

SYSTEMS AND METHODS TO GENERATE AN
ENERGY CONSUMPTION INDEX

FIELD OF THE DISCLOSURE

[0001] This disclosure relates generally to the measurement of energy consumption and, more particularly, to systems and methods to generate an energy consumption index.

BACKGROUND

[0002] Energy management and conservation has become an increasing public concern. Agencies such as the United States Environmental Protection Agency have developed programs like Energy Star to assist businesses and the public in general in making environmentally-conscious decisions when it comes to electrical devices and home appliances. Tools such as “carbon footprint” calculators can assist an individual, family or business in determining the environmental impact of their consumption. Further, some governments use emissions trading as a means to encourage the reduction in pollution emission.

[0003] Homes and consumers typically have many opportunities to reduce personal consumption. However, there are few sources to provide feedback information on how effective a person’s efforts to reduce personal consumption are on reducing emissions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. 1 is an illustration of an example system to collect resource consumption information from a panel of persons, households and/or companies.

[0005] FIG. 2 is an illustration of an example system to collect resource consumption information from a variety of sources within a selected household.

[0006] FIG. 3 is a block diagram of an example system to receive resource consumption information from appliances associated with a measured home.

[0007] FIG. 4 is a flowchart representative of an example process 400 that may be carried out to associate an activity with energy consumption.

[0008] FIG. 5 is a block diagram of an example system to receive resource consumption information from a vehicle associated with a measured person or household.

[0009] FIG. 6 is a block diagram of an example system to collect resource consumption information associated with purchases made by a measured person or household.

[0010] FIG. 7 is a flowchart representative of an example process that may be carried out to collect data associated with purchases made by a household.

[0011] FIG. 8 is a flowchart representative of an example process that may be carried out to generate a personal energy consumption index for a person.

[0012] FIG. 9 is a flowchart representative of an example process that may be carried out to generate a household energy consumption index for a household.

[0013] FIG. 10 is a block diagram of an example system to generate a company energy consumption index.

[0014] FIG. 11 is a flowchart representative of an example process that may be carried out to generate a company energy consumption index for a company.

[0015] FIG. 12 is a diagram of an example processor system that may be used to implement the example processes described herein.

DETAILED DESCRIPTION

[0016] Although the example systems described herein include, among other components, software executed on hardware, such apparatus is merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all

of the disclosed hardware and software components could be embodied exclusively in dedicated hardware, exclusively in software, exclusively in firmware or in some combination of hardware, firmware, and/or software.

[0017] In general, the systems and methods described herein may be used to measure, calculate, and/or identify resource and energy consumption by a person, household, and/or company and, further, to generate an energy consumption index therefor. Portions of the resource and energy consumption by a household or company may be further assigned to individual persons associated with the household or company so that the consumption total of the persons is equal to the total household or company consumption. In another respect, individual energy consumption data may be aggregated to define consumption for a collection of individuals (e.g., a household, a company, or some other organization).

[0018] As described in detail below, a data collector aggregates resource consumption data from sources used by the person, household, or company, calculate the energy associated with generating, transporting, disposing of, and otherwise utilizing the resources, and reports the resources and/or energy consumed. The data collector may report to the person, household, or company using the resources or may report to another party (e.g., a research agency) responsible for collecting data from multiple persons, households, and/or companies.

[0019] In one described example, a data collector collects personal consumption information and generates a personal energy index based thereon. The example personal consumption information includes at least a portion of home resource consumption allocated to a monitored person, resource consumption by the monitored person outside the home, and purchase information allocated to the monitored person. The data collector receives the personal consumption information, generates a personal energy index, displays the personal energy index at a location

visible to the monitored person, and transmits the personal energy index and/or the personal consumption information to a third party.

[0020] In an example system described herein for monitoring home or household energy consumption, a data collector receives data from several sources, including home appliances, fixtures, devices, electrical meters, water meters, and natural gas meters, vehicle usage, and purchasing information. The example data received from the home appliances, fixtures, meters, and devices is used to determine how much energy is consumed by the home. The data may also be analyzed to identify consumption trends. Energy consumption habits may also be determined for certain activities, such as cooking or watching television. Additionally, example data received from a vehicle associated with the persons living in the home is used by the data collector to determine how much energy is consumed by each person for travelling activities. Energy consumed is divided among and assigned to the persons traveling in the vehicle. The example data collector also receives data associated with purchases made by the persons, determines the energy associated with the purchases, and assigns the energy and/or purchases to one or more of the persons. Thus, household energy may be home energy and any energy consumed by a household member outside of the home, and may further include consideration of purchases by household members.

[0021] In another described example, the data collector generates one or more energy indices based on the resource consumption data received. Each person associated with an example household, as well as the household itself, has an energy index. The personal and/or household energy indices are displayed on the data collector for the persons to observe, allowing them to track energy conservation efforts over time.

[0022] In yet another described example, a central data collector generates a company energy index based on resource consumption information from resource meters and equipment energy consumption meters, and purchasing information from a purchasing system. The central data collector receives the resource consumption information and purchasing information, generates a company energy index based on the received information, and displays the company energy index to one or more persons associated with the company. The example central data collector may also allocate resource consumption information and purchasing information to organizational units and/or individual persons associated with the company to generate other energy indices for the units and/or persons.

[0023] Turning now to the drawings, FIG. 1 is an illustration of an example system 100 to collect resource consumption information from a panel of persons, households, and/or companies. As used herein, the term “household” is taken to mean one or more persons living together in a living space. The households 102, 104, 106 may be any type of residence to be monitored. Residence types may include, but are not limited to, single and/or multi-family houses, condominiums, apartments, and/or duplexes. A number of households are selected including households 102, 104, and 106, and each household 102, 104, and 106 is associated with a number of persons 108 living in the respective households. These persons 108 consume resources such as food, clothing and other items, as well as other resources associated with the household, such as electricity, natural gas and/or water. The households 102, 104 and 106 may also be associated with vehicles (not shown) used for, among other things, transportation of one or more persons 108.

[0024] Each household 102, 104, 106 includes a data collector 110 that collects resource consumption data, which is generated from the activities of persons 108 and the households 102, 104, and 106. As described below in detail, the data

collector 110 receives resource consumption data from household appliances, purchases associated with the persons 108, vehicles, and/or other sources. In one example, the collected data is compiled and/or interpreted, and transmitted to a central data processing facility 112 having a data processing server 114. Alternatively, the data may be forwarded to the central data processing facility 112 without being processed before forwarding.

[0025] The data processing server 114 is connected to the data collectors 110 via the Internet, and receives the data from the data collectors 110 for analysis and storage. Alternatively, the data processing server 114 may be connected to the data collectors 110 via other means, such as a direct modem connection via telephony. There may be several data processing servers 114 within the central data processing facility 112 based on the amount of information to be analyzed, and, likewise, there may be several central data processing facilities 112.

[0026] The central data processing facility 112 may also collect data from companies, such as the example company Corporation XYZ 116. Corporation XYZ 116 uses a data collector 118 which may be the same, substantially the same, or different than the data collectors 110 used in households 102, 104 and 106. For example, the data collector 118 may be implemented as a software module on a computer network of Corporation XYZ and/or have a larger number of inputs corresponding to the larger number of resource-consuming equipment. The data collector 118 also communicates with the central data processing facility 112.

[0027] FIG. 2 is an illustration of an example system 200 to collect resource consumption information from a variety of sources within a selected household. For ease of discussion, the following description will refer to the example household 102 shown in connection with FIG. 1. Several persons 108 are associated with the example household 102. There are also a number of appliances 202, 204, and 206

within household 102 that use energy or resources. In addition to resource-consuming equipment inside the household 102, there may also be one or more vehicles 208 associated with the household 102 and/or the persons 108. Lastly, the persons 108 purchase goods 210 from outside the household 102 for consumption. As described below, the energy consumption associated with any or all of these aspects may be monitored and/or analyzed.

[0028] The example vehicle 208 is used by one or more persons 108 associated with the household 102 to travel between the household 102 and among other locations. To transport the persons 108 in the vehicle 208, the vehicle 208 must consume resources such as fuel, engine fluids, and tire rubber. The consumed resources are measured and allocated to the persons 208 being transported in the vehicle, as described in detail below.

