components each corresponding to electrical energy use associated with the appliance 102. It should also be appreciated that additional filtering methods can be used, such as those, but not limited to including, moving average filters, evenly weighted moving average filters, the like, or a combination of these filters, which may be particularly suitable for implementation in firmware.

[47] Ultimately, the processor resolves electrical properties of the appliance 102 into usage information such that the system 100 can calculate carbon emission reductions from measured electricity consumption of the appliance 102, for example how much power the appliance 102 uses with respect to time. The related calculation variables (e.g., baseline, fraction of non-renewable biomass (fNRB), which represents the proportion of woody biomass that is harvested unsustainably) are coded into the processor and can be updated via an update if any parameter changes.

[48] In a number of embodiments, the processor converts the signals from the sensor into digital values by way of module 106 (e.g., currency, fiat currency, digital currency, cryptocurrency, token, monetary value or number value) and communicates messages based on those digital values to a user device 108 via a network interface or saves them in memory for retrieval by the user device 108, as will be discussed greater detail with reference to Figure 2.

[49] The network interface is also adapted to facilitate communication between a remote firmware update mechanism and the processor. As will be appreciated by those skilled in the art, the remote firmware update mechanism together with the processor may be adapted to periodically check for updates from a remote repository, download firmware updates and to compare downloaded firmware to existing firmware to determine the necessity of installing the downloaded firmware and the like. For example, the remote firmware update mechanism may be used to update variables (e.g., baseline, FNRB) that are coded into the processor and can be updated via an over the air (OTA) update if any parameter changes.

[50] The smart plug 104 is also configured to connect to the user device 108. The user device 108 is typically a mobile device, such as an Android™ mobile device. At the user device 108 the user can monitor the credit amount proportional to the carbon emission reduction caused by using the appliance 102 and other statistics. A skilled person will readily identify suitable schemas for providing for providing the stated function, for example, each credit amount or block may be defined by an XML schema or similar and then sent to the user device 108.

[51] Figure 2 shows a block diagram 200 of how a user 214 is credited the amount of carbon credit associated with an electric cooktop 102 via an application 202 running on mobile device 108 in accordance with an embodiment. As described above, the electric cooktop 102 is a qualified clean cooking device equipped with a “dongle” in the form of either a hardware integrated circuit (IC) or with firmware that allows the system 200 to only credit users 214 for using that specific type of appliance 102. The electric cooktop 102 is powered by smart plug 104. smart plug 104 includes a network interface for communicating with mobile application 202. The mobile application 202, for example an Android™ or iOS™ application has inbuilt integrations to a) device usage data b) digital wallet for either tokenised payouts or fiat currency (mobile money) c) serving as a light node for on-chaining usage data.

[52] In one or more embodiments, the mobile application 202 serves as the user interface for the system 100 interaction, connected to the smart plug 104 via Bluetooth or Wi-Fi, for example. It may serve as a remote control of smart plug’s 104 functionality (e.g., selecting cooking programs) as well as the gateway to on-chain (upload) calculated emission reductions to a decentralised ledger (DLT) or

other suitable blockchain technology 204. The mobile phones processing, memory and storage capabilities will be used to set up the mobile phone as a light node of the connected ledger 204.

[53] The mobile application 202 may also provide users 214 with balance information, power usage statistics, data indicative of a balance remaining for the user to own the electric cooktop 102 and the like.

[54] In one or more embodiments, the DLT 204 is used to manage transactions in a decentralised, private and encrypted way. The DLT 204 in return is integrated to carbon verification platforms 206 such as the Hedera Guardian to establish Digital Measurement Reporting and Verification processes (dMRV) for any connected verification body (e.g., Gold Standard or Verra). The term dMRV can apply to a broad range of technologies, tools, and applications. However, for system 200, dMRV can be defined as software solutions capable of automated data collection, processing, analysis, and generation of carbon credits, including validation and verification processes by a third party.

