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SIZING & ANALYSIS OF RENEWABLE ENERGY AND BATTERY SYSTEMS IN RESIDENTIAL MICROGRIDS

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***Abstract*—**Accelerated development of eco-friendly technologies such as renewable energy, smart grids, and electric transportation will shape the future of electric power generation and supply. Accordingly, the power consumption characteristics of modern power systems are designed to be more flexible, which impact the system sizing. However, integrating these considerations into the design stage can be complex. Under these terms, this paper presents a novel model based on mixed integer linear programming for the optimization of a hybrid renewable energy system with a battery energy storage system in residential microgrids in which the demand response of available controllable appliances is coherently considered in the proposed optimization problem with reduced calculation burdens. The model takes into account the intrinsic stochastic behavior of renewable energy and the uncertainty involving electric load prediction, and thus proper stochastic models are considered. This paper investigates the effect of load flexibility on the component sizing of the system for a residential microgrid in Okinawa. Also under consideration are different operation scenarios emulating technical limitations and several uncertainty levels?

Keywords:LPC2148,Optocoupler,Energy meter

INTRODUCTION

Conventional power generation systems use fossil fuels as a primary source of electricity, yet these finite natural resources are known to be the dominant producers of greenhouse gases. In order to reduce harmful emissions and meet the increased global electricity demand, renewable energy sources are introduced as future replacements. The intensive research and development in this field has led to a huge growth in res installations that are driven by cost decreases [1], [2]. However, the irregularity of ress, and the limitations of available battery energy storage system (bess) technologies prevent a high level of res integration. Hybrid renewable energy systems (hress), comprising different renewable energy technologies in one design, are helpful since they provide a higher balance in energy supply as compared to a single-source system. Smart grids (sgs), which are perceived as next generation power systems, provide two-way communication channels between energy generation sources and end users [3], and allow the shift of demand to off-peaks or to renewable generation periods. This offers reduced operations and management costs for utilities, lower power costs for consumers, and ultimately, reduced emissions [4]. Furthermore, the recent increase in the use of electric vehicles (evs) will increase electricity

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demands, but at the same time will increase energy demand flexibility by the control of evs charge periods and other vehicle-to-grid applications [6]. Due to these facts, the planning, operation, and management of future power systems will not be identical to those of conventional power systems, where all of the involved technologies should be considered in the design stage.

LITERATURE SURVEY

The novelty of this work lies in developing an integrated model that accounts for the different aspects and characteristics of energy consumption in modern power systems. More importantly, the load flexibility gained by using smart grid demand response programs, that enable the scheduling of high energy-consuming appliances such as washing machines, cloth driers, dish washers, and evs in aims to benefit the users rather than treating them as randomly committed appliances. Therefore, it coincides with the principle of a smart grid operation. The model can be applied to large-scale design cases including numerous operation patterns, without imposing high computational burdens. The smart grid is an intelligent power generation, distribution, and control system. The proposed system is helpful in collection and analysis of real time data along with the control of electrical loads for energy reduction. Emphasizing the importance of the communication infrastructures required to support device control and data exchange between the various domains which comprises the smart grid. Our proposed scheme is implemented with a protocol.In proposed system we extend our data transmission to IOT (INTERNET OF THINGS) so that the relevant parameters are monitored through GUI. This is very useful in the case when the user is moving in industrial area. Along with the data monitoring devices is also controlled based on the values.

PROPOSED SYSTEM

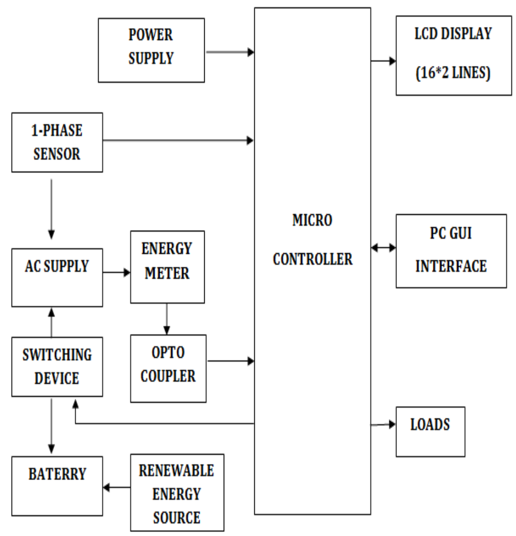

FIG .1: Block diagram

METHODOLOGY

Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI:

ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of

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processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (LCD)

It is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

Opto Couplers:

There are many situations where signals and data need to be transferred from one system to another within a piece of electronics equipment, or from one piece of equipment to another, without making a direct electrical connection. Often this is because the source and destination are (or may be at times) at very different voltage levels, like a microcontroller which is operating from 5V DC but being used to control a triac which is switching 230V AC. In such situations the link between the two must be an isolated one, to protect the microprocessor from over voltage damage.

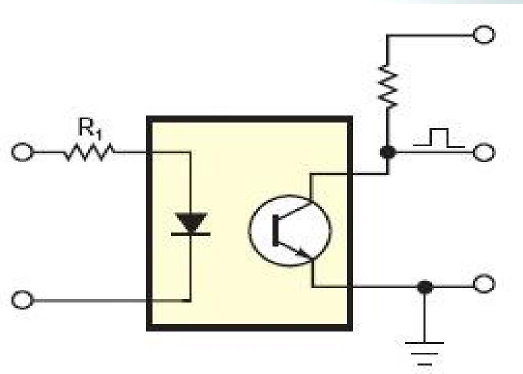

FIG.2: Optocoupler structure

Relays can of course provide this kind of isolation, but even small relays tend to be fairly bulky

compared with ICs and many of today's other miniature circuit components. Because they are electro-mechanical, relays are also not as reliable ó and only capable of relatively low speed operation. Where small size, higher speed and greater reliability are important, a much better alternative is to use an Optocoupler. These use a beam of light to transmit the signals or data across an electrical barrier, and achieve excellent isolation. Christo Ananth et al.[5] presented a brief outline on Electronic Devices and Circuits which forms the basis of the Clampers and Diodes.

Energy Meter:

An electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device.Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour. Periodic readings of electric meters establishes billing cycles and energy used during a cycle.In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. In some areas the electric rates are higher during certain times of day, reflecting the higher cost of power resources during peak demand time periods. Also, in some areas meters have relays to turn off nonessential equipment

CONCLUSION

Generally, the optimal components sizing was affected by demand flexibility and strongly affected by operational conditions (scenarios), asserting the potential use of the introduced method in modern smart grid design. The observed benefits gained by demand flexibility were encouraging for the increased adoption of the proposed system.

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