[0029] The household 102 includes a data collector 110 for receiving data associated with resource consumption from a variety of sources such as those mentioned above. To receive data, the data collector 110 is communicatively coupled to devices configured to measure and report resource consumption data. Such devices can include, but are not limited to, appliance meters 212, barcode scanners 214, mobile devices 216, and/or utility meters 218.

[0030] Appliance meters 212, discussed in greater detail below, may be coupled to various household appliances, fixtures, and/or devices to measure resource consumption information. Example appliance meters 212 may be coupled to, among other things, a refrigerator (i.e., an appliance), an electrical outlet (i.e., a fixture), and a television (i.e., a device). The appliance meters 212 measure resource consumption data for one or more types of resources and report the resource consumption to the data collector 110 at regular and/or irregular intervals.

[0031] The barcode scanner 214 scans UPC codes to recognize purchased items 210. The UPC codes are sent to the data collector 110, which associates the UPC codes with corresponding energy values and allocates the energy values to one or more of the persons 108 in the household 102.

[0032] The mobile device 216 determines resource consumption by a monitored person while located outside the household 102. The mobile device 216 may track travel information of the monitored person 108 and forward the information to the data collector 110.

[0033] Greater or lesser resolution of resource consumption information may depend on the type and/or quantity of devices 212-218 used. Appliance meters 212 that measure resource consumption by individual appliances typically provide information with more resolution or precision than utility meters 218. However, the utility meters 218 may ensure all or substantially all of the resource consumption by the household 102 is logged. For example, the utility meters 218 may not be able to determine that a particular appliance (e.g., the refrigerator) consumes a relatively large portion of energy, but it can determine when the household 102 is using the most energy. In contrast, an appliance meter 212 coupled to an appliance can determine how much electrical energy the refrigerator is using, but may not be able to determine how much energy the entire household 102 is using.

[0034] To determine how the household resources are allocated, the household 102 may also include a device to detect the presence of the monitored persons 108 associated with the household 102. For example, each person 108 may carry a device (e.g., the mobile device 216) that allows the data collector 110 to detect the proximity of the person. Alternatively, the data collector 110 may be programmed with information indicating when each person 108 is typically at the household or away from the household. This information could indicate allocation rules such as, for

example, a certain person 108 is typically away from the household 102 from 8AM to 5PM, Monday through Friday of each week and, thus, does not consume household resources during these times. The persons 108 may then input exceptions to the allocation rules, and/or input times at the household 102 and away from the household 102 for the times that do not have defined allocation rules.

Household Resource Consumption

[0035] FIG. 3 is a block diagram of an example system 300 to receive resource consumption data from appliances 304-330 associated with a measured household. For ease of discussion, the example system 300 of FIG. 3 will be considered part of the household 102 being measured. The example system 300 has a Home Resource Consumption Management (HRCM) device 302. The HRCM device 302 receives information from a number of appliances, fixtures and/or devices associated with household 102. Example devices include a refrigerator 304, a freezer 306, a furnace 308, an air conditioner 310, a microwave oven 312, a television 314, a personal computer 316, a home electric meter 318, a light fixture 320, a home water meter 322, a stove and/or oven 324, a dishwasher 326, a water heater 328, and/or a clothes washer and/or dryer 330. This list of appliances is intended to be illustrative rather than limiting. Any of the appliances, fixtures or devices listed or not listed may be combined or split into multiple appliances, fixtures and/or devices. Although the appliances, fixtures and/or devices 304-330 are shown in FIG. 3 as within the household 102, appliances such as the air conditioner 310 may be located outside the household 102 as is common.

[0036] Additionally, each appliance, fixture and/or device may have one or more meters 332a-n coupled to it to measure the resources used by it. For example, a clothes dryer may use natural gas to heat clothes being dried while using electricity to

power a tumbling device, requiring multiple meters 332 or one meter 332n capable of measuring electricity and natural gas consumption.

[0037] Appliances may be added or subtracted from this list to adjust the resolution or granularity of data desired. For example, when measuring resources it may be desirable to use meters 332a-n to individually measure appliances, fixtures and/or devices that consume a relatively large portion of electricity or have special features, such as the air conditioner 310, microwave oven 312, and television 314. Another meter 332h may then be used to track the home electrical meter 318 (used by a power company providing power to the household 102) to measure the amount of power used by the rest of the appliances, fixtures and devices associated with the household 102. This may save meters from being used to measure, for example, individual light fixtures 320 from which high-resolution data may not be necessary. The same may be done for the home water meter 322 as an alternative to measuring every faucet that uses water.

[0038] The meters 332a-n are communicatively coupled to the HRCM device 302 to report measured data to the HRCM device 302. The reporting may be performed at regular and/or irregular intervals, continuously or substantially continuously, on demand from the HRCM device 302, and/or manually. The HRCM device 302 may passively receive data from the meters 332a-n and/or may actively request data from any or all of the meters 332a-n. After receiving data, the HRCM device 302 may store the data or process it to obtain a particular data format. For example, the HRCM device 302 may receive an electricity usage measurement from a meter 332, determine the energy in Joules and/or the associated carbon load to produce the electricity, and store the information in a memory for later transmission.

[0039] The example HRCM device 302 is also communicatively coupled to the data collector 110 for the household 102 to report raw and/or processed data. For

example, the HRCM device 302 may be a module communicatively and mechanically coupled to the data collector 110. Alternatively, the HRCM device 302 may be integrated into the data collector 110 as software. The example system 300 may also have a multiplexing device or switch between the HRCM device 302 and the meters 332a-n to reduce the number of physical inputs required at the HRCM device 302. The HRCM device 302 may also have a wireless link instead of or to complement a wired connection to the data collector 110 to transmit resource consumption measurements.

[0040] To differentiate the resource consumption measurements sent to the HRCM device 302 from the meters 332a-k, the meters 332a-k may provide an identification code. The identification code may be transmitted before, during, and/or after the resource consumption measurement information is transmitted. Alternatively, each meter 332a-k may encode the transmitted consumption measurement information with a unique code to identify the source of the transmitted information to the HRCM device 302. Similarly, if the HRCM device 302 requests resource consumption information from an example meter 332a, the HRCM device 302 may transmit a code with the request to identify the desired meter 332a.

[0041] Home resource consumption measurements may be collected and/or reported for any type of resources, including, but not limited to, electricity, natural gas, gasoline, fuel oil, kerosene, propane, wood, light, temperature, water, and/or heating oil. Measurements as collected and/or reported may have various units depending on the resource measured, and may be converted to a standard unit of measurement (e.g., joules, tons of CO₂) by the data collector 110, HRCM device 302, meters 332a-n, and/or a central data processing facility (e.g., the central data processing facility 112 or data processing server 114 as described in FIGS. 1 & 2).

[0042] The example HRCM device 302 and/or the example data collector 110 include a user interface to enter and/or adjust resource consumption information.

Some types of resources, such as wood, are difficult for a machine to measure. The user interface allows a person 108 to input resource consumption measurements to the HRCM device 302 and/or the data collector 110 to log such resources.

[0043] The example HRCM device 302 and/or the example data collector 110 may also be useful for determining energy consumption associated with various household activities, such as cooking or watching television. For example, a person 108 may be in a kitchen of the example household 102 to cook a meal. To cook the meal, the person utilizes the stove and/or oven 324, microwave oven 312, as well as a television 314 located in the kitchen, each having a meter 332e, 332f, and 332k that transmits a consumption indicator to the HRCM device 302 when the meters 332e, 332f, and 332k initially register resource consumption.

[0044] In the example activity, the person 108 first turns on the stove/oven 324, which begins to consume a relatively large amount of electrical or gas energy. The meter 332k registers the increase in consumed power and sends a consumption indicator to the HRCM device 302 for the stove/oven 324. On receiving the indicator, the HRCM device 302 signals the meters 332e and 332f associated with the microwave oven 312 and television 314 to monitor the microwave oven 312 and the television 314, respectively, for resource consumption. The person 108 additionally turns on the television 314 and cooks part of the meal in the microwave oven 312, which cause the meters 332e and 332f to measure the corresponding consumed resources.