[55] The credit issuance conducts shortly after the transaction is validated at block 208 and the data verified through dMRV policies 206. Issued credits are either distributed directly to carbon buyer accounts (carbon pre-finance project setups) or tokenised utilising external services like Toucan (a trademark). However, other digital infrastructure for tokenised carbon credits may also be used. Those skilled in the art will recognise that “tokenisation” 208 here describes the process of replacing a sensitive data element (here verified carbon emission avoidance in form of carbon credits) with a non-sensitive and in effect public tradeable data element, i.e., carbon credit representing tradeable tokens in a defined exchange rate, e.g., 1 ton of emission reduction = 1 carbon credit = 1 token.

[56] In one or more embodiment, the tokenisation occurring at block 208 may lead to fractional ownership of the electric cooktop 102. For example, depending on a households contribution to generating 1 token for public trade, they might only be entitled to a small portion (fraction) of that token. As the value of the public traded token might change over time, the transfer of ownership in form of a fractional token payout enables the household to decide independently (limitations may apply around max lifecycle of a carbon token) when to monetise their partial ownership of the underlying carbon credit.

[57] The mobile application further serves as the digital wallet 212 for tokenised carbon credits and can be connected to trading platforms (like ACX), which allow customers to monitor current token price development and take independent decisions on where and when to monetise their carbon token

assets into fiat currency. Payouts are connected to the mobile money account integrated to the mobile application 202.

[58] The digital wallet 212 may also serve as an interface to query the status of the underlying DLT 204 blockchain balance, provide an endpoint for payouts as well as serving as a light node to the network. As an alternative to token-based payouts the wallet section will also have mobile money integrations to process fiat based payments.

[59] Figure 3 shows a block diagram 300 of a PLC protocol 302 that may be used in accordance with an embodiment of the present invention. X10 is an example PLC protocol. It is important for the smart plug 104 to recognise the appliance 102 as only carbon credit should be credited for use of approved/clean appliances. This may be done mechanically, by way of spring-loaded pins or pogo pins paired with a one wire interface system where power, synchronisation, payload information e.g., a unique identifier of the appliance 102, and address information are all delivered to the processor on the bus line such that no other wires or lines are provided between the appliance 102 and the processor. However, in another embodiment a PLC protocol may be employed between the smart plug 104 and the appliance 102 thereby negating the need for additional pins as the PLC protocol primarily uses power line wiring for signaling.

[60] If no appliance 102 is plugged into the smart plug 104, an internal switch controlling a metering circuit electrically connected to the processor is set to OFF. Two scenarios of how the PLC protocol 302 may be employed follows.

[61] Scenario A, a non-approved appliance is plugged into the smart plug 104: The smart plug 104 starts sending a PLC command (binary 0 0 1 0 = device ON) to the powerline and awaits response. As the connected appliance is not prepared to receive, interpret and respond to the command, the metering switch remains OFF, however the AC connection to the power outlet is functional so the appliance can be operated as normal (this is to avoid having to plug in/out the smart plug if wall socket is used for operating any other appliance like hair dryer etc.)

[62] Scenario B, clean cooking appliance 102 with dongle is plugged into smart plug 104: The smart plug starts sending a PLC command (e.g. binary 0 0 1 0 = device ON) to the powerline and awaits response. As soon as the clean cooking appliance is physically connected, its power board is able to supply energy to the dongle IC. However, the appliance cannot be turned on without the IC receiving the PLC command (e.g. binary 0 0 1 0 = device ON) to do so from the smart plug 104. When the appliance 102 ON command is received, the IC responds to the command with an PLC acknowledgement message

(e.g. 1001 = Hail acknowledgement). This acknowledgement message in returns opens the switch for the metering circuit.

[63] This approach ensures that a) clean cooking appliance 102 can only be operated when plugged into the smart plug 104 and b) the smart plug 104 can operate other AC appliances but only meters equipped clean cooking devices 102.

[64] It will also be appreciated that other anti-tampering measures may be employed, such as triggering alerts if the appliance 102 opened. This may be achieved by using a light sensor in the enclosure of the appliance, as soon as someone opens the enclosure the light sensor triggers a signal to the processor, which puts the appliance 102 in a potentially compromised state in the processor.

