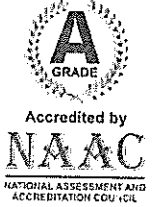




Bharath

INSTITUTE OF HIGHER EDUCATION AND RESEARCH

(Declared as Deemed-to-be University under section 3 of UGC Act, 1956)
(Vide Notification No. F.9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4th July 2002)



Phone : 044-22290742 / 22290125 . Telefax : 044-22293886
Website : www.bharathuniv.ac.in

173, Agaram Road, Selaiyur, Tambaram,
Chennai -600 073. Tamil Nadu.

Ref No. SMS-2018-O-2

Date : 07/10/2018

TO

Mr.K.Sakthivel,

Asst Professor/EEE,

BIHER

Thro: Concern Head of the Department

Greetings!!!

We are happy to announce that the Research Advisory Committee has approved your proposal for Seed Money Scheme-2018 which was presented by you. You are requested to complete the proposal and send the progress report to the Dean Research in the prescribed time period.

Title of the Project: Hybrid Renewable Generation System

Seed Money Amount: Rs.1,00,000/- (Rupees One Lakh Only)

Approved on : 27/09/2018

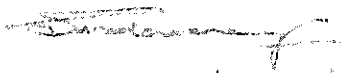
Payment details:

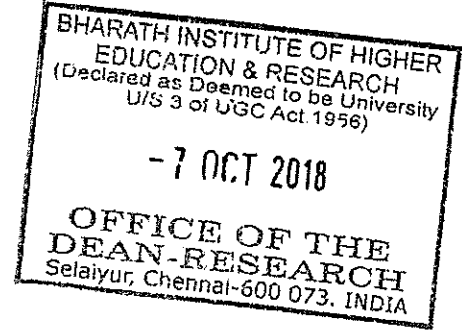
Cheque No. 351622

,Dated: 09/10/2018

Bank Name: Indian Bank, Selaiyur, Chennai.

With Regards


Dean-Research 07/10/18



Received

K. Sakthivel



Branch: SELAYUR (TAMBARAM)
PLOT NO. 17 AND 18, HASAN COLONY
AGARAM ROAD, SELAYUR, TAMBARAM, CHENNAI, T.N.
IFS Code: IDIB0005246

VALID FOR THREE MONTHS ONLY
09 | 10 | 20 | 18
D | M | Y | Y | Y | Y

PAY Mr. K. SAKTHIVEL
RUPEES ₹ One Lakh Only

श्री शंकर को OR BEARER

वत. नं. A/c No.	CA 6670628110	श्री. को.	₹ 1,00,000/-
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CBS Code: 02505

FOR BIHER RESEARCH AND CONSULTANCY

992000069

PAYABLE AT PAR AT ALL OUR BRANCHES

[Signature]
AUTHORISED SIGNATORY

Please sign above

⑈ 351622⑈ 800019250⑈ 828110⑈ 29

PROPOSAL SUBMISSION

1. Details of Principal Investigator

Name : Mr.K.Sakthivel
Designation : Assistant Professor
Highest Qualifications : M.E
Department : Electrical and Electronics Engineering
E-mail : ksakthivelme@gmail.com
Contact no : 8122969691
Date of Joining : 10.08.2015

2. Details of Co - Principal Investigator

Name : Dr.V.Jayalakshmi
Designation : Associate Professor
Highest Qualifications : Ph.D.
Department : Electrical and Electronics Engineering
E-mail : jayalakshmi.eee@bharathuniv.ac.in
Contact no : 9940114425
Date of Joining : 09.07.2007

Technical details

1. Introduction

Hybrid-Renewable Energy Systems in Micro grids: Integration, Developments and Control presents the most up-to-date research and developments on hybrid-renewable energy systems (HRES) in a single, comprehensive resource. With an enriched collection of topics pertaining to the control and management of hybrid renewable systems, this proposal presents recent innovations that are molding the future of power systems and their developing infrastructure.

