FORM 2

THE PATENTS ACT, 1970

(39 of 1970)

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The Patent Rules, 2003

COMPLETE SPECIFICATION

(See section 10 and rule 13)

TITLE OF THE INVENTION

"IoT based Smart hybrid grid energy system with energy efficiency in remote area location"

We, applicant(s)

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The following specification particularly describes the nature of the invention and the manner in which it is performed:

FIELD OF INVENTIONS:

In general, the current disclosure pertains to portable generating systems which use sustainable sources of electricity especially remote army location.

DISCUSSION OF THE PRIOR ART:

The military operates in distant sites, whether during natural disasters or on external territory during war, to train and conduct military operations and has to be ready to act at short notices, in any climate and in extended periods of time. As a consequence, they now depend upon relocation temporary camps (RTCs) under severe operational and environment circumstances for their deployment. RTCs rely on logistics for the continuously delivery of fossil fuel (mostly diesel) as primary energy supply to maintain operations, since there is no utilities grid. Ineligible differences in present methods contribute to vulnerabilities of energy infrastructures, such as power production shortages and greater supply needs, with the result that transport logistics during operations have increased considerably. In addition, RTCs generate spot loads by connecting loads to a common generator set that excessively measures each generator to meet peak demands, even if they are seldom used. The generators, however, are usually chosen with a much larger capacity, resulting in a costly and inexpensive power source, greater maintenance and wet sacking, which results in a poor combustion of fuel.

There are thus many operational difficulties facing military engineers in recent years, including energy convoys and infrastructure, restricted supply, and climate change.

REMOTE SECURE DEVICE MANAGEMENT IN SMART GRID AMI NETWORKS

Publication number: 20150365238

Abstract: Presented herein are techniques for securely configuring or managing devices in a variety of geographic locations. At a device manager for a device, a first public key of a first public-private key pair is presented to a network management system as part of a request for one or more work orders. The work order, generated and signed by the network management system using a second private key of a second public-private key pair, includes the first public key, and is received by the device manager. The signed work order is provided to the endpoint device for validation of the signed work order using a second public key, and all subsequent communications from the device manager to the endpoint device are sent such that the communications are signed with the first private key. In some embodiments, each work order is valid for a specified amount of time.

Type: Application

Filed: June 12, 2014

Publication date: December 17, 2015

Inventors: Jonathan W. Hui, Raja Rajaram Kannan, Wei Hong

SMART GRID APPLIANCE CONTROL

Publication number: 20180152769

Abstract: Systems and methods for controlling small grids of appliances are described. One sample method includes receiving consumption data from a plurality of electrical appliances that are plugged into outlets at a first location and monitoring power usage at the first location. The method includes evaluating the received consumption data to identify one or more predetermined conditions in one or more of the plurality of electrical appliances and evaluating stored data related to power consumption preferences at the first location. The power consumption preferences define conditions when a consumer associated with the first location has agreed to enable remote control of at least one designated appliance upon an occurrence of one or more predetermined conditions. The method includes determining that the one or more conditions are satisfied and to provide a first secure communication to the first appliance to control the power consumption.

Type: Application

Filed: January 26, 2018

Publication date: May 31, 2018

Inventors: Jeff Kotowski, Charles Cai

SYSTEM AND METHOD TO DETERMINING EFFICIENCY OF A SMART APPLIANCE AND PROVIDING FEEDBACK BASED OF EFFICIENCIES OF SIMILAR SMART APPLIANCES IN A SMART GRID NETWORK

Publication number: 20190165606

Abstract: The present invention is a system and method for determining the efficiency of a smart appliance in a smart grid network and providing feedback based on the efficiencies of similar smart appliances in the smart grid network. The system includes a central controller in digital communication with a network component of a smart grid and smart appliances in the smart grid network. The smart appliances are associated with ADLs. An energy consumption measurement is calculated for the smart appliances for each ADL. A notification is transmitted from the central controller to a smart appliance or to the owner of the smart appliance indicating to repair or replace the smart appliance when the energy consumption measurement is below an inefficiency threshold. The energy consumption measurement is determined based on data such as appliance meta data, smart meter data, a user profile, user demographics, a user specific ADL schedule, and historical data.

Type: Application

Filed: November 30, 2017

Publication date: May 30, 2019

Inventors: Gopal K. Bhageria, Ravi Mandalika, Krishnasuri Narayanam, Ramasuri Narayanam

REMOTE ENERGY MANAGEMENT USING PERSISTENT SMART GRID NETWORK CONTEXT

Publication number: 20130103221

Abstract: A device may include a memory to store control policies set for a network of smart grid. devices connected to a power grid, the control policies including an energy consumption threshold associated with the network of smart grid devices; and a processor configured to obtain network content including energy consumption data associated with the network of smart grid devices, compare the energy consumption data to the energy consumption threshold associated with the network of smart grid devices, generate a first instruction with respect to energy consumption associated with network of smart grid devices, and generate a second instruction with respect to replenishment of unforced capacity associated with the network of smart grid devices.