[65] Figure 4 shows a flow chart for a method of crediting an amount of carbon credit associated with an appliance. The method starts at start block 402. At block 404 at least one electrical property of a power supply that selectively powers the appliance is measured. The electrical property may include power, apparent power, current RMS, voltage RMS, power factor, frequency and the like.

[66] Based on that electrical property, the carbon emission reduction data is determined at block 406. The carbon emission reduction data, may be determined variables that change over time, these may be updated by a processor either at the device carrying out the method or at an external device. After carbon emission reduction data has been determined, the method proceeds to block 408 where a user is credited an amount proportional to the carbon emission reduction caused by using only the appliance. The credit may be in the form of a token (as described above) or in the form of a fiat currency. The method ends at end block 410.

[67] The term “carbon credit”, as used herein is intended to be interpreted in the broadest sense, generally describing a transferable commodity-like asset having a utilitarian value and a financial value aspect. The term should not be necessarily limited by reference to any existing programs that use the term “carbon credit” to describe a particular transferable unit. The term “carbon credit” may also at times be used herein to refer to a credit for a predefined tonnage amount, e.g., for one carbon ton. The term “carbon credit” may also at times be used to refer generally to a carbon offset amount that may vary from offset to offset.

[68] The term “distributed ledger,” as used herein, refers to a decentralised electronic ledger of data records which are authenticated by a federated consensus protocol. A distributed ledger may be a blockchain. Multiple computer systems within the distributed ledger, referred to herein as “nodes”, “light nodes” or “compute nodes,” each comprise a copy of the entire ledger of records (or in

the case of a “light node” instead of storing the entirety of the blockchain in its memory, it only stores parts of the blockchain that are relevant to the transaction being performed). Nodes may write a data “block” to the distributed ledger, the block comprising data regarding an electronic event, said blocks further comprising data and/or metadata. In some embodiments, only miner nodes may write
5 electronic events to the distributed ledger. In other embodiments, all nodes have the ability to write to the distributed ledger. In some embodiments, the block may further comprise a time stamp and a pointer to the previous block in the chain (e.g., a “hash”). In some embodiments, the block may further comprise metadata indicating the node that was the originator of the electronic event. In this way, the entire record of electronic events is not dependent on a single database which may serve as a single
10 point of failure; the distributed ledger will persist so long as the nodes on the distributed ledger persist.

[69] Furthermore, as used herein the term “user device” may refer to any device that employs a processor and memory and can perform computing functions, such as a personal computer or a mobile device, wherein a mobile device is any mobile communication device, such as a cellular telecommunications device (i.e., a cell phone or mobile phone), personal digital assistant (PDA), a
15 mobile Internet accessing device, or other mobile device.

[70] It will be appreciated that some embodiments may be comprised of one or more generic or specialised controllers or processors (or “processing devices”) such as microcontrollers, microprocessors, digital signal processors, customised processors and field programmable gate arrays (FPGAs) and unique stored program instructions (including both software and firmware) that control
20 the one or more processors to implement, in conjunction with certain non-processor circuits, some, most, or all of the functions of the method and/or apparatus described herein. Alternatively, some or all functions could be implemented by a state machine that has no stored program instructions, or in one or more application specific integrated circuits (ASICs), in which each function or some combinations of certain of the functions are implemented as custom logic. Of course, a combination of
25 the two approaches could be used.

[71] As discussed above, the various embodiments can be implemented in a wide variety of operating environments, which in some cases can include one or more user computers, computing devices, or processing devices which can be used to operate any of a number of applications. User or client devices can include any of a number of general purpose personal computers, such as desktop or
30 laptop computers running a standard operating system, as well as cellular, wireless, and handheld devices running mobile software and capable of supporting a number of networking and messaging protocols. Such a system also can include a number of workstations running any of a variety of commercially-available operating systems and other known applications for purposes such as

development and database management. These devices also can include other electronic devices, such as dummy terminals, thin-clients, gaming systems, and other devices capable of communicating via a network.