Renewable energy sources appeared as a viable alternative for environmentally hazardous sources. However, sources of renewable energy have considerably unpredictable and environmental conditions dependent power output and as such can't be directly incorporated into existing electrical grid. These sources are usually integrated to the electrical grid as part of micro grid or hybrid energy source that consists of two or more energy sources, converters and/or storage devices. In hybrid energy sources, generation and storage elements complement each other to provide high quality and more reliable power delivery. The main work in this proposal is oriented towards defining a generalization of control problem for power electronics interfaces in hybrid energy source, the development of control for grid connected three phase switching converters and inverters the development of a maximum power point tracking algorithm that can be easily incorporated into hybrid source control.

2. Review of status of Research and Development in the subject

- **A New Variable-Speed Wind Energy Conversion System Using Permanent-Magnet Synchronous Generator and Z-Source Inverter**

Seyed Mohammad Dehghan, *Student Member, IEEE*, Mustafa Mohamadian, *Member, IEEE*, and Ali Yazdian Varjani, *Member, IEEE*

With the growth of wind energy conversion systems (WECSs), various technologies are developed for them. Permanent-magnet synchronous generators (PMSGs) are used by these technologies due to special characteristics of PMSGs such as low weight and volume, high performance, and the elimination of the gearbox. In this paper, a new variable-speed WECS with a PMSG and Z-source inverter is proposed. Characteristics of Z-source inverter are used for maximum power tracking control and delivering power to the grid, simultaneously. Two control methods are proposed for delivering power to the grid: Capacitor voltage control and dc-link voltage control. Operation of system with these methods is compared from the viewpoint of power quality and total switching device power (TSDP). In addition, TSDP, current ripple of inductor, performance, and total harmonic distortion of grid current of proposed system is compared with traditional wind energy system with a boost converter.

- **Operation and control of wind/fuel cell based hybrid micro-grid in grid connected mode**

Vigneysh, T. Kumarappan, N. ; Arulraj, R. Dept. of Electr. Eng., Annamalai Univ., Chidambaram, India

A micro-grid is a collection of loads and micro sources that operate as a single controllable system to provide both heat and power to a small area. A hybrid grid consists of both AC and DC grid. AC power sources and loads are connected to the AC grid whereas DC power sources and loads are connected to the DC grid and both the grids are connected together by a bidirectional converter. In this paper, a hybrid micro-grid consisting a wind turbine and fuel cell stack is proposed to reduce the process of multiple AC-DC-AC and DC-AC-DC conversions which are commonly seen in an

individual AC grid or DC grid. The proposed hybrid grid is operating in grid connected mode. The various control mechanisms are implemented for the power electronic converters for smooth power exchange between AC and DC grids and for stable operation of the proposed hybrid micro-grid under various resource conditions. A small hybrid grid is considered and simulated using the MATLAB/SIMULINK environment.

- **Implementation of real-time optimal power flow management system on hybrid AC/DC smart micro-grid.**

Salehi, V. ; Florida Int. Univ., Miami, FL, USA ; Mohamed, A. ; Mohammed, O.A.

The concept of micro-grid involves coordination between distributed load and generation by enhancing the system controllability, flexibility, energy management and storage capability. The problem of optimal management of the resources in a micro-grid is under investigation and recent studies propose new strategies to use centralized and distributed control schemes by utilizing real-time monitoring and control system. This paper presents the development of a real-time Optimal Power Flow (OPF) management system which is implemented in the Smart Grid Test-bed lab at Florida International University. The paper will discuss briefly the developed Hybrid AC/DC micro-grid and its components. Implementation of real-time monitoring and control system creates the feasibility of performing online OPF and applying load-generation settings and strategies in real-time format.

- **Micro-grid control of PV-Wind-Diesel hybrid system with islanded and grid connected operations**

Arulampalam, A. ; Dept. of Electr. & Electron. Eng., Univ. of Peradeniya, Peradeniya, Sri Lanka ; Mithulananthan, N. ; Bansal, R.C. ; Saha, T.K.