Type: Application

Filed: December 11, 2012

Publication date: April 25, 2013

Applicant: VERIZON PATENT AND LICENSING, INC.

Inventor: Verizon Patent and Licensing, Inc

REMOTE ENERGY MANAGEMENT USING PERSISTENT SMART GRID NETWORK CONTEXT

Patent number: 9568973

Abstract: A device may include a memory to store control policies set for a network of smart grid devices connected to a power grid, the control policies including an energy consumption threshold associated with the network of smart grid devices; and a processor configured to obtain network content including energy consumption data associated with the network of smart grid devices, compare the energy consumption data to the energy consumption threshold associated with the network of smart grid devices, generate a first instruction with respect to energy consumption associated with network of smart grid devices, and generate a second instruction with respect to replenishment of unforced capacity associated with the network of smart grid devices.

Type: Grant

Filed: December 11, 2012

Date of Patent: February 14, 2017

Assignee: VERIZON PATENT AND LICENSNG INC.

Inventors: Madhusudan Raman, Jean Francois Dubois, Renu Chipalkatti

PROTOCOL TRANSLATION IN SMART GRID COMMUNICATIONS

Publication number: 20140201381

Abstract: A system and method for managing smart grid communication is disclosed. The system includes a communication module, a discovery module, a translation module and a smart grid module. The communication module receives data initiating smart grid communication between a utility server and a communication node. The discovery module identifies a server protocol used by the utility server to communicate with the communication node. The discovery module identifies a node protocol used by the communication node to communicate with the utility server. The node protocol is incompatible with the server protocol. The translation module performs a protocol translation between the server protocol and the node protocol. The smart grid module handles the smart grid communication between the utility server and the communication node using the protocol translation.

Type: Application

Filed: January 15, 2013

Publication date: July 17, 2014

Applicant: TOYOTA JIDOSHA KABUSHIKI KAISHA

Inventor: TOYOTA JIDOSHA KABUSHIKI KAISHA

While the present invention is described herein by example using embodiments and illustrative drawings, those skilled in the art will recognize that the invention is not limited to the images of drawing or drawings described and are not intended to represent the various scale components. Further, some features that may form a part of the invention may not be illustrated in specific figures for ease of illustration. Such omissions do not limit the embodiments outlined in any way.

It should be understood that the drawings and detailed descriptions are not intended to limit the invention to the particular form disclosed. Still, on the contrary, the story is to cover all modifications, equivalents, and alternatives falling within the scope of the present invention as defined by the appended claims. As used throughout

In this description, the word "may" is used in a permissive sense (i.e., meaning having the potential to) rather than the mandatory reason (i.e., meaning must). Further, the words "a" or "an" mean "at least one," and the word "plurality" means "one or more" unless otherwise mentioned. Furthermore, the terminology and phraseology used herein are solely for descriptive purposes and should not be construed as limiting in scope. Language such as "including," "comprising," "having," "containing," or "involving," and variations thereof, is intended to be broad and encompass the subject matter listed after that, equivalents, and additional subject matter not recited, and is not intended to exclude other additives, components, integers or steps. Likewise, the term "comprising" is considered synonymous with the words "including" or "containing" for applicable legal purposes. Any discussion of documents, materials, devices, articles, and the like are included in the specification solely to provide a context for the present invention. It is not suggested or represented that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention.

In this disclosure, whenever a composition or an element or a group of elements is preceded with the transitional phrase "comprising," it is understood that we also contemplate the same design, component or group of elements with transitional words "consisting of," "consisting," "selected from the group of consisting of, "including," or "is" preceding the recitation of the composition, element or group of elements and vice versa.

The present invention is described from various embodiments concerning the accompanying drawings, wherein reference numerals used in the accompanying drawing correspond to the like elements throughout the description. However, this invention may be embodied in many different forms and should not be construed as limited to the embodiment set forth herein. Instead, the image is provided so that this disclosure will be thorough and complete and fully convey the invention's scope to those skilled in the art. The following detailed description provides numeric values and ranges for various aspects of the implementations described. These values and ranges are treated as examples only and are not intended to limit the claims' scope. Also, several materials are identified as suitable for various facets of the implementations. These materials are to be treated as exemplary and are not intended to limit the invention's scope.