[0045] When the person 108 has finished cooking, the stove/oven 324, microwave oven 312 and television 314 are turned off. The meters 332e, 332f and 332k then send the resource consumption measurements to the HRCM device 302,

which associates the consumed resources with the cooking activity and transmits the data to the data collector 110. The data collector 110 may, for example, determine the resources consumed by the cooking activity for an entire time period (e.g., a month) and display it for the person 108 to analyze.

[0046] Although three appliances/devices were used in the example activity, it is contemplated that more or fewer appliances may be monitored and/or measured for any appropriate activity. For example, the washer/dryer 330 may be monitored for an activity such as doing laundry.

[0047] Additionally, for an activity such as cooking, appliances and/or devices (e.g., a food processor or a blender) may be used and then put away. Although such appliances and/or devices may not require a meter 332, using, for example, information from an electrical meter for the entire household 102 may not provide the desired granularity of information for the cooking activity. In this example case, it may be desirable to provide a meter 332 for all kitchen electrical outlets to measure resource consumption for appliances and/or devices drawing energy from the kitchen electrical outlets.

[0048] FIGS. 4, 7-9 & 11 are flowcharts representative of example processes that may be executed to implement the example data collector 110, barcode scanner 214, HRCM device 302, central processor 502, mobile device 520, or central data collector 1028 of FIGS. 1-3, 5, 6 & 10. The example processes of FIGS. 4, 7-9 & 11 may be executed by a processor, a controller, and/or any other suitable processing device. For example, the example processes of FIGS. 4, 7-9 & 11 may be implemented using coded instructions stored on a tangible medium such as a flash memory, or random access memory (RAM) associated with a processor (e.g., the processor 1212 shown in the example processor platform 1200 and discussed below in conjunction with FIG. 12). Alternatively, some or all of the example flowcharts of

FIGS. 4, 7-9 & 11 may be implemented using ASICs, programmable logic devices (PLD), field programmable logic devices (FPLD), discrete logic, hardware, firmware, etc. In addition, some or all of the example flowcharts of FIGS. 4, 7-9 & 11 may be implemented manually or as a combination of any of the foregoing techniques, for example, a combination of firmware, software, and/or hardware. Further, although the example processes of FIGS. 4, 7-9 & 11 are described with reference to the flowcharts of FIGS. 4, 7-9 & 11, many other methods of implementing the example data collector 110, barcode scanner 214, HRCM device 302, central processor 502, mobile device 520 or central data collector 1028 of FIGS. 1-3, 5, 6 & 10 may be employed. For example, the order of execution of the blocks may be changed, and/or some of the blocks described may be changed, eliminated, sub-divided, and/or combined. Additionally, the example processes of FIGS. 4, 7-9 & 11 may be carried out sequentially and/or carried out in parallel by, for example, separate processing threads, processors, devices, circuits, etc.

[0049] FIG. 4 is a flowchart representative of an example process 400 that may be executed to associate an activity with energy consumption. The example process 400 may be executed to implement the example HRCM device 302 or the example data collector 110 described in FIG. 3. The HRCM device 302 or the data collector 110 collects energy consumption information for a period of time (e.g., a month). Each monitored period of time may result in different measured energy consumption based on, for example, energy conservation measures, weather, or habits of a measured person or household. Thus, each monitored time period has an associated energy index based on the energy consumed by the measured person or household during the monitored time period. The process 400 begins by determining whether the measurement period has ended (block 402).

[0050] If the measurement period has not ended, the HRCM device 302 begins monitoring a first meter (e.g., one of the example meters 332a-n shown in FIG. 3) associated with an appliance (e.g., example the stove/oven 324 shown in FIG. 3) (block 404) and determines whether the meter 332k has issued a consumption indicator (block 406). For ease of reference, we will hereinafter refer to the stove/oven 324 as an oven in describing this example.

[0051] If no consumption indicator has been issued (block 406), control returns to block 404 to monitor the meter. The example oven 324 typically utilizes a relatively small amount of resources when not actively used. At some time, a person 108 utilizes the oven 324 for a cooking activity, which requires the person 108 to turn on the oven 324 and cause it to consume a larger amount of resources. When the meter 332k detects the larger consumption, it issues a consumption indicator to the HRCM device 302, which receives the consumption indicator (block 406) and responds by instructing a second meter (e.g., meter 332e) to measure consumption information (block 408). For example, the HRCM device 302 may respond to the person 108 turning the oven 324 on by instructing the meter 332e coupled to the microwave 312 to measure resources consumed by the microwave 312 while the oven 324 is on.

[0052] While the person 108 continues cooking, the HRCM device 302 waits to receive a second consumption indicator indicative of the person turning the oven off (block 410). When the second consumption indicator is received (block 410), the HRCM device 302 receives the consumption information from the meters 332e and 332k (block 412). The meters 332e and 332k may be configured to transmit the measurements to the HRCM device 302 in response to a stop measurement instruction and/or an information request. On receiving the consumption information from the meters 332e and 332k, the HRCM device 302 associates the consumption information

with the cooking activity (block 414). Control then returns to block 402 to determine whether the measurement period is over and/or to monitor for another activity.

[0053] If the data collector 110 or the HCRM device 302 determines at block 402 that the measurement period has ended, the HCRM device 302 determines the total energy consumption attributed to the cooking activity (block 416). The total energy consumption may then be displayed for one or more persons to see and/or analyze.

[0054] In addition to the example process 400, the HCRM device 302 and/or data collector 110 may continuously or substantially continuously receive resource consumption measurements from the meters 332. Similarly, the meters 332 may continuously or substantially continuously measure resource consumption associated with the household appliances, fixtures, and/or devices 304-330 to which the meters 332 are coupled.

Vehicle and Remote Resource Consumption

[0055] FIG. 5 is a block diagram of an example system to receive resource consumption information from a vehicle 208 associated with a measured person or household. The example vehicle 208 is equipped with a central processor 502, which handles many of the vehicle functions. The central processor 502 is provided to the vehicle 208 by the manufacturer. Among other functions, the example central processor 502 receives fuel gauge measurements from a fuel gauge 504, distance measurements from an odometer 506, and seat occupation indications from seat detectors 508-512. The fuel gauge measurements may indicate how much fuel was used in an example trip, from which the processor 502 may determine the energy consumed. The odometer measurements may be used by the processor 502 to determine other resources that were used, such as tire wear and/or engine fluid

contamination, or in combination with the fuel gauge measurements to determine the efficiency of the example trip.

[0056] Each seat in the example vehicle 208 is equipped with a seat detector 508, 510, 512 to determine if the seat is occupied, and the information is then used to determine or allocate the resources consumed by each person 108 on the example trip. For example, if one gallon of fuel is used with a driver and no passengers, 1 gallon of fuel is reported as consumed by the driver. However, if one gallon of fuel is used with a driver and three passengers, each passenger and the driver is reported to consume $\frac{1}{4}$ gallon of fuel.

[0057] The example central processor 502 uses resource measurement software 514 to utilize received measurements and indications from the gauges and sensors 504-512 of the vehicle 208. Because such software is not typically included with a vehicle, the software and/or hardware may be installed at a time after the vehicle 208 is constructed. The central processor 502 may also be implemented utilizing a separate processing system coupled to the central processing system provided to the vehicle 208. Such a separate processing system may be configured to interface with the central processing system of the vehicle 208 to extract the desired resource consumption measurements from the gauges and sensors 504-512 via the central processing system. A third alternative may be to couple a separate processing system directly to the sensors and gauges 504-512 in parallel with the central processing system of the vehicle 208.

[0058] To communicate with the data collector 110, the central processor 502 may be coupled to an antenna 516, allowing the central processor 502 to transmit data via a wireless connection 518. Protocols that may be used include WLAN (IEEE 802.11), Bluetooth or any other wireless protocol. Alternatively, the person 108 driving the car may carry a device 520, such as a mobile phone, PDA, or portable

storage device (e.g., a USB flash drive), which may be communicatively coupled to the central processor 502 via a wireless or wired connection 522. Data associated with a trip may be downloaded to the device 520, which is then carried into the household 102 by a person 108 and communicatively coupled to the data collector 110 via a wireless or wired connection.