This paper discusses modeling of a micro-grid with PV-Wind-Diesel generator hybrid system and its operations. The PV system is modeled with a DC/AC inverter with a pre-defined Maximum Power Point Tracking (MPPT) control. Fixed speed

induction generator based wind turbines are used to model the wind farm. The diesel generator controls are modeled with droop governor and automatic voltage regulator (AVR). The PV inverter controls, including MPPT and voltage droop, are modeled in the DC/AC inverter itself. The proposed MPPT control is more stable with additional input of PV cell temperature. The complete system is modeled in PSCAD/EMTDC software. Performance of this system is studied on (i) fault tripping of the main grid and (ii) islanded operation of micro-grid with intermittent power from the wind and PV plants. The simulation results confirm the smooth operations of the proposed concept for disturbances from main grid as well as due to the intermittent wind and PV renewable power plants.

- **Modeling and performance analysis of a hybrid power system**

Saha, N.C. ; Khulna Univ. of Eng. & Technol., Khulna, Bangladesh ; Acharjee, S.; Mollah,M.A.S.; Rahman,K.T.

Now-a-days there is a tendency to harness power from alternative sources of energy that are non-polluting and renewable. The existing renewable energy sources are weather dependent so their output power is unstable. To make the renewable power system more stable and reliable a Hybrid Power System is introduced by interconnecting both conventional power sources and non-conventional power sources to reduce the weather dependency as well as increase the stability and reliability of electricity and reduce the production of conventional energy and greenhouse emissions from the combustion of fossil fuels. This proposed system can be used as isolated as well as an interconnected grid power system. The cost effectiveness of this can be ensured by ensuring maximum energy production from low cost energy sources.

2.1 International Status: NIL

2.2 National Status: NIL

3. Progress/achievement so far,

- a) Reference papers was collected.
- b) Literature survey was studied.
- c) Proposal work has been started in the wind turbine based PMSG fed three phase inverter for grid connected system.

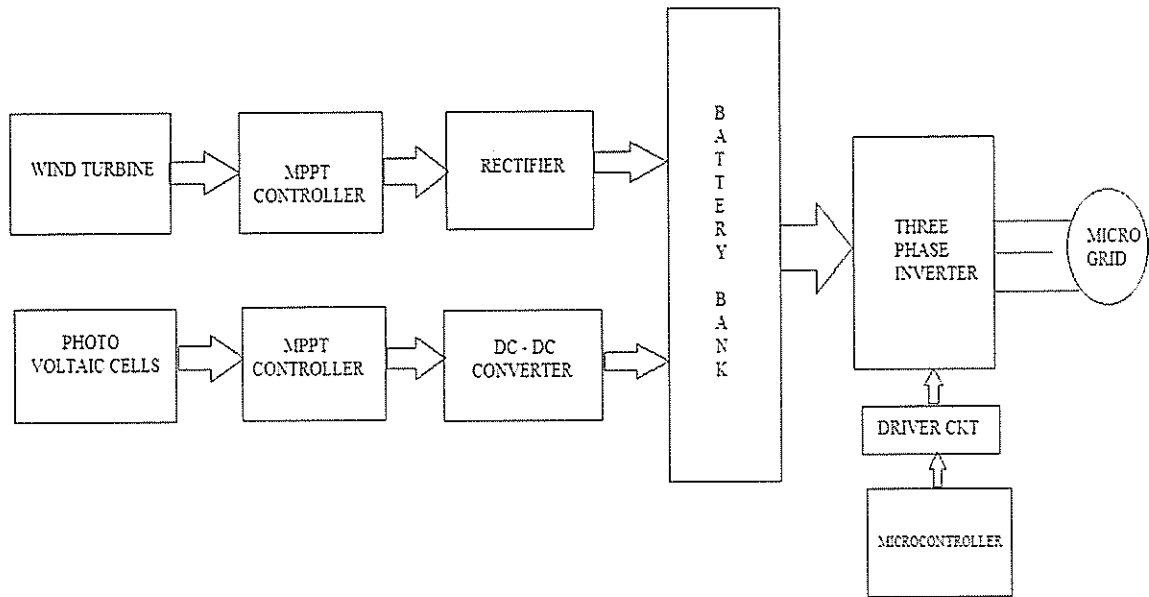
4. Work Plan:

4.1 Methodology:

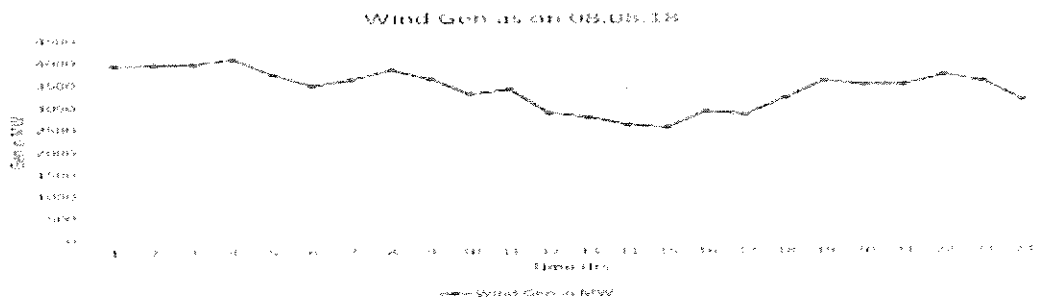
The main objectives of the hybrid renewable energy system fed micro-grid are as follows,

- To extract the power from the wind turbine and photovoltaic cells the generated voltage is given to the micro-grids system.
- To analysis the performances of wind turbine driven PMSG and photovoltaic cells fed micro-grid connected systems.
- To design and simulate the wind turbine driven PMSG based three phase Voltage source inverter (VSI) fed micro-grid connected system.
- To design and simulate the wind turbine driven PMSG based three phase impedance source inverter (ZSI) fed micro-grid connected system.
- To design and simulate the photovoltaic cells based three phase Voltage source inverter (VSI) fed micro-grid connected system.
- To design and simulate the photovoltaic cells based three phase impedance source inverter (ZSI) fed micro-grid connected system.

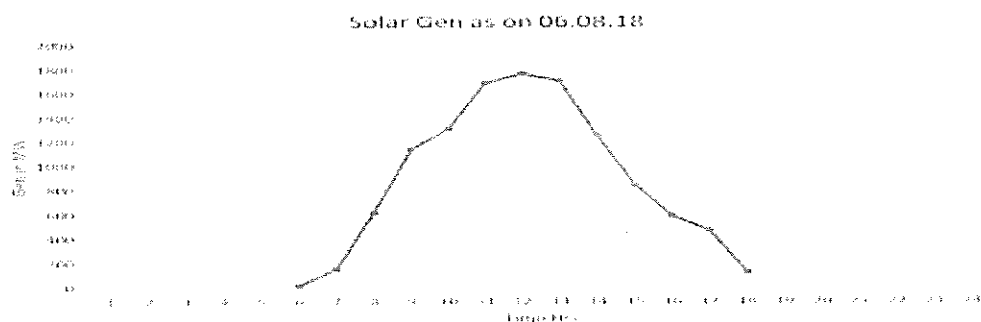
Block Diagram:



Typical Wind Generation Pattern in Tamil Nadu



Typical Solar Generation pattern in Tamil Nadu



Courtesy: Tamil Nadu Energy Development Agency

Installed capacity of Wind & Solar As on 30.06.18

All India

Wind : 34293.48 MW (9.9% of total generating capacity)
 Solar : 23022.83 MW (6.6% of total generating capacity) (Total IC conventional + non conventional 345494.61 MW)