SUMMARY OF THE PRESENT INVENTION:

The new option for a military camp has been defined by such concept. With the integration of the micro grid with energy storage systems, renewable resources and waste heat recovery technologies, the launching method is substantially improves the current solutions, thus drastically reducing fuel supplies to the RTCs. A good SHW system is capable of delivering substantially a portion of the base camp's demands for water heating by means of solar energy;a combination of smart micro grid and renewable energy may, besides substantial carbon reductions, decrease base camp demand for energy and fuel consumption. The Micro grid-connected Waster Heat Recovery System is considered separately, with the lowest energy usage (up to 16% decrease).

Intelligent micro grids, supplying electricity with enhanced voltage and frequency stability, boost network dependability and extended life of final use devices, EMS, equipped with real-time monitoring and basic parameter management, allows the decision making process to be central and informed. Configurable automated load distribution offers the ability to reduce camp energy usage for regular and unplanted activities.

BRIEF DESCRIPTION OF THE DRAWINGS

With respect to the RTC solution's design requirements, SHES was evaluated for energy generation and storage technologies in containerized emergency solutions. The equipment has been chosen based on size estimates and container space from a variety of commercial goods.

Weight and volume of travel, logistical support, maintenance and any risks related to systems were also taken into account. Finally, thorough design work was performed for each of the chosen technologies.

The Armed Forces system was suggested, the performance of the SHES system was evaluated using dynamic energy and energy management simulations, combining tools such as DoE Energy Plus and HOMER Pro. Firstly, the Energy Plus Energy model was developed, including geometry, structures, occupancy, hyper accessible electricity, lighting, equipment, operation, air conditioning and energy management systems (EMS) data. The current 150-person military camp was reproduced. In addition, the energy model was calibrated to correspond with RTC's real net energy and heating use as a reference for the design process and to derive and collect data from previous RTC installations.

For this reason, the combined consumption of electricity and diesel heating equipment was characterized as the net energy consumption. Secondly, the HOMER Pro micro grid design, simulation and optimization tool Energy Plus generated electric and heat loading profiles were used as a design and investment support tool for selecting, sizing, positioning and dispatching the optimum portfolio of multiple energy sources that feed and service the decentralized electricity systems. In sensitivity studies, HOMER Pro was also utilized to determine the most cost-intensive design of the system for different fuel prices and nominal reducing rates.

The dynamic analyses have enabled comparisons to be conducted among the existing Basic Camp practices across scenarios including various distributed energy supplies and energy saving techniques. Further simulations on the most cost-elective method suggested estimating the fuel consumption and energy savings for the most efficient climatic areas were later done. In HOMER Pro the operation of various systems configurations with dynamic energy balance has been simulated in order to assess the economic and technical viability of the numerous alternatives and to take into account the differences in technology prices and energy resource availability. HOMER Pro evaluated the demand in electricity and thermal power to the energy that the system can provide and estimated the energy flow from and to each component of the system in each step and for each system configuration examined. The analysis focused on how the generators are operated and if the batteries are to be charged or discharged and whether a set-up is possible.

The SHES is intended to operate either in standalone mode or in the local grid. SHES is composed of a single system of integrated technologies: (a) photovoltaic (PV) array, (b) electric energy storage; (c) existing diesel generators; (b) waste-to-heat energy recovery system (WHRU) for space heating; (e) solar hot water systems (SHW) for hot household water.

The conceptual arrangement of energy vectors is shown in Figure 1, while the full HVAC and power production architecture of the SHES is shown in Figure 2.

The SHES system consisted in particular of the following components:

A total power output of 100 kW with a 446 m2 surface is provided with 21 percent e of Photovoltaic modules (SPR-X21-345). Each array has an optimum tilt angle that varies by location and is attached to the soil using an aluminum mounting system. Since base camp loads utilise AC, inverters are needed to convert the PV-generated direct current (DC). It is important to note that the PV configuration had employed a larger (approximately four-times bigger) system to meet the whole energy demand of the camp; however, in addition to the high initial system cost and spatial restrictions, the PV system was designed to cover its peak electricity carefully, taking into account the Army's requirements for continuous transport and reinstallation.

• Energy storage enables renewable sources to overcome their intermittent character. When PV systems exceed their load, excess energy is stored in the batteries of sodium-sulfur. On the other side, the batteries are drained when the power produced by the photovoltaic's is in high demand for electricity. A battery management system monitors and protects the cells (BMS). Different battery models have been examined and the cheapest one has been chosen. Based on the relatively large capacity (1230 kWh), the output discharge (max 286,1 kW), the long life (4.4h), long service life (20years or 6 250,000 kWh), reasonable guarantees periods (10 years) and physical size considerations, BASF's containerization NAS lithium-ion energy storage system was found to be a cost-eligible solution for this project. A minimum charge level of 40% was anticipated, while the most economical approach was an 80% charge level.