[0059] Data may also be collected by manually reporting fuel consumption and mileage of the drivers and passengers of the vehicle 208. For example, the driver (or any person 108) of the vehicle 208 may log the passengers and mileage of each trip. When the vehicle 208 is refueled, the driver logs the total fuel and the total mileage. Then, the driver manually inputs the logged information into the data collector 110, which allocates the some or all of the consumed fuel to the driver and any passengers according to the fuel consumption and personal mileage for each driver and passenger. Logging may be performed manually (e.g., paper and pencil) or on a device (e.g., the device 520). By logging the fuel and mileage information to the device 520, the device 520 may easily transmit the logged information to the data collector 110 with less effort required of the persons 108.

[0060] On receiving the data from the central processor 502, the data collector 110 processes the data (if processing was not performed by the central processor 502 and/or device 520) and stores the processed data into memory or into a data store.

[0061] Additionally or alternatively, the device 520 associated with the person 108 may track the travel of the person 108. Such travel may include riding public transportation, air travel or other travel not associated with a measured vehicle 208. For example, the device 520 may periodically determine geographical coordinates or other location information and log the information in an internal data store to be transmitted to the data collector 110 at a later time. An example device 520 that may be used for this purpose is a Nielsen® NPod™ which is described in U.S. Patent

Application 11/668,931. The device 520 may then process and/or transmit travel data for the person 108 to the data collector 110 via a wired or wireless link.

Purchase-related Resource Consumption

[0062] FIG. 6 is a block diagram of an example system 600 to collect resource consumption information associated with purchases made by a measured person or household. Resource consumption information for purchases is linked to energy consumption by measured persons or households by determining an energy value for each item purchased. Energy values for a given item may be derived from, among other things, the energy associated with the raw materials for the item, the energy required to produce and/or grow the item, the energy required to package the item, the energy required to transport the item from the producer to the consumer, and/or the energy required to maintain the quality of the item at a store.

[0063] To demonstrate an example calculation for the energy value of a purchased item, an apple will be considered. To determine the energy for the raw materials and production of the apple, the average amount of fertilizer, water, and fuel (and their corresponding energy values) to grow and gather a harvest of apples is divided by the average number of apples gathered from the harvest. Next, the energy required to sort the apples is divided by the number of apples. The energy value of the packaging material used to package the apples is divided by the apples in a package. Next, the average fuel to transport a truck load of apples (and other items) to a grocery store is divided by the apples (and other items) in the truck load. Finally, the average energy to keep the apples fresh while at the grocery store is divided by the average number of apples in the grocery store. The sum of the energy values described is used as the energy value for each purchased apple. Other purchased items may have energy values calculated in a similar way or using any other method to determine the approximate energy associated with purchasing an item. For

example, some purchased items may have energy values that are based on the energy required to dispose of or recycle them in addition to or as an alternative to the energy values described above.

[0064] For ease of discussion, the following description of FIG. 6 will refer to the example household 102 shown in connection with FIG. 1. Within the household 102 is the data collector 110 as described in FIGS. 1-3 & 5. The data collector 110 may be integrated into a system such as the Nielsen® HomeScan™ system, which logs purchases for market research. In the example system 600, the data collector 110 is provided with a barcode scanner 214 to read machine-readable indicia (e.g., UPC codes) associated with purchases made by the persons 108 associated with the household 102. Purchases may include groceries 604, clothes 606, or miscellaneous purchases 608 bought outside the household 102. Some purchases, such as grocery produce, do not necessarily have a UPC code or other type of machine-readable indicia. To enter data into the data collector 110 for such items, a user (e.g., a person 108) may use an input device such as a touchscreen, keyboard, or other input device (e.g., the input devices 1124 described in connection with the processing system of FIG. 11).

[0065] The example data collector 110 also has a display device (such as one of the display devices 1124 described in connection with the processing system of FIG. 11) to provide output to a user (i.e., a person 108) while the user enters purchase data into the data collector 110. Output may include context-sensitive menus, selection lists, prompts, confirmations, or any other type of output to assist the user in entering data.

[0066] An example entry process may occur when a person 108 being measured returns to the household 102 from a shopping trip. While on the example shopping trip, the person 108 makes purchases at a grocery store, a clothing store, and

a general merchandise store. When the person 108 returns to the household 102, the person 108 logs the purchases made from each store. In the example, the person 108 logs the purchases from the grocery store first. The person 108 enters the grocery store location (e.g., by selecting from a list and/or entering a store name and/or location) into the data collector 110. Once the location (and date, if necessary) is entered, the person 108 scans the UPC 1 code associated with the first item with the barcode scanner 214, which identifies the first item. If price data is desired, the data collector may prompt the person 108 to enter the price of the item. The person repeats scanning UPC codes 604 to identify the purchases made from the grocery store. If a purchased item (e.g., broccoli) does not have a UPC code, the person 108 may enter the item and quantity by doing a keyword search, selecting from a list, or other method of data entry.

[0067] One alternative method of receiving purchase information is to provide the data collector 110 with an image scanner and optical character recognition software to scan a purchase receipt. The data collector 110 may scan the receipt with the image scanner, and analyze the image with optical character recognition to determine any or all of the data that would otherwise be input by a person 108. A second alternative method for receiving purchase information is to receive a purchase log directly from a store system. For example, the data collector 110 may communicate with a grocery store purchase system via the Internet to download a file, which may contain purchased items information, UPC codes, store name, store location, purchase dates, prices, and/or any other information that may be used to determine energy values for the purchased items. Once all the purchased items are logged for the grocery store, the person 108 repeats the logging for the items purchased from the clothing store (i.e., UPC codes 606) and the general merchandise store (i.e., UPC codes 608).

[0068] When all of the purchases are logged into the data collector 110 or, alternatively, after each purchased item is logged, the data collector 110 performs a query to find the energy associated with each purchased item. The data collector 110 may have a storage device or data store to store energy values for all known items or, alternatively, frequently-purchased items. If the query does not result in an energy value for the purchased item(s), the data collector 110 may query an outside server. For example, the central data processing server 114 may store the calculated energy values for any or all UPC codes, and/or items that do not have UPC codes, such as produce. If the outside server does not respond with an energy value, the person 108 may be requested to classify the item via a list, wherein each classification has an approximate energy value per unit quantity. The item and the energy associated with the item are stored in a memory of the data collector 110.

[0069] As an alternative to the data collector 110 querying for energy values and storing the purchased item information with the corresponding energy values, the data collector 110 may instead generate a list of purchased items. The list of purchased items is transmitted to an external server, such as the central data processing server 114, which receives the list of purchased items and determines corresponding energy consumption information. The central data processing server 114 returns the energy consumption information to the data collector 110 for further analysis.

[0070] A purchased item may be allocated to one or more persons 108 to associate the energy for purchased item with the one or more persons 108 consuming the item. This allocation is in contrast to dividing the energy for the purchased item among all members of the household 102 equally. For example, an adult may typically do the purchasing for a household, but certain items, such as baby diapers or formula, are not consumed by the adult. Thus, allocating the purchases of baby

diapers and/or formula to the baby, instead of sharing the energy associated with the purchases equally, may generate more accurate personal energy indices for both the adult and the baby.

[0071] In addition to purchased goods consumed in or near the household 102, the example data collector 110 also logs goods and services purchased away from the household 102. Example goods and services purchased away include, foods and/or drinks purchased from a restaurant, an automotive care service, a lawn care service, a car rental, and/or any other goods or services the example person 108 may purchase that are not related to the household 102. If the person 108 prefers to log purchases on a later day, the date the purchases were made may be entered as well.