Tamil Nadu

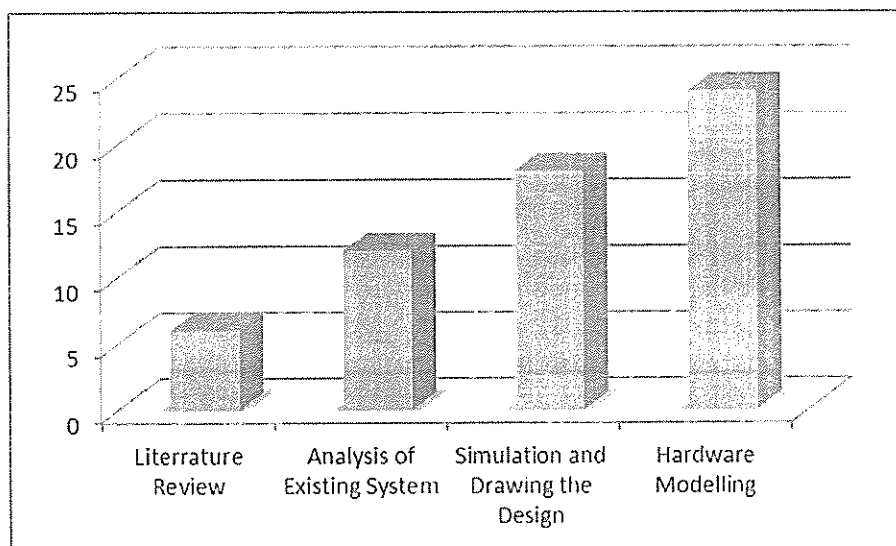
Wind : 8255 MW (15.35% of total generating capacity)
 Solar : 2141 MW (11.76% of total generating capacity)
 (Total IC conventional + non conventional 18204 MW)

Courtesy: Tamil Nadu Energy Development Agency

4.2 Time Schedule of activities giving milestones through BAR diagram.

Work plan (including detailed methodology and time schedule)

Sl. No.	Activity / Milestone	1 st Year		2 nd Year	
1.	Literature review	1-6			
2.	Analysis of existing system		7-12		
3.	Simulation and Drawing the design			13-18	
4.	Hardware modelling				19-24



Expected outcome within the time period of Seed Money Scheme

- a) Prototype Hardware design can be implemented within the time period of Seed Money Scheme.

b) For a real time HRES field work can be done within the time period of Seed Money Scheme.

5. Suggested Plan of action stating the name of funding agency where the project will be communicated for financial support within the time period of project.

Nil

6. Bibliography: Nil

7. List of Projects submitted/implemented by the Investigators (Separate for Pi and Co-PI)

Nil

7.1 Details of Projects submitted to various funding agencies:

Sl. No.	Title	Cost in lakhs	Month of submission	Role as PI/ Co-PI	Agency	Status
	NA	NA	NA	NA	NA	NA

7.2 Details of Projects under implementation

Sl. No.	Title	Cost in lakhs	Duration	Role as PI/ Co-PI	Agency
	NA	NA	NA	NA	NA

Details of Projects completed during the last 5

7.3 years

Sl. No.	Title	Cost in lakhs	Duration	Role as PI/ Co-PI	Agency
	NA	NA	NA	NA	NA

8. List of publications published by the Investigators, if any:

a) Co - Principal Investigator

S.No	Author names	Title of paper	Name of Journal	Vol (issue)	Page no.	Year
1.	Dr.T.R.Rangaswamy, Dr.V.Jayalakshmi	THERMAL POWER PLANT FURNACE AUTOMATION SYSTEM	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	65-72	2018
2.	Dr.T.R.Rangaswamy, Dr.V.Jayalakshmi	INTELLIGENT AUTHENTICATION SYSTEM FOR LOAD MANAGEMENT	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	443-451	2018
3.	Dr.T.R.Rangaswamy, Dr.V.Jayalakshmi	OPTIMAL PERFORMANCE CONTROLLER FOR THERMAL POWER PLANT	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	473-482	2018
4.	Dr.T.R.Rangaswamy, Dr.V.Jayalakshmi	MODEL BASED PID CONTROLLER FOR COMBUSTION OF BOILER	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	2873-2883	2018
5.	Dr.T.R.Rangaswamy, Dr.V.Jayalakshmi	ADVANCED AUTHENTICATION METHOD FOR CREDIT CARD SECURITY	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	95-101	2018
6.	Dr.V.Jayalakshmi, Sujeet Kumar	SIMULATION FOR SMART GRID INTEGRATION OF SOLAR/WIND ENERGY CONVERSION SYSTEM	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	7897-7910	2018
7.	Dr.V.Jayalakshmi, Sujeet Kumar	ANALYSIS OF ISOLATED TWO-TRANSISTOR ZETA CONVERTER	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	7927-7940	2018
8.	Dr.V.Jayalakshmi, Sujeet Kumar	ENERGY CONVERSION SYSTEM	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	7959-7969	2018