· A constant electricity supply was built into a micro grid by the Existing internal combustion diesel generator. The minimal proportion of part load was estimated to be 15 percent.

THE WHRU offers a space heating waste heat (combined heat and power) to recover from generators augmented with a diesel boiler (89%). The WHRU comprised of heat exchangers and water systems for counter flow supplying heated water to the heating devices. A fan-coil unit was the terminal heating system.

The system utilized by THW covers a surface area of 90 m2 and a capacity of 63 kW that provides a considerable part of the DHW needs for base camp and the remaining portion is met by the existing electric heater. With this approach a 10,000 L storage tank will be able to raise the efficiency of the SHW system to a higher temperature (80 kbC).

The EMS regulates all components and guarantees grid stability, continuous energy production and consumption balance. It optimizes energy production by creating a hierarchy of sources and places renewable energy priority at the same time as optimizing the interactions between various components. The EMS is equipped with remote monitoring and manages the parameters of the base camp, making centralized and informed choices possible.

Depending on the availability of other renewables, the alternative is to incorporate them in the microgrid. The SHES may be completely sized to provide 270 kW to 2.7 MW of electric power to suit the varied energy requirements in base camps of 150 to 1500 people. Various components of the system may be linked to supplement the system supplied for a base camp of 150 people with a broader operating power range, and ultimately centralised at each tent. Extra PV arrays, additional battery units, bigger generators, a large-scope WHRU and a large-scale SHW system are part of the scalability possibilities.

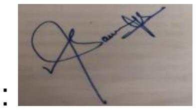
The SHES design architecture offers redundancy to ensure that any subsystem breakdown is ongoing, while the power supply from the microgrid ensures extended service and lifetime.

The hybrid energy generating architecture makes renewable energy priority, followed by battery power, which results in reduced power consumption and therefore less maintenance. The EMS enables operations and maintenance problems to be identified before they become problem-free, increasing problem response time and ensuring overall system dependability. In addition, system parameters central and remote monitoring enhances the supervision, scheduling and control of maintenance. Fire protection and security features are given for the suggested system. The SHES includes current technology and cutting-edge components. Possible replacement parts are, therefore, readily accessible on the market. After minimal on-site assembly, the system is predirected, preconfigured and may be used quickly as a plug-in and play system.

We Claim:

1. a portable, clean power generation system with a system consisting of: a variety of electricity generation units that are operated to produce a DC electricity, which include a solar power generator, a solar energy generator and a current and voltage sensor; a wind energy generating unit that includes a wind turbine, wind energy generation and wind power generation.
2. The claim 1 system further includes an electrically connected DC current surge protector with a multitude of power production units, power storage device and inverter.
3. The claim 1 system, including a DC electrically linked breaker, the power storage device and an inverter, in addition to several power generating plants.
4. The claim 1 system, which also includes the electrically linked AC current breaker with the inverter.
5. Claim 1 system, which includes an electrically linked local display with the main controller.
6. A communication method that is to sent data and receive on site data and to automatically report when battery pod and battery container powers level is nearly depleted, and also the site controller automatically schedules a time to deliver a fully charged battery container and reports this action to headquarters.

Dated this 17th day of September, 2021

Signature: 

Applicant(s)

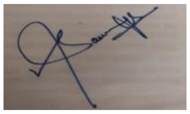
Ms. C. Sonia et. al.

Abstract:

IoT based Smart hybrid grid energy system with energy efficiency in remote area location

Current fuel inefficiency is creating logistical difficulties linked to fuel supply in relocatable temporary camps of armed forces. The energy requirements of these camps are mostly met by diesel engine generators, which mean that these camps, frequently constructed in isolated locations, must be supplied with large amounts of fuel constantly. This article offers an alternate approach called the Smart Hybrid Energy System (SHES) which aims to reduce fuel use substantially while decreasing travel logistics while fulfilling camp energy requirements. SHES combines the current diesel generator with solar power production, energy storage and waste heat recuperation technologies, along with a micro grid connector that ensures continuous supply of power and hot water. All components are regulated by an electricity management system that gives priority to the output and switching between various energy sources to ensure optimal functioning. In normal shipping 20 foot containers SHES components were chosen to be readily transported. The solution's molecularity, which can accommodate 150 people from the base camp, is developed according to available renewable energy sources, so that different camp dimensions may be optimized for various climates with energy.

Dated this 17th day of September, 2021

Signature: 

Applicant(s)

Ms. C. Sonia et. al.