REG

Renewable Energy Group

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The renewable energy group at Bahria University is working towards providing practical solutions to solve the energy crisis in Pakistan. With ever increasing electricity rates in the country, the need to shift to efficient solar solutions has become a necessity. The prices of solar panels have dropped by 80% in the last five years, making solar more economical than the grid system in Pakistan. However, significant issues still exist that have limited the widespread use of solar energy. The main issue is the high initial capital cost which deters most of the consumers. Without proper financial support, most consumers cannot afford the large cost of a solar installation at their homes. Additionally, most businesses operate in Plazas where the roof rights are reserved so they cannot shift to solar energy. Furthermore, load shedding has been an endemic problem in the country, and although currently there is very limited load shedding, it can surface again if the energy prices spike up. The renewable energy research group has been focusing on addressing the issues of high energy cost, load shedding and energy efficiency. The group focuses on providing products and services that can help energy consumers save costs and shift to renewable resources. A number of interesting prototypes have been developed by the group which work perfectly and can be commercially deployed with the help of investors in the industry. These products not only solve some critical problems but can bring huge profits to the private sector if properly developed and marketed.

"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that."

-Thomas Edison

RESEARCH & SERVICES PORTFOLIO

1.5 Ton (18000 Btu/hr) Air-conditioner for Load Shedding

A special 1.5 ton capacity split Air-conditioner has been developed at BU that can provide full cooling (1.5ton / 18000btu) for up to three hours during load shedding or grid failure without using batteries or a generator. The current inverter based ACs can not run on a UPS (despite tall claims by manufacturers) as the inverter AC while providing full cooling takes as much power as a standard AC and hence cannot be run on UPS. It can only function on UPS if it is providing just 1/10th of its normal cooling (1800 to 2000 btu). In addition, since it is running on batteries hence the cost of replacing batteries offsets any financial benefit to the consumer. Since, the AC developed bt REG does not use batteries hence there is no recurring cost. The user does not need any generators and hence saves the cost of the generator and its fuel. This AC is ready for commercial production and requires an investment of Rs. 50 Million (The time would be 2 years for commercial production). This system is ideal for high end restaurants, hotels, guest houses, homes, hospitals etc. which cannot afford interruption of Air-conditioning during power break downs or load shedding, but do not want the problems of generators.

Solar Air-Conditioner for Night Time Operation

Running an Air-conditioner directly on solar has always been a challenge. The standard solution available in the market involves a solar inverter with batteries and panels. The solar inverter can at best run an inverter AC and that too for a few hours a day. Most of the times it uses the batteries along with solar to run the AC thus reducing battery life and increasing battery replacement cost. In the end the consumer ends up paying more for the batteries than he saves from the solar. Needless to mention that the system cannot work in the evenings or at night when most domestic consumers need air-conditioning the most. A solar AC based on special energy storage technique using PCMs has been developed that not only provides cooling during the day but can work for 10 hours during the night. The system does not require any batteries or availability of live AC power supply. The system is completely independent and once installed can provide 25 years of cooling on solar during day and night without a single rupee of recurring cost. The prototype of the system is already developed and is ready commercial production. This system is ideal for places where there is no grid or users who do not want to pay dues for running their Air-conditioners.

Energy Consumption Testing

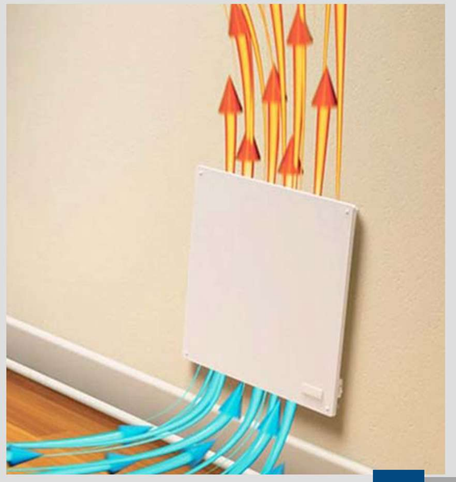
One of the issues facing any consumer while buying an electricity appliance is to determine how much electricity will it consume. Most energy consumption claims made by manufacturers are highly exaggerated at best or false and misleading. For example, each manufacturer of inverter AC claims any where from 30% to 70% energy savings. For a consumer there is no independent way to verify these claims. Similarly for selecting LED lighting, fans, motors there is no unbiased authority in Pakistan to verify the claims. At Bahria University, a setup exists where any user can bring any appliance for energy efficiency and performance testing. We can test refrigerators, deep freezers, ACs, LED lights, fans, motors for actual output and the energy consumed per day or per month. This service is provided at minimal charges to the consumer, however by selecting the right device or model or make the user can save thousands of rupees in the long run in electricity bills.

Solar Power System Advisory & Design Services

The group has a lot of experience in installing grid-tied and stand alone solar systems. Currently a 100KW grid tied system has been designed and installed at BU Islamabad campus which is working without any issues for the last two years. Similarly a 12KW system to provide electricity to classrooms has been deployed. The output of a solar system greatly depends on how well it is designed and selection of the right inverter and panels. A slight shade on just one panel can reduce the output of the entire system by 90%. Most installers in Pakistan do not take into account these multiple factors which result in the end user being disappointed by the system. A great deal of exaggeration is done by vendors when quoting the numbers. The Renewable Energy Group at Bahria University can provide consultancy, design and installation services to any consumer who wants to install a solar power system. The group has the expertise and equipment to check the efficiency of the panels, inverters, batteries and can recommend the best possible models and design to meet the user demands at the lowest cost.

