

**Vodafone Essar-IIT Centre of Excellence in Telecommunications (VEICET)**  
**G.S. Sanyal School of Telecommunication, IIT Kharagpur**

**Innovation-01**

**1. Brief Name of the Innovation**

Hybrid controller for renewable energy power plant in stand-alone sites

**2. Contact Information**

Dr. PRABODH BAJPAI, Assistant Professor,  
Department of Electrical Engg. , I.I.T. Kharagpur-721302  
Email: pbajpai@ee.iitkgp.ernet.in  
Phone: 03222-281752(Off.) 03222-282262(Fax)

**3. What is the technology?**

This Hybrid controller Technology uses mix of conventional and non-conventional energy sources to supply the load in stand-alone site. The renewable energy resources have the problem of intermittency, so the hybrid controller has to changeover automatically among the energy sources in an efficient, economical and reliable manner. The hybrid controller has separate Distribution Switching Control Alarm and Monitoring Unit (DSCAM) for Solar PV, Fuel Cell, and Diesel Generator. It has Charge Controller Modules (DC-DC Converter for SPV, FC) and (AC-DC Converter for Diesel Generator). Load, Battery Banks, Output from Charge Controller Modules are connected to common DC Bus. The DSCAM units have parameters display and LED indicators and provision for remote monitoring.

**4. What does the technology do?**

This Hybrid Controller Technology can supply the load through green sources to the load at remote locations using optimal energy management strategy implemented through microcontroller based changeover logic with some user defined parameters.

**5. Explain the specific problem this technology has created to address or solve?**

Telecom Stations in the remote locations are using Diesel Generator and battery bank to supply the BTS load because of unreliable and/or non availability of Grid power at remote locations. This increases the operation cost of the system as well as the environmental pollution by emitting Carbon contents. To solve this issue, environment friendly renewable energy based hybrid power plant has been proposed that uses a hybrid controller designed with energy efficient changeover logic to avoid the intermittency in the available green energy sources.

**6. Why is it better? How much better?**

The renewable solutions available in the market are limited to application of Solar PV and Wind. However, hybrid energy system with Fuel cells is probably not available. Fuel Cell is a one of the most promising electrical energy source and this technology will take over very fast with easiness and low cost availability of Hydrogen fuel or fuel reformers. The proposed hybrid controller is far better than the available technologies, because, it has integrated FC , Solar PV and existing solution (DG and Battery). Presently this technology is costly (high CAPEX but low OPEX)) but it has several outweighed benefits in long-term. It may overcome most of the issues with current technology solutions like environmental pollution, high OPEX, fuel pilferage, difficult in remote monitoring and control. This controller uses green energy sources, so the emission is carbon free, noise free, low maintenance and operating cost, and this controller can be modified for different applications such as

- Base telecom stations
- Remote & standalone applications
- Military establishments
- Hospitals, Cold storage, etc.

**7. Have you filed for Intellectual Property (IP)? Have Patent Cooperation Treaty (PCT) applications filed?**

Intellectual Property application is under draft stage and in process of submission.

**8. What is the development stage of this innovation?**

The proposed hybrid controller technology is in final stage of testing and performance analysis with all energy sources placed in laboratory.

**9. Have any prospective users or buyers shown interest in this technology?**

This is a sponsored project under Vodafone – IIT Kharagpur Centre of Excellence on Telecom (VICET).

**10. Who do you consider competitors or competing technology?**

BHEL has patent on a Solar Photovoltaic- Grid - Diesel/Kerosene gen set hybrid controller. Another patent is on solar PV-Wind hybrid system for stand-alone applications has published on Dec. 2010. The proposed hybrid Controller is the new of this kind with FC as an integrated source of energy

**11. List the milestones remaining to be accomplished to bring your technology to full development and ready for the intended end-user?**

First is the error proof and fully satisfactory testing and performance analysis of the complete system in the lab. Second is the field trail at a BTS site.

**12. Broad Technical Specifications?**

The Hybrid Controller have DSCAM unit for every sources (SPV, FC, DG) and charge controller modules for every sources (SPV, FC, and DG). The specifications of the Charge Controller module are given as follows. Each Charge Controller Module is rated to 50 A maximum, and depending on the Load requirements, the Charge Controller Modules can be added/ removed in the system.

**Solar Charge controller:**

Module Input Voltage: 44 V – 86 V DC

Module Output Voltage range: 48 -55.2 V DC

Module Output Current: 50 A

Over Current protection: 105%

**Fuel cell charge controller:**

Module Input Voltage: 43.5 V – 57 V DC

Module Output Voltage range: 48 -55.2 V DC

Module Output Current: 50 A

Over Current protection: 105%

**DG SMR Unit:**

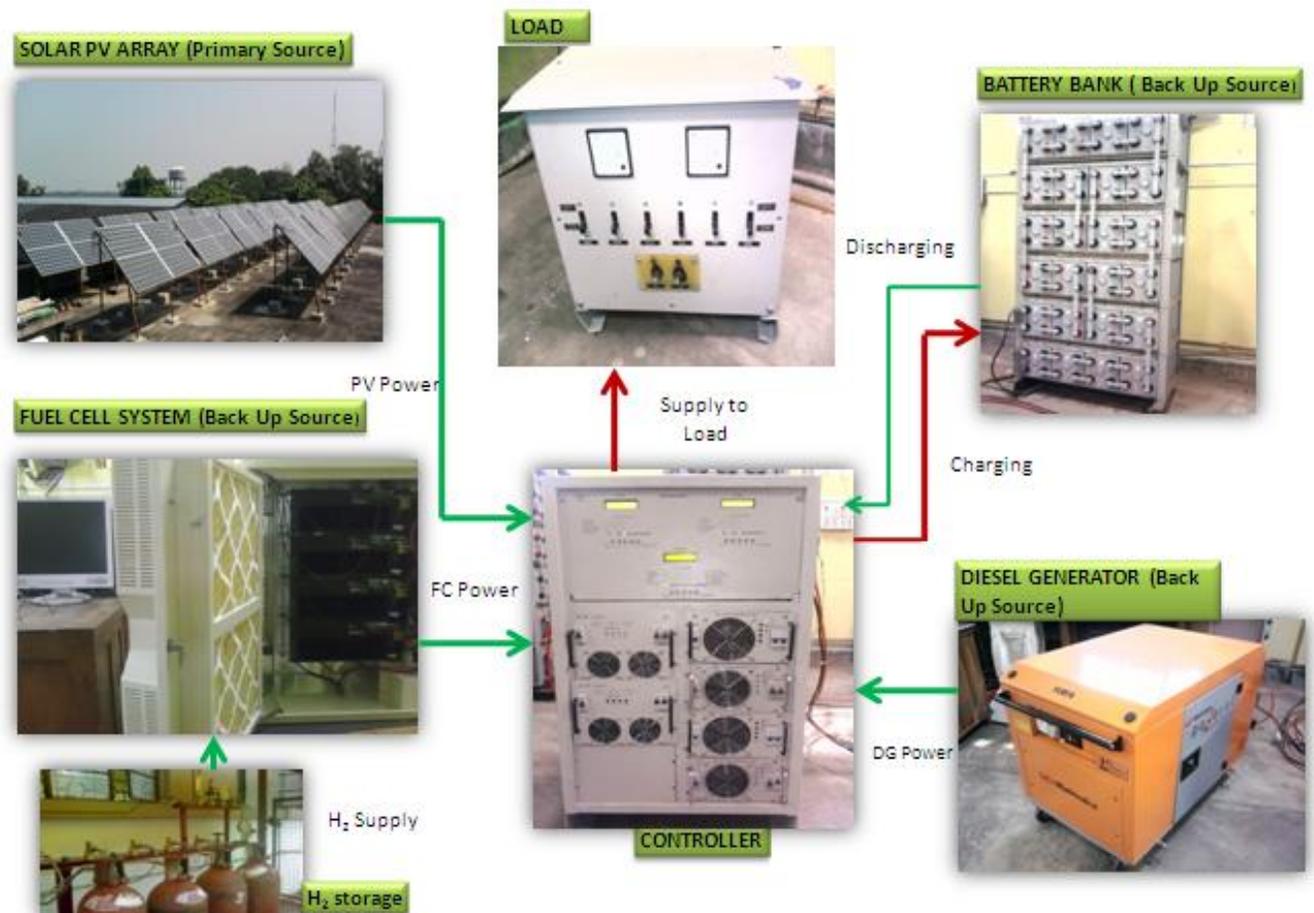
Module Input Voltage: 180 V -240 V AC

Module Output Voltage range: 48 -55.2 V DC

Module Output Current: 50 A

Over Current protection: 105%

**13. Diagram or Pictures if any?**



**Fig 1: The proposed Hybrid System schematic**