[72] Various aspects also can be implemented as part of at least one service or Web service, such as can be part of a service-oriented architecture. Services such as Web services can communicate using any appropriate type of messaging, such as by using messages in extensible markup language (XML) format and exchanged using an appropriate protocol such as SOAP (derived from the "Simple Object Access Protocol"). Processes provided or executed by such services can be written in any appropriate language, such as the Web Services Description Language (WSDL). Using a language such as WSDL allows for functionality such as the automated generation of client-side code in various SOAP frameworks.

[73] Some embodiments may utilise at least one network that would be familiar to those skilled in the art for supporting communications using any of a variety of commercially-available protocols, such as TCP/IP, OSI, FTP, UPnP, NFS, and CIFS. The network can be, for example, a local area network, a wide-area network, a virtual private network, the Internet, an intranet, an extranet, a public switched telephone network, an infrared network, a wireless network, and any suitable combination thereof.

[74] The environment can include a variety of data stores and other memory and storage media as discussed above. These can reside in a variety of locations, such as on a storage medium local to (and/or resident in) one or more of the computers or remote from any or all of the computers across the network. In a particular set of embodiments, the information can reside in a storage-area network ("SAN") familiar to those skilled in the art. Similarly, any necessary files for performing the functions attributed to the computers, servers, or other network devices can be stored locally and/or remotely, as appropriate. Where a system includes computerised devices, each such device can include hardware elements that can be electrically coupled via a bus, the elements including, for example, at least one central processing unit (CPU), at least one input device (e.g., a mouse, keyboard, controller, touch screen, or keypad), and at least one output device (e.g., a display device, printer, or speaker). Such a system can also include one or more storage devices, such as disk drives, optical storage devices, and solid-state storage devices such as random access memory ("RAM") or read-only memory ("ROM"), as well as removable media devices, memory cards, flash cards, etc.

[75] Such devices also can include a computer-readable storage media reader, a communications device (e.g., a modem, a network card (wireless or wired), an infrared communication device, etc.), and working memory as described above. The computer-readable storage media reader

can be connected with, or configured to receive, a computer-readable storage medium, representing remote, local, fixed, and/or removable storage devices as well as storage media for temporarily and/or more permanently containing, storing, transmitting, and retrieving computer-readable information. The system and various devices also typically will include a number of software applications, modules, services, or other elements located within at least one working memory device, including an operating system and application programs, such as a client application or Web browser. It should be appreciated that alternate embodiments can have numerous variations from that described above. For example, customised hardware might also be used and/or particular elements might be implemented in hardware, software (including portable software, such as applets), or both. Further, connection to other computing devices such as network input/output devices can be employed.

[76] Storage media and computer readable media for containing code, or portions of code, can include any appropriate media known or used in the art, including storage media and communication media, such as but not limited to volatile and non-volatile, removable and non-removable media implemented in any method or technology for storage and/or transmission of information such as computer readable instructions, data structures, program modules, or other data, including RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disk (DVD) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by a system device.

[77] Where the terms “comprise”, “comprises”, “comprised” or “comprising” are used in this specification (including the claims) they are to be interpreted as specifying the presence of the stated features, integers, steps or components, but not precluding the presence of one or more other features, integers, steps or components, or group thereof.

[78] While the invention has been described in conjunction with a limited number of embodiments, it will be appreciated by those skilled in the art that many alternative modifications and variations in light of the foregoing description are possible. Accordingly, the present invention is intended to embrace all such alternatives, modifications and variations as may fall within the spirit and scope of the invention as closed.