[0072] FIG. 7 is a flowchart representative of an example process 700 that may be executed to collect data associated with purchases made by a household. The example process 700 may be performed by, for example, the data collector 110 of FIGS. 1-3, 5 & 6. The process begins with a person (e.g., the person 108 of FIGS. 1-3, 5 & 6) starting to log purchases at the data collector 110. The data collector 110 receives input for location information associated with one or more purchased items (block 702). The data collector 110 may also receive purchase date information if, for example, the items are not logged the same day they are purchased. Next, the data collector 110 scans (e.g., via the barcode scanner 214 of FIGS. 2 & 5) a UPC code for a purchased item (block 704). If the UPC is not recognized by the data collector 110 (block 706), the data collector 110 may request the person 108 to input the type and quantity of the item, which is stored in memory with the associated UPC code (block 708).

[0073] If the UPC is recognized by the data collector 110 (block 706), or after the person 108 inputs the item information (block 708), the data collector 110 performs a query for the energy associated with the item (block 710). The query may

search the data collector 110 data store or an external server (e.g., the data processing server 114 described in connection with FIG. 1). Queries that do not return energy values may require the user to classify the item, which allows the data collector to approximate the energy associated with the item based on the classification.

[0074] The data collector 110 may further request the person 108 to allocate the item to one or more persons 108 associated with the household to reflect the user(s) or consumer(s) of the item. For example, if one person 108 of the household is the only one to eat a certain type of food product, and purchases of that food product are allocated to that person 108 to reflect the energy consumption by that person 108. The person 108 entering the purchases may allocate the item to one or more persons 108 by, for example, selecting a photo and/or name of the person. Purchased items may be unallocated if the final consumer or user of the item is not known. Alternatively, the item may be allocated to the user or consumer after the item is consumed by selecting the item and associating the user or consumer with the item.

[0075] When an energy value has been identified (via the query or classification), the data collector 110 prompts the user as to whether there are additional purchases from the current location (block 714). If there are additional purchases, control returns to block 704 to scan another UPC code. If there are no more purchases for the current location (block 714), the data collector prompts the user as to whether there is another purchase location (block 716). If there is another location where items were purchased, control returns to block 702 to input the next purchase location. Otherwise, the logging session may end for the person 108 and the data collector 110 transmits the purchases data to the central data processing site 112 (block 718). The data collector 110 may alternatively wait until all purchases are

logged to query for energy values. In this case, any items for which an energy value is not returned may have an associated prompt for more information from the user.

[0076] Alternatively, the process 700 may omit the energy value query and, instead, transmit a list of purchased items to an external server (e.g., the central data processing server 114 of FIG. 1). The central data processing server 114 then generates the energy values associated with the purchased items and, if appropriate, sorts them by user or consumer according to the allocation of the purchased items. After generating the energy values corresponding to the purchased items, the central data processing server 114 transmits the example list of purchased items and corresponding energy values to the data collector 110.

Energy Consumption Index

[0077] FIG. 8 is a flowchart representative of example machine readable instructions 800 that may be executed to generate a personal energy consumption index for a person 108. The example machine readable instructions 800 may be used to implement a function of the data collector 110 described in FIGS. 1-3, 5 & 6. During a particular time period (e.g., a week, a month), the data collector 110 receives resource consumption data from appliances, fixtures, and/or devices (e.g., via meters 332 described in FIG. 3) associated with a measured household (e.g., the example household 102 described in FIGS. 1, 2, 5 & 6). Receiving may be done by accepting measurements, requesting data from the meters 332, and/or any other method or technique for receiving data (block 802). When the resource consumption measurements for the example month are received, the data collector allocates them to the persons 108 associated with the household 102. If there is more than one measured person associated with the household 102 (block 804), the resource consumption is divided among the measured persons 108 associated with the household 102 (block 806). Division of the resources may be done equally between

each person in the household (i.e., for four persons 108, each person 108 is allocated $\frac{1}{4}$ of the total resources) or according to another resource allocation scheme (e.g., adults are allocated more per person than children). The resources may also be allocated by the persons 108 of the household according to actual consumption of the purchased items. If there is only one measured person 108 associated with the household 102 (block 804), the data collector 110 associates all of the resource consumption to the measured person 108 (block 808).

[0078] The data collector 110 next determines whether there are any vehicles associated with the household 102 (block 810). For example, vehicles may be registered in the data collector 110 during the initial setup of the data collector 110 and/or when persons 108 associated with the household 102 acquire or dispose of vehicles. If there is a vehicle 208 associated with the household 102 or a person 108 (block 810), the data collector 110 loads and/or receives remote resource consumption measurements for the vehicle 208 (block 812). Example methods of communicating data from a vehicle 208 to the data collector 110 may include a wireless communication link (e.g., wireless link 518) or via a mobile unit (e.g., the mobile unit 520) associated with a person 108, which downloads data from the vehicle 208 and uploads the data to the data collector 110. The data collector 110 receives and/or loads remote resource consumption data for each measured vehicle 208. Additionally or alternatively, the data collector 110 may load or receive miscellaneous travel data associated with the person 108 from the device 520. This miscellaneous travel data may represent travel by the person 108 using, for example, public transportation.

[0079] If there are no vehicles associated with the example household 102 or person 108 (block 810) or when the data collector 110 loads and/or receives resource consumption measurements for the vehicle (block 812), the data collector 110 loads purchase data (e.g., from a data store) for items logged during the measured month

(block 814). For example, a person 108 may log purchases for each week on a particular day. When the purchase data is loaded, the data collector 110 determines whether the purchase data for the example month is complete (block 816). This may be accomplished by, for example, prompting a person 108 to enter final purchase data or determining the logging habits of the user 108 relative to the end of the example month. If the data collector 110 determines that the purchase data is incomplete (block 816), the data collector 110 receives the remaining purchase data for the time period (block 818). If the data collector determines the purchase data is complete (block 816) or when the complete purchase data is received (block 818), the data collector 110 is prepared to generate the personal energy consumption index.

[0080] When the appropriate resource consumption data has been received and loaded into the memory of the data collector 110 (blocks 802-818), the data collector 110 generates a personal energy consumption index for the example month based on the resource consumption measurements and purchases information and stores the index in memory (block 820). To generate an example personal energy consumption index, the data collector 110 sums the resource consumption attributed to the person 108. The personal resource consumption may then be compared to a standard amount of personal resource consumption, which may be based on, for example, demographics, location, seasonal weather, and/or other appropriate resource consumption factors. The personal resource consumption may also be used without comparison to a standard amount, using any desired units such as carbon units or energy.

[0081] After the personal energy consumption index is generated, it may then be displayed with personal energy consumption indices for previous time periods for the example person 108 to view changes (block 822). This will allow the person 108, for example, to view how conservation efforts being undertaken are affecting the

personal energy consumption index over time. The example data collector 110 also transmits the personal energy consumption index to a central data processing facility (e.g., the central data processing facility 112 and/or data processing server 114 described in FIGS. 1 & 2) for storage and/or processing (block 824). The example central data processing facility 112 uses the personal energy consumption index, which may be associated with demographic information for the person 108, to generate statistical data.

[0082] Alternatively, the process 800 may omit generating the personal energy consumption index. Instead, the process 800 may transmit the resource consumption data associated with the household 102, vehicle 208 and purchases to an external location (e.g., the central data processing server 114 of FIG. 1). The central data processing server 114 receives the resource consumption data and generates a personal energy consumption index, which may then be transmitted to the data collector 110 for display to the person 108.

[0083] FIG. 9 is a flowchart representative of an example process 900 that may be executed to generate a household energy consumption index for a household 102. The household 102 is associated with one or more persons 108, who each may have a personal energy consumption index as described herein. The example process 900 may be used to implement a function of the data collector 110 described in FIGS. 1-3, 5 & 6. During a particular time period (e.g., month), the data collector 110 receives resource consumption data from appliances, fixtures, and/or devices (e.g., via meters 332 described in FIG. 3) associated with a measured household (e.g., the example household 102 described in FIGS. 1, 2, 5 and 6). Receiving may be done by accepting measurements from meters 332, requesting data from the meters 332, and/or any other method for receiving data (block 902).

