Introduction

Sustainable energy, i.e., renewable energy, refers to forms of energy that are naturally obtained from the environment and from sources that can be replenished naturally. These include solar energy, wind energy, geothermal energy, hydropower, bioenergy, etc. It is a multidisciplinary field of science that consists of applying engineering, physics, math, statistics, chemistry, computer science, etc. The penetration level of sustainable energy/renewable energy is growing worldwide due to abundant availability, less environmental impacts, and low per-unit energy cost. Therefore, extensive research in this subject impacts any country's growth and development of sustainable energy.

To satisfy the increasing need for specialists in this subject, the Department of Electrical and Electronic Engineering (EEE), Faculty of Engineering, American International University-Bangladesh (AIUB) proposes to establish "Centre for Sustainable Energy Research (CSER)" in its premises.

The CSER will bring together researchers and specialists who will work on researching and developing sustainable energy sources, improving stability concerns, energy storage, efficiency augmentation, and designing converters, among other things, to provide reliable electricity to the people of the country. Continuous research in this center would provide students and teachers with more opportunities to get practical expertise in the field of Sustainable Energy.

Aim, Objective & Vision

The CSER will aim to conduct the research study on the application of renewable energy technology that will diminish the energy crisis and dependency on fossil fuel-based power plants as well as stability issues of the grid. In addition, it will fulfill the global sustainable development goal 7 (SDG 7), which is affordable and clean energy.

This research center will use different engineering software and types of equipment to develop, analyze and test the various sustainable energy sources. Also, it will develop and explore different models to ensure the smooth operation of power systems. The design of converters, energy storage, PV cell, wind turbines, etc., will be another salient feature of this center. This research center will train and teach new generations who are interested in this field to meet the growing demand in this area.

Contribution to Sustainability

Energy always plays a vital part in sustainable development. Energy consumption has risen at a far faster rate than the global population since the beginning of industrialization. The essential reform of the energy supply system is supported by three main strategic elements: efficiency, consistency, and sufficiency. On the other hand, renewable energies fulfil all essential requirements for a future sustainable energy supply system.

Therefore, to achieve the goal of sustainable and affordable energy, it is essential to design and development of renewable energy field through appropriate research and techniques. As

previously mentioned, the CSER will entirely focus on research and development relevant to sustainability. The following will be specific research contributions to ensure sustainable development goals in energy.

- Design and development of solar photovoltaic (PV) system
    - Solar cell efficiency improvement
    - Material processing for solar cell
    - Solar irrigation systems for energy optimization
    - Grid-tied solar park
    - PV-based electric vehicle
    - Efficient inverter design of PV panel

- Design and development of wind power system
    - Blades design of wind turbine to increase efficiency
    - Gid stability issue to integrate maximum capacity of the wind turbine
    - Wind generator system

- Design and development of energy-efficient sustainable appliances
- Finding the new renewable energy technologies
- Reduction of buildings energy consumption to reduce $C0_2$ emission
- Reliable access to affordable and high-quality energy services
- Design and development of biomass, hydro, wave, and tidal energy sources

The current energy supply and consumption patterns are not sustainable. Effective innovations for the implementation of an ecologically friendly and resource-conscious energy market must begin in the next decades. There are significant signs that the planned introduction of renewable energies, along with more efficient energy consumption, will be capable of meeting the essential sustainability standards. Therefore, it is expected that the CSER will generate ideas and research relevant to renewable energy.

Expertise Field of Research Interests

AIUB CSER lab will be focused on the following fields but not limited to:

- Renewable Energy Systems (Especially Wind Power & Photovoltaic (PV)/Solar Power Generation Systems)
- Advanced Renewable Energy-based Power System Analysis, Dynamics, Stability and Control
- Micro-grid and Hybrid Power Systems
- Application of Intelligent Control Techniques to Renewable Energy-based Power System
- Energy Storage System
- Application of Power Electronics
- HVDC System for Renewable Energy System
- Application of Renewable Energy to achieve the goals of 4^{th} Industry Revolution

Requirement for CSER

Primarily, one spacious room is required to establish CSER with furniture, i.e., tables, chairs, etc., computers and projector in AIUB premises. Gradually the following software and instruments will be installed to conduct research.

Research Tool/Equipment	Purpose
1. PSCAD/EMTDC software	Modeling, Simulation, and Analysis
2. MATLAB software	Modeling, Simulation, and Analysis
3. HOMER software	Microgrid Modeling, Simulation, and Analysis
4. Inverter Mains Tests with Grid Simulator	Test and analyze different parameters of grid-tied inverter
5. Mini Wind Turbine Model with computer data acquisition	Test and analyze wind turbines
6. Smart Grid Module	Implementation, Testing and Analyze Smart grid application

Finance and Resource Management

The proposed center will seek funds from the government and organizations such as Sustainable and Renewable Energy Development Authority (SREDA), Energy and Power Research Council (EPRC), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Government of Peoples' Republic Bangladesh (GoB), United States Agency for International Development (USAID) and other research funding authorities. It is expected that research funding agencies will allocate funds for research and lab development.

Conclusion

The CSER would benefit students to a great extent as it will widen up the opportunity to develop their career in this direction and serve the nation through research.

Therefore, the Department of Electrical and Electronic Engineering (EEE), Faculty of Engineering, seeks cooperation from American International University-Bangladesh (AIUB) to establish "Centre for Sustainable Energy Research (CSER)" so that research can be conducted in this multidisciplinary and dynamic arena.