70% Gas Saving Heaters for Homes and Offices

In a typical home, most gas is consumed by room heaters. However, this is the most inefficient form of heating possible due to heat loss through windows and open doors. A special heater has been designed by the group in which water is heated outside the house in a special tank and circulated in the rooms, where a forced convection heat exchanger heats the room. It is more efficient then conventional central heating systems and at a much lower cost. Since there is no burning of gas inside the room, hence the user can keep the windows and door closed resulting in very low losses. The heater is equipped with a thermostat and can keep the temperature at a fixed point throughout the day. The heater can also be used at night. It has been calculated that using this heater can result in 70% reduction of the gas bill, and in addition it provides a clean environment in the room and is totally safe.



Wind Power Forecasting and Maintenance Algorithm for Wind Farms

Wind energy as a clean and renewable resource plays a very important role in mitigating the climate change and provides renewable energy to the grid. The penetration of wind electric energy in the national grid has increased considerably. Wind energy is unpredictable which is why a country like Pakistan where total energy comprises of fossil fuel and renewable energy, is in a need of Wind Farms management system to predict/forecast power output. Due to the fluctuating output of wind farms, the predicted power output will be given by the wind farm management to Government of Pakistan. Beside this, efficient fault diagnosis, prognostic and maintenance algorithm using data from Wind Farm data can be used to predict the failure well before time and also for the remaining life of the individual subsystems of wind turbines. This algorithm will be used to provide failure diagnosis in time as well as reduce down-time and prevent unplanned maintenance of wind farm which result in loss of power output.

Conversion of standard Inverter ACs to Run on Solar Panels Directly.

Inverter ACs are ideally suited to run on solar panels due to their variable speed BLDC compressor motor. However, it requires the development of special driver boards, MPPT trackers and other modifications. A special kit can be developed which will convert any AC to run directly on panels without a solar inverter thus making it cost effective. Batteries would not be needed as well. This kit has a lot of commercial potential since it is hard for people to pay their electricity bills. If properly funded by the industry, a prototype can be developed within one year.

Battery Regenerating System

There is a significant demand for lead-acid storage batteries to power electric vehicles, UPS, Offshore and Grid Connected Photovoltaic System in Pakistan. Hence, the market of lead-acid batteries is expected to grow in the future as the economic merits continue to overcome their size and weight demerits. However, the main disadvantage is that, these batteries cannot be recovered after degradation because the growth of lithium dendrite crystals that acts as a separator. In contrast, the recovery is possible for lead-acid batteries because the primary cause of battery degradation is sulphation, which can normally be removed using high kHz incident voltage pulses. Such high-voltage promotes liquefaction of lead sulphate crystals. As such, these high current and high frequency pulses breaks down the sulfate crystals that are formed on the battery plates. Thereafter, desulfation restores the ability of the battery life partially. A battery regenerating system has been developed at REG

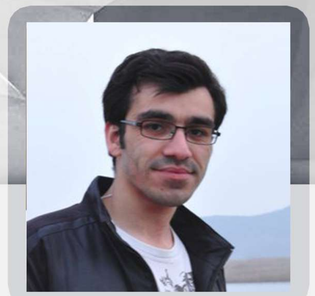
KEY RESEARCHERS

Mr. Jehanzeb Ahmad

Mr. Jehanzeb Ahmad is working as an Associate Professor in the Department of Electrical Engineering at Bahria University, Islamabad. He is the head of renewable energy research group at BU. He has an MS in electrical Engineering from Purdue University, USA, and BS in electrical engineering from UET Lahore. His has previously worked as a chip Designer at Intel Corp, Silicon Valley USA, in the microprocessor products group at Santa Clara, CA. He has also worked at Nescom Pakistan as General Manager (Tech) and as Head of EE department at Bahria University. His current area of research is renewable energy storage technologies with special emphasis on Phase Change Materials. He is an expert in Air-conditioning technology and is currently developing special Air-conditioners that work directly with solar energy without using batteries. He also has a number of publications and patents. to his name.

Dr. Asad Waqar

Dr. Asad Waqar is working as an Associate Professor at Bahria University Islamabad. He completed his Ph.D. degree in Electrical Engineering with specialization in Power Systems from Huazhong University of Science and Technology China in 2016. He did his Master's in Electrical Power Engineering from RWTH Aachen Germany in 2011 and Bachelors in Electrical Engineering from UET Taxila in 2002. At the moment he is working as a member of Renewable Energy Group. His interest areas include power system analysis, grid integration of renewable sources, power electronics applications in power systems, smart grids and machine learning applications in power systems. He has a specialized profile to train power grid and utility personnel in the context of power systems' load flow calculations, short-circuit analysis, reliability analysis, stability analysis, harmonic analysis and techno-economic analysis.



Dr. Muhammad Amir

Dr. Muhammad Aamir is working as a Senior Assistant Professor at Bahria University Islamabad. He completed his Ph.D. degree in Electrical Engineering from University of Malaya, Malaysia in 2017. He has masters in Electrical Engineering from Hanyang University South Korea in 2011 and a Bachelor's in Electrical Engineering from UET Peshawar in 2007. He has published more than 17 impact factor publications and a book titled "Design of a Non-isolated Single Phase Online UPS Topology with Parallel Battery Bank for Low Power Applications" for which he receive Best thesis award by Springer Nature in 2017. At the moment he is working as a member of Renewable energy Group. His interest areas include power electronics, Inverter design, Power Supply design, Grid integration of renewable sources, Micro grids, and Non-linear control of Inverters.