[0084] To collect resource consumption measurements from a vehicle (e.g., the vehicle 208 described in FIGS. 2 and 5), the data collector 110 first determines whether there are any vehicles associated with the household 102 (block 904). For example, vehicles may be registered in the data collector 110 during the initial setup of the data collector 110 and/or when persons 108 associated with the household 102 acquire or get rid of vehicles. If there is a vehicle 208 associated with the household 102 or a person 108 (block 904), the data collector loads and/or receives remote resource consumption measurements for the vehicle 208 (block 906). Example methods of communicating data from a vehicle 208 to the data collector 110 may include a wireless communication link (e.g., wireless link 508) or via a mobile unit (e.g., the mobile unit 520) associated with a person 108, which downloads data from the vehicle 208 and uploads the data to the data collector 110. The data collector 110 receives and/or loads remote resource consumption data for each measured vehicle 208. Additionally or alternatively, the data collector 110 may load or receive miscellaneous travel data associated with measured persons 108 from devices 520 corresponding to those persons. This miscellaneous travel data may represent travel by persons 108 using, for example, public transportation.

[0085] If there are no vehicles associated with the example household 102 or person 108 (block 904) or when the data collector 110 loads and/or receives resource consumption measurements for the vehicle (block 906), the data collector 110 loads purchase data (e.g., from a data store) for items logged during the measured month (block 908). For example, a person 108 may log purchases for each week on a particular day. When the purchase data is loaded, the data collector 110 determines whether the purchase data for the example month is complete (block 910). This may be accomplished by, for example, prompting a person 108 to enter final purchase data or determining the logging habits of the person 108 relative to the end of the example

month. If the data collector 110 determines that the purchase data is incomplete (block 910), the data collector 110 receives the remaining purchase data for the time period (block 912). If the data collector determines the purchase data is complete (block 910) or when the complete purchase data is received (block 912), the data collector 110 is prepared to generate the household energy consumption index.

[0086] When the appropriate resource consumption data has been received and loaded into the memory of the data collector 110 (blocks 902-912), the data collector 110 generates a household energy consumption index for the example month based on the resource consumption measurements and purchases information and stores the index in memory (block 914). The household energy consumption index may be generated using any desired units, such as joules or tons of CO₂. The current household energy consumption index may then be displayed with household energy consumption indices for previous time periods for the example household 102 (block 916). This will allow the persons 108 associated with the household 102, for example, to view how conservation efforts being undertaken are affecting the household energy consumption index over time and continue, modify and/or end particular efforts accordingly. The example data collector 110 also transmits the household energy consumption index to a central data processing facility (e.g., the central data processing facility 112 and/or data processing server 114 described in FIGS. 1 & 2) for storage and/or processing (block 918). The central data processing facility 112 uses the household energy consumption index, which may be associated with demographic information for measured persons 108 associated with the household 102, to generate statistical data.

[0087] Alternatively, the process 800 may omit generating the household energy consumption index. Instead, the process 800 may transmit the household resource consumption data and/or the personal resource consumption data for the

persons 108 associated with the household 102, vehicle 208, and purchases to an external location (e.g., the central data processing server 114 of FIG. 1). The central data processing server 114 receives the resource consumption data and generates a household energy consumption index and/or the personal energy consumption indices, which may then be transmitted to the data collector 110 for display to the persons 108 associated with the household 102.

[0088] The example processes 800 and 900 are executed at the end of a particular time period such as the example months described. Additionally or alternatively, any or all of the blocks of the example processes 800 and/or 900 may be executed at any time during a time period to gather information or generate intermediate personal or household energy indices.

Company Energy Consumption Index

[0089] FIG. 10 is a block diagram of an example system 1000 to generate a company energy consumption index. An example company 1002 has four departments: Management and Support 1004, Research and Development 1006, Manufacturing 1008 and Purchasing 1010. The Management/Support department 1004 has equipment 1012 (e.g., computers, printers, storage equipment) and supplies 1014 (e.g., copy paper, pens, pencils, paper clips). The Research and Development department 1006 includes Development Tools 1016 (e.g., design computers, prototyping machines), Test Equipment 1018 (e.g., scopes, meters), and Materials/Equipment Purchases 1020 (e.g., office supplies, chemicals, circuit components, building materials). The Manufacturing department 1008 includes Machinery 1022 (e.g., manufacturing, packaging, and shipping machines), Control and Lighting 1024 (e.g., operator interface equipment, lights, HVAC), and Materials/Equipment Purchases 1026 (e.g., raw materials, reagents, machinery). The

example Purchasing department 1010 has Purchasing systems 1027 to, among other things, collect and log purchasing data from the other departments.

[0090] Additionally, the example system 1000 includes a Central Data Collector 1028. The Central Data Collector 1028 may be implemented as a software module on a server, as a separate Central Data Collector system coupled to the network of the company, or some combination of components.

[0091] The example company 1002 practices the common method of submitting purchase requests to the Purchasing Department 1010, which is responsible for organizing and procuring the requested item(s). The Central Data Collector 1028 may then obtain the purchase information from the Purchasing 1010 systems, which may be organized by individual, group, department, product line, product, manufacturing line, or any other criteria depending on the information contained in Purchasing 1010 systems. The Central Data Collector 1028 may passively receive and/or actively request purchasing information from the Purchasing 1010 systems.

[0092] After receiving the purchasing information, the Central Data Collector 1028 determines an amount of energy associated with each purchase. The Central Data Collector 1028 may create a total energy amount from all purchases for the company 1002 and/or may create a sum energy amount for an organization level (e.g., individual, group, department, product line, product, and/or manufacturing line).

[0093] In addition to receiving purchase information, the example Central Data Collector 1028 receives resource consumption information from the Management/Support 1004, Research and Development 1006 and Manufacturing 1008 departments. The example resource consumption information collected in the system 1000 includes any of electricity, natural gas, gasoline, fuel oil, kerosene, propane, wood, light, temperature, water, and/or heating oil. Information associated

with other types of resources may also be measured and collected. To collect the resource consumption measurements, the example system 1000 may implement meters similar to the meters 332 described in connection with FIG. 3. Additionally or alternatively, the example system 1000 may use other types of meters, resource management software, or other tools to provide resource consumption information to the Central Data Collector 1028.

[0094] After receiving the resource consumption information, the Central Data Collector 1028 converts resource measurements (if not performed by the meter or system providing the measurement) to a standard unit (e.g., Joules, kilocalories, tons of CO₂). The resource consumption measurements may then be used with the purchasing information received from the Purchasing 1010 systems to generate a company energy consumption index. The company energy consumption index may be used to compare energy consumption by the example company 1002 during different time periods or to measure the effectiveness of conservation efforts. Additionally or alternatively, other energy consumption indices may be generated for individual employees, departments, product lines, products, manufacturing lines and/or other organizational units. For example, a Research and Development department energy consumption index may be generated based on purchases originating from the Research and Development 1006 department (i.e., Materials and Equipment purchases 1020) and the measured consumption of resources by the Development Tools 1016 and Test Equipment 1018.

[0095] The example Central Data Collector 1028 also transmits generated energy consumption indices and/or other data to a Central Data Processing Facility (e.g., the Central Data Processing Facility 112 described in connection with FIGS. 1 & 2). At the Central Data Processing Facility 122, the generated energy consumption indices and/or raw data may be used to track the use of Carbon Units, which are units

of emissions traded among companies that allow the companies to emit a certain volume of pollutants per Carbon Unit. The generated energy consumption indices and/or raw data may also be used to more accurately and/or more precisely assign energy consumption values to goods and/or services purchased by a household (as described in connection with FIGS. 2 and 6-9).

[0096] The Central Data Collector 1028 may collect purchase information and resource consumption measurements from the departments 1004-1010 using any appropriate method. The manner in which the Central Data Collector 1028 collects information and generates energy consumption indices may depend on, for example, the software systems used by the company 1002. As an example, a small company may not have a purchasing department or use purchasing software and may instead prefer to enter any purchases into the Central Data Collector 1028 manually. This may be done by entering purchase information into a computer terminal, loading payment information from a credit card, scanning and recognizing an invoice, downloading purchase histories from a supply company web site, and/or any combination of the described or other methods. Resource consumption information may be manually entered using the information contained in a utility bill.

