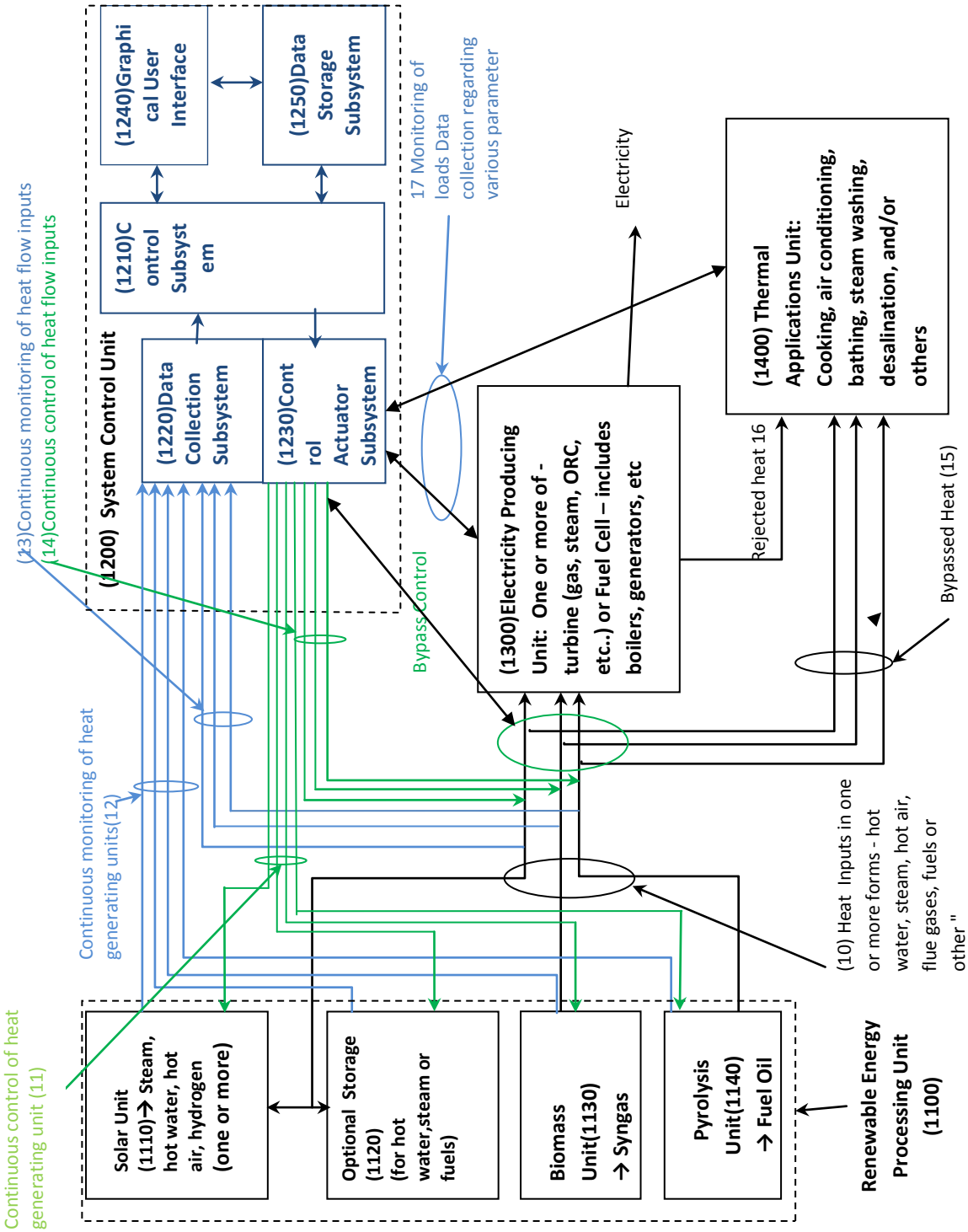

Figure 1

SSreedharan

Sunita K Sreedharan
Of SKS Law Associates
Attorney of the Applicant

FIELD OF THE INVENTION:

The present invention relates to the integrated, closed-loop, highly efficient renewable energy system designed for rural, semi-rural and urban application. More specifically the invention provides for a control system that is able to optimize the use of energy drawn from different types of renewable energy sources.

BACKGROUND OF THE INVENTION:

Due to the negative impact of the non-renewable sources of energy on the environment such as climate change and global warming as well as the limitation of the availability of non-renewable resources such as fossil fuels, governments are pushing for the research and commercialization of alternative and renewable sources of energy.

Currently, the main sources of renewable energy include solar energy, energy derived from harnessing hydropower, wind and geothermal activity, or from gasification of biomass or through pyrolysis of non-biodegradable matter. The advantages associated with these renewable energy sources is that they are clean sources of energy and do not produce any net pollution or green-house gas effect unlike nonrenewable sources of energy.

Although these renewable sources of energy have tremendous potential to replace the non-renewable sources, their wide spread use is hindered by a variety of problems. For example, the source is required in copious amounts in the production of electricity, which may be a problem. As another example, solar energy is not available in the night or during the monsoon and unseasonal rains. Similarly, biomass is limited by the seasonal variation while wind energy is limited by the variability of the wind.