The claims defining the invention are as follows

1. A system for crediting an amount of carbon credit associated with an appliance, the system comprising:
 - 5 a sensor for measuring at least one electrical property of a power supply, wherein the power supply selectively provides power to the appliance;
 - at least one processor; and
 - a memory coupled to the processor, the memory containing instructions that, when executed by the processor, configure the system to:
 - 10 determine carbon emission reduction data based on the at least one electrical property and the appliance; and
 - credit a user of the system with a credit amount proportional to the carbon emission reduction caused by using only the appliance.
2. The system of claim 1, wherein the power supply provides power to only the appliance.
- 15 3. The system of claim 1, wherein the credit amount corresponds to at least one of: currency, fiat currency, digital currency, crypto currency, token, monetary value or number value.
4. The system of claim 1, wherein the system further comprises:
 - a network interface to establish a network connection with the processor and a user device.
5. The system of claim 4, wherein the credit amount is sent to the user device via the network
20 connection.
6. The system of claim 5, wherein the user device includes a digital wallet for storing the credit amount fixed with respect to at least one of: currency, fiat currency, digital currency, crypto currency, token, monetary value or number value.
7. The system of claim 5, wherein the digital wallet participates in a distributed ledger.
- 25 8. The system of claim 7, wherein the digital wallet participates in a distributed ledger hosted by a plurality of computing nodes for a financial institution and/or a clearing house;

the distributed ledger stores one or more transaction blocks representing transactions relating to the credit amount; and

each computing node in the plurality of computing nodes stores and maintains a copy of the private distributed ledger.

5 9. The system of claim 5, wherein the digital wallet includes software in the form of an application installed locally on the user device.

10. The system of claim 9, wherein the application is configured to provide balance information for the credit amount including:

the credit amount;

10 the carbon emissions reduction data;

the credit amount fixed with respect to a fiat currency; and/or

the credit amount applied against a number relating to the appliance.

11. The system of claim 10, wherein the number relating to the appliance is indicative of a balance remaining for the user to own the appliance.

15 12. The system of claim 3, wherein the network interface includes communication circuitry that permits wireless communications in accordance with an IEEE 802 standard.

13. The system of claim 12, wherein the IEEE 802 standard is Wi-Fi or Bluetooth or Bluetooth Low Energy.

14. The system of claim 1, wherein the system further comprises:

20 a housing;

a male plug extending from the housing, the male plug configured to electrically connect to the power supply;

a socket in the housing, the socket configured to electrically connect to the appliance and to deliver electrical energy from the power supply to the appliance,

25 wherein the processor is further configured to communicate with the appliance via a communications protocol.

15. The system of claim 14, wherein the communications protocol is used to determine whether to supply power to only the appliance and/or credit the user for using the appliance.
16. The system of claim 14, wherein the communications protocol is a PLC protocol.
17. The system of claim 14, further comprising at least one pin used to determine whether to supply power to only the appliance and/or credit the user for using the appliance.
18. The system of claim 17, wherein the at least one pin includes a pogo pin or spring-loaded pin.
19. A pass-through wall power plug, comprising:
- a housing;
 - a male plug extending from the housing, the male plug configured to electrically connect to a power supply;
 - a socket in the housing, the socket configured to electrically connect to an appliance and to selectively deliver electrical energy from the power supply to the appliance;
 - a sensor for measuring at least one electrical property of the power supply, wherein the power supply selectively provides power the appliance;
 - at least one processor; and
 - a memory coupled to the processor, the memory containing instructions that, when executed by the processor, configure the system to:
 - determine carbon emission reduction data based on the at least one electrical property and the appliance; and
 - credit a user of the system with a credit amount proportional to the carbon emission reduction caused by using only the appliance.
20. The plug of claim 19, wherein the power supply provides power to only the appliance.
21. The plug of claim 19, wherein the processor is further configured to communicate with the appliance via a communications protocol.
22. The plug of claim 19, wherein the communications protocol is a PLC protocol.

23. A method for crediting an amount of carbon credit associated with an appliance, the method comprising:

measuring, via a sensor, at least one electrical property of a power supply, wherein the power supply selectively provides power to the appliance;

5 determining carbon emission reduction data based on the at least one electrical property and the appliance; and

crediting a user with a credit amount proportional to the carbon emission reduction caused by using only the appliance.