[0097] The example Central Data Collector 1028 may also measure resource consumption by activities that are engaged in by the company, such as manufacturing. To measure resource consumption by an activity, the Central Data Collector 1028 monitors equipment via resource consumption meters or utility meters for information indicative of a particular activity. When the Central Data Collector 1028 receives an indication that a particular activity is starting, the Central Data Collector 1028 may begin to monitor additional meters to measure the energy consumed by that particular activity. Further, the Central Data Collector 1028 may have material or supply usage information associated with the activity. While the activity is performed, the Central

Data Collector 1028 monitors the associated equipment until one or more indications are received that the activity has ceased. The measured energy consumption and any materials or supply usage information are then used to determine the energy consumed by the activity. Any other types of information, resources, and/or monitoring techniques may be used to determine the energy consumption by an activity.

[0098] One such activity that may be measured is manufacturing one thousand units of a circuit board. Prior to the start of manufacturing, the Central Data Collector 1028 monitors a number of meters coupled to equipment on an example production line including a conveyor belt, a soldering oven, a part placement machine, and a packaging machine. To begin the production of the circuit boards, the conveyor belt is turned on. The meter coupled to the conveyor belt signals to the Central Data Collector 1028 that it has turned on, and the Central Data Collector 1028 begins to further monitor the meters coupled to the soldering oven, the part placement machine, and the packaging machine. As the circuit boards are manufactured, the monitored equipment consumes energy, which is measured by the meters and transmitted to the Central Data Collector 1028.

[0099] When the example manufacturing process is complete, the conveyor belt is turned off and the meter coupled thereto sends an indication to the Central Data Collector 1028 that the activity has ended. The Central Data Collector 1028 then determines the total energy consumed by the equipment, as well as energy associated with the components, solder and packaging for the circuit board. The energy values are totaled to determine the energy to manufacture the one thousand circuit boards and, by dividing the energy by the quantity, one circuit board.

[0100] Although the described example includes manufacturing a fixed quantity of objects, the energy of any company activity may be monitored by

measuring the energy consumption of the appropriate equipment and/or materials. Further, the Central Data Collector 1028 may transmit the energy consumption information and materials information to an external server (e.g., the central data processing server 114 of FIG. 1) to determine the total energy and/or unit energy (e.g., energy per unit, energy per time).

[0101] FIG. 11 is a flowchart representative of an example process 1100 that may be executed to generate a company energy consumption index for a company 1002. The example process 1100 may be implemented as a series of steps executed on the example Central Data Collector 1028 described in FIG. 10. The Central Data Collector 1028 loads resource consumption measurements for a current time period (e.g., the current month) from a memory or data store (block 1102). The measurements for the current time period may not include all resources consumed for the current time period, so the Central Data Collector 1028 determines whether the resource consumption information for the current time period is accounted for (block 1104). For example, the Central Data Collector 1028 may query meters and/or other sources (e.g., Equipment 1012, Development Tools 1016, Test Equipment 1018, Machinery 1022 and/or Control/Lighting 1024 described in FIG. 10). If the resource consumption measurements are not complete for the current time period, the Central Data Collector 1028 requests measurements from meters and/or any other sources (block 1106). After requesting and receiving additional resource consumption information, control returns to block 1104.

[0102] If the resource consumption measurements are complete for the current time period (block 1104), the Central Data Collector 1028 receives purchasing data corresponding to the query from the purchasing systems 1027 (block 1108). The Central Data Collector 1028 then analyzes the purchasing data from the Purchasing systems 1027 to determine whether additional purchasing data is required (block

1110). For example, purchasing data may be pushed by the purchasing systems 1027 to the Central Data Collector 1028 at regular or irregular intervals. If the purchasing data is not updated when the example time period is over, the Central Data Collector 1028 may require the remaining purchasing data to generate an accurate company energy index.

[0103] If the example Central Data Collector 1028 determines that further purchasing data is necessary (block 1110), the Central Data Collector 1028 receives additional purchasing data (block 1112). The additional purchasing data may be remaining data for the example current period (i.e., only the data not already received by the Central Data Collector 1028) or may be the complete data or substantially complete purchasing data for the current period, including data already received by the Central Data Collector 1028. The purchasing data may be received by the Central Data Collector 1028 in response to, for example, a request from the Central Data Collector 1028 to the purchasing systems 1027 containing the purchasing data.

[0104] If additional purchasing data is not required (block 1110) or after additional purchasing data is received (block 1112), the Central Data Collector 1028 generates a company energy index based on the resource consumption measurements and the purchasing data (block 1114). The Central Data Collector may also generate energy indices for one or more individual employees, departments, product lines, products, manufacturing lines and/or other organizational units. When the company energy index has been generated, the Central Data Collector 1028 loads additional company energy indices from previous time periods and displays the energy indices with the current company energy index for analysis (block 1116). Display of the indices may occur on a display, printed medium, or other human- and/or machine-readable means. Additionally or alternatively, the Central Data Collector 1028 transmits the company energy index to a central data processing facility (e.g., the

example central data processing facility 112 of FIGS. 1 & 2) to be analyzed and compared (block 1118).

[0105] Alternatively, the process 1100 may omit generating the personal energy consumption index. Instead, the process 1100 may transmit the resource consumption data and purchasing data to an external location (e.g., the central data processing server 114 of FIG. 1). The central data processing server 114 receives the resource consumption data and purchasing data and generates a company energy consumption index and/or other organizational or employee energy consumption indices, which may then be transmitted to the Central Data Collector 1028 for display.

[0106] FIG. 12 is a diagram of an example processor system 1210 that may be used to implement the example machine readable instructions described herein, as well as the data collector 120, central data processing facility 122, appliances 202-206, meters 212 and 332, barcode scanner 214, mobile devices 216 and 520, HRCM device 302, appliances and devices 304-330, central processor 502, fuel gauge 504, odometer 506, seat detectors 508-512, equipment 1012, supplies 1014, development tools 1016, test equipment 1018, machinery 1022, control/lighting 1024 and/or purchasing systems 1027 of FIGS. 1-3, 5 & 6 & 10.

[0107] Turning now to FIG. 12, an example processor system 1200 includes a processor 1202 having associated memories, such as a random access memory (RAM) 1204, a read only memory (ROM) 1206 and a flash memory 1208. The flash memory 1208 of the illustrated example includes a boot block 1210. The processor 1202 is coupled to an interface, such as a bus 1212 to which other components may be interfaced. In the illustrated example, the components interfaced to the bus 1212 include an input device 1214, a display device 1216, a mass storage device 1218 and a removable storage device drive 1220. The removable storage device drive 1220 may include associated removable storage media 1222 such as magnetic or optical media.

[0108] The example processor system 1200 may be, for example, a conventional desktop personal computer, a notebook computer, a workstation or any other computing device. The processor 1202 may be any type of processing unit, such as a microprocessor from the Intel[®] Pentium[®] family of microprocessors, the Intel[®] Itanium[®] family of microprocessors, and/or the Intel XScale[®] family of processors. The memories 1204, 1206 and 1208 that are coupled to the processor 1202 may be any suitable memory devices and may be sized to fit the storage demands of the system 1200. In particular, the flash memory 1208 may be a non-volatile memory that is accessed and erased on a block-by-block basis.

[0109] The input device 1214 may be implemented using a keyboard, a mouse, a touch screen, a track pad, a barcode scanner or any other device that enables a user to provide information to the processor 1202.

[0110] The display device 1216 may be, for example, a liquid crystal display (LCD) monitor, a cathode ray tube (CRT) monitor or any other suitable device that acts as an interface between the processor 1202 and a user. The display device 1216 as pictured in FIG. 12 includes any additional hardware required to interface a display screen to the processor 1202.

[0111] The mass storage device 1218 may be, for example, a conventional hard drive or any other magnetic or optical media that is readable by the processor 1202.

[0112] The removable storage device drive 1220 may, for example, be an optical drive, such as a compact disk-recordable (CD-R) drive, a compact disk-rewritable (CD-RW) drive, a digital versatile disk (DVD) drive or any other optical drive. It may alternatively be, for example, a magnetic media drive. The removable storage media 1222 is complimentary to the removable storage device drive 1220, inasmuch as the media 1222 is selected to operate with the drive 1220. For example,

if the removable storage device drive 1220 is an optical drive, the removable storage media 1222 may be a CD-R disk, a CD-RW disk, a DVD disk or any other suitable optical disk. On the other hand, if the removable storage device drive 1220 is a magnetic media device, the removable storage media 1222 may be, for example, a diskette or any other suitable magnetic storage media.