Another major source of energy loss typically found in thermal energy systems is that the energy usage is not often optimized to use all of the energy generated.

These types of inefficiencies in capturing energies result in the higher cost of producing energy, which is the major reason for non-exploitation of viable sources of renewable forms of energy in many countries. Therefore, most

developing as well as developed countries continuously rely on non-renewable resources such as coal, petroleum, etc.

Hence there is an urgent need for a highly efficient renewable energy system which can efficiently provide energy to a community in a fully sustainable and cost effective way.

OBJECT OF THE INVENTION:

The main object of the invention is to provide a control system that optimizes the generation of energy from the various different types of renewable energy production units as per the available renewable energy resources.

Another object of the invention is to provide a self-adaptive control system which identifies and finds the optimum operating conditions at which the system ought to operate in order to optimize the energy generated by the electricity producing unit and the energy demands of the various applications based on the energy generation and usage data collected over a period from the renewable energy production units and the various applications including thermal units.

Yet another object of the invention is to provide a system in which the unused heat in the electricity producing unit can be used by thermal application units for applications requiring heat energy such as laundry, washing and cooking.

Yet another object of the invention is to provide a control system for monitoring of the energy resources produced by the renewable energy production units and apportioning the said energy resources between the electricity producing unit and thermal application units in such a manner that the system operates with peak achievable efficiency.

SUMMARY OF THE INVENTION:

Accordingly the present invention provides for an integrated, closed loop, and highly efficient renewable energy system designed for rural, semi-rural and urban applications. The system comprises of at least one Renewable Energy Processing Unit, at least one Thermal Application Unit, and at least one System Controller Unit. The system may include Electricity Producing Unit.

The Renewable Energy Processing Unit comprises of some, multiple or all of the following subsystems: solar unit, biomass unit and a pyrolysis unit. Other units may be added to the Renewable Energy Processing Unit so long as they produce "Heat". "Heat " is hereby defined to be any medium that contains heat in either present actual or latent form, and could include any form of, including but not limited to, heat generated through steam, hot water and fuels such as hydrogen, producer gas and biogas. The Renewable Energy Processing Unit may also contain any form of storage of the said heat.

The Electricity Producing Unit comprises of a turbine which may be a steam turbine, gas turbine, organic Rankine, or other types of turbine, fuel cells, boilers, generators or any other device or combination of devices which converts heat from the renewable energy unit to electricity. The heat from the Renewable Energy Processing Unit may be used in one or more of the electricity producing subsystems or which can be connected in any configuration (series, parallel, or any series/parallel combination).

The said Thermal Application Unit includes subsystems that use heat such as heating of water, cooking, air conditioning, laundry activities such as washing and drying etc. The heat that is used by this Thermal Application Unit is that heat which is produced as a by-product by the renewable heat generating units in the system. The subsystems can be connected in series, parallel or any combination thereof.

The System Controller Unit controls the manner in which the said heat produced by the Renewable Energy Processing Unit is utilized in the Electricity Producing Unit and Thermal Application Unit. The system is designed such that unused heat from the Electricity Producing Unit is transmitted to the Thermal Application Unit.

Part or all of the said heat can be controlled so as to bypass the Electricity Producing Unit and go directly to the Thermal Application Unit. The heat is allocated for the thermal applications as per requirement.

The said System Control Unit comprises of:

1. Control SubSystem (CSS)

2. Data Collection and Storage Subsystem (DCSS)

The control subsystem comprises of a network of wired or wireless sensors and networks and multiple safety systems that handle real-time performance analysis and conduct remote monitoring of energy generation and energy consumption. The control subsystem links with the data collection and storage subsystem (DCSS) which has the data storage system for storing data collected periodically. The system is accessed through user friendly graphical user interfaces (GUI).

An additional innovative feature of the control subsystem is that it is self-adaptive: it finds and identifies the optimum operating conditions given the demand at the loads, based on data collection over a period of time. The control subsystem can be a server which may be a dedicated server, a cloud computing server, an embedded system, or a distributed system of any combination of these types. The said control subsystem is programmed through learning algorithms in a manner that it continuously looks for ways to improve its performance.

The important function(s) of the control subsystem includes periodic monitoring of heat resources in the various units and subsystems, apportioning of the said heat resources in the Electricity Producing Unit and its subsystems, and in the Thermal Application Unit and its subsystems in such a manner that the entire system works with peak achievable efficiency. The advantage of the said GUI (Graphical User Interface) feature is that system inputs and/or outputs can be easily determined and controlled by the user, and the control subsystem will use said inputs and outputs to determine and perform the control of the system automatically.

The DCSS of the System Control Unit has a database record of all system variables, inputs, and outputs for future analysis. The said database acquisition and monitoring can be done locally and/or remotely via the internet or other remote means and can be stored on any digital storage media in a distributed or centralized manner. Said database is also helpful for the self-adaptive algorithm.

The significant aspect of the invention is that the present invention employs full and flexible utilization of the said heat produced from the Renewable Energy Processing Unit by efficiently using any said heat not used by the Electricity

Producing Unit in the Thermal Application Unit, which includes the various thermal processes mentioned earlier.

Dated this the 1st day of October 2013.

Varsha Yadav
of SKS Law Associates
Attorney for the Applicant

To
The Controller of Patents,
The Patent Office,
Chennai