9.	Dr.V.Jayalakshmi, Sujeet Kumar	IMPLEMENTATION OF DC MOTOR DRIVE CONTROL BY SPEECH RECOGNITION	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	7979-7992	2018
10.	Dr.V.Jayalakshmi, Shekhar Kumar	IMPLEMENTATION OF FIVE LEVEL INVERTER FOR STATCOM	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	8011-8024	2018
11.	Dr.V.Jayalakshmi, Sudhamshu Patel	PIR SENSOR BASED ENERGY CONSERVATION AND SECURITY SYSTEM	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	8041-8051	2018
12.	Dr.V.Jayalakshmi, T. Saravana Kumar	Coupled Inductor Based High Gain Step-up Converter System with Reduced Ripple Voltage	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	8069-8080	2018
13.	Dr.V.Jayalakshmi, Sudhamshu Patel	A TEMPERATURE BUILT ENERGY CONTROLLER TO ELECTRICAL DEVICES.	International Journal of Pure and Applied Mathematics	Volume 119, No. 12 (2018)	8137-8144	2018
14.	Jayalakshmi.V and Dr.N.O.Gunasekhar	Dynamic Voltage Restorer using Three Phase AC-AC Converter	Journal of Theoretical and Applied Information Technology	Vol. 64 No.1	pp.142-147.	10th June 2014.
15.	Jayalakshmi.V and Dr.N.O.Gunasekhar	Mitigation of Voltage Sag by Dynamic Voltage Restorer using Single Phase Z Source Inverter	International Journal of Applied Engineering Research	Volume 9, Number 17	4181-4188	2014
16.	Jayalakshmi.V	Wireless Sensor Network for Performance Monitoring of Electrical Machine	Middle-East Journal of Scientific Research	20 (8)	996-999	2014
17.	Jayalakshmi.V	A Method to Reduce Neutral Current in Three Phase Four Wire Electric Distribution Systems by Using Active Power Filter	Middle-East Journal of Scientific Research	20 (11)	1561-1564	2014
18.	Jayalakshmi.V	Variable Speed Cage Machine Wind Generation Unit	Middle-East Journal of Scientific Research	20 (11)	1670-1676	2014
19.	Jayalakshmi.V	Real and Reactive Power Coordination for a Unified Power Flow Controller	Middle-East Journal of Scientific Research	20 (11)	1680-1685	2014

b) Principal Investigator

S.No	Author names	Title of paper	Name of Journal	Vol (issue)	Page no.	Year
1.	K.Sakthivel, R.Sathyapriya	Implementation Of Droop Control Based Power Sharing For A Micro grid With Manifold Distributed Generations	International Journal of Pure and Applied Mathematics	119	6913-6920	2018
2.	K.Sakthivel, G.Hemavathi	Real Time Detection system In Vehicular Network Model	International Journal of Pure and Applied Mathematics	119	5225-5230	2018
3.	K.Sakthivel, R.Sathyapriya	Modelling Of Speed Control Based On Digital PID Controller For Pm Stepper Motor	International Journal of Pure and Applied Mathematics	119	6957-6964	2018
4.	K.Sakthivel, S.Dhivya	Modelling Of Cascaded Multilevel Trans-Z-Source Inverter	International Journal of Pure and Applied Mathematics	119	