[0113] As described in detail hereinafter, the disclosed system enables the processor 1202 to read information from the removable storage media 1222 placed in the removable storage device drive 1220 in a pre-boot environment. This functionality is imparted to the processor 1202 through a firmware extension that is stored on the removable storage media 1222 at, for example, the time the removable storage media 1222 is formatted. For convenience, the example processor system 1200 of FIG. 12 will be used to describe the format, write, read and boot processes described herein. It will be understood, however, that one or more of these processes may be carried out by different processor systems. For example, a software manufacturer may format an optical disk to include the firmware extension using a first processor to execute the format process and a consumer who purchases the software may use a second processor to execute the read process on his/her system to install the software.

[0114] Although this patent discloses example systems including software or firmware executed on hardware, it should be noted that such systems are merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of these hardware and software components could be embodied exclusively in hardware, exclusively in software, exclusively in firmware or in some combination of hardware, firmware and/or software. Accordingly, while the above specification described example systems, methods and articles of manufacture, persons of ordinary skill in the art will readily appreciate that the examples are not the

only way to implement such systems, methods and articles of manufacture.

Therefore, although certain example methods, apparatus and articles of manufacture have been described herein, the scope of coverage of this patent is not limited thereto.

On the contrary, this patent covers all methods, apparatus and articles of manufacture fairly falling within the scope of the appended claims either literally or under the doctrine of equivalents.

What is claimed is:

1. A method to generate a personal energy consumption index, comprising:
receiving home resource consumption measurements associated with at least one of a household appliance, fixture or device;
receiving remote resource consumption measurements associated with a person;
receiving purchase information associated with the person; and
generating a personal energy consumption index based on the received resource consumption measurements, remote resource consumption measurements, and purchase information.
2. A method as defined in claim 1, further comprising displaying the personal energy consumption index at a location visible to the person.
3. A method as defined in claim 1, further comprising transmitting the personal energy index to an external server.
4. A method as defined in claim 1, further comprising adjusting at least one of the home resource consumption measurements, remote resource consumption measurements or purchase information based on a second person.
5. A method as defined in claim 1, wherein the remote resource consumption measurements comprise vehicle resources.
6. A method as defined in claim 1, wherein home resource consumption measurements comprise at least one of electricity measurements, natural gas measurements, gasoline measurements, fuel oil measurements, kerosene measurements, propane measurements, wood measurements, light measurements, temperature measurements, water measurements, and/or heating oil measurements.
7. A method to generate a personal energy consumption index, the method comprising:

measuring resources consumed by a home associated with a person to be measured and calculating a first amount of energy associated with the resources consumed by the home;

measuring resources consumed by the person while located outside the home and calculating a second amount of energy associated with the resources consumed by the person while located outside the home;

measuring resources associated with goods purchased by the person and calculating a third amount of energy associated with the resources associated with the purchased goods; and

generating a personal energy consumption index associated with the person based on the calculated amounts of energy.

8. A method as defined in claim 7, further comprising adjusting at least one of the first, second or third calculated amounts of energy based on measured resources consumed by a second person.

9. A method as defined in claim 7, further comprising displaying the personal energy consumption index at a location visible to the person.

10. A method as defined in claim 7, wherein the resources consumed by the person while located outside the home comprise vehicle resources.

11. A method as defined in claim 7, wherein resources consumed by the home comprise at least one of electricity measurements, natural gas measurements, gasoline measurements, fuel oil measurements, kerosene measurements, propane measurements, wood measurements, light measurements, temperature measurements, water measurements, and/or heating oil measurements.

12. A method as defined in claim 7, further comprising transmitting the personal energy index to an external server.

13. An apparatus to generate a personal energy consumption index, comprising:

a data collector to receive data associated with resource consumption by at least one of an appliance, a fixture, or a device, to receive data associated with remote resource consumption by a person, and to receive data associated with goods purchased outside a home associated with the person;

a processor configured to determine energy associated with the received data and generate a personal energy index based on the determined energy; and

a transmitter to send data to an external server.

14. A method to generate a household energy consumption index, the method comprising:

measuring resources consumed by a home associated with a household to be measured and calculating a first amount of energy associated with the resources consumed by the home;

measuring resources consumed by a member of the household while located outside the home and calculating a second amount of energy associated with the resources consumed by the member while located outside the home;

measuring resources associated with goods purchased by the member of the household and calculating a third amount of energy associated with the purchased goods; and

generating a household energy consumption index based on one or more of the first, second or third calculated amounts of energy.

15. A method as defined in claim 14, further comprising displaying the personal energy consumption index at a location visible to the member of the household.

16. A method as defined in claim 14, further comprising transmitting the household energy index to an external server.

17. A method as defined in claim 14, wherein the resources consumed by a member of the household while located outside the home comprise vehicle resources.

18. A method as defined in claim 14, wherein home resource consumption measurements comprise at least one of electricity measurements, natural gas measurements, gasoline measurements, fuel oil measurements, kerosene measurements, propane measurements, wood measurements, light measurements, temperature measurements, water measurements, and/or heating oil measurements.

19. A method to collect energy consumption data, comprising:

- receiving first information associated with resources consumed by a home;
- receiving second information associated with resources consumed by an automobile;
- receiving third information associated with resources consumed by one or more persons;
- receiving fourth information associated with purchases made by one or more persons; and
- determining one or more amounts of energy associated with the first, second, third or fourth received information.

20. A method as defined in claim 19, further comprising calculating an energy consumption index based on one or more of the first, second, third or fourth received information.

21. A method as defined in claim 20, further comprising displaying the energy consumption index at a location visible to the persons.

22. A method as defined in claim 19, further comprising transmitting one or more of the first, second, third or fourth received information to an external server.

23. A method to generate energy consumption data, comprising:

- receiving purchase location information;
- reading an indicia associated with a purchased item;

querying one of an internal memory or an external server for an energy value associated with the purchased item; and

storing information associated with the purchased item and the energy value associated with the purchased item.

24. A method as defined in claim 23, further comprising associated at least a portion of the energy value with a person.

25. A method to associate an activity with resource consumption, comprising:
monitoring a first meter for first consumption information;
receiving a consumption indicator from the first meter;
instructing a second meter to measure second consumption information in response to receiving the consumption indicator;
receiving the second consumption information; and
associating the first and second consumption information with the activity.

26. A method as defined in claim 25, further comprising receiving a second consumption indicator from the first meter or the second meter.

27. A method as defined in claim 25, further comprising determining total resource consumption for the activity for a measurement period.

28. A method as defined in claim 25, wherein the first meter is coupled to an appliance to generate the first consumption information.

29. A method as defined in claim 25, wherein the activity is performed at a company location.

30. A method as defined in claim 25, wherein the activity is performed at a household location.

31. A method to generate energy consumption information, comprising:
receiving household resource consumption information from one or more monitored households each having one or more monitored persons;

receiving company resource consumption information from one or more
monitored companies;

receiving purchase information from one or more stores associated with consumer
and company purchases; and

generating an energy consumption index for at least one of a company or a
household based on the household resource consumption information, the company
resource consumption information, and the purchase information.

32. A method as defined in claim 31, wherein the purchase information comprises
one or more purchased items or services from the one or more stores.

33. A method as defined in claim 31, wherein the household resource
consumption information has an associated energy value.

34. A method as defined in claim 31, wherein the company resource consumption
information has an associated energy value.

ABSTRACT

Systems and methods to generate an energy consumption index are disclosed. In one described example, a method to generate a personal energy consumption index is disclosed, comprising receiving home resource consumption measurements associated with at least one of a household appliance, fixture or device, receiving remote resource consumption measurements associated with a person, receiving purchase information associated with the person, and generating a personal energy consumption index based on the received resource consumption measurements, remote resource consumption measurements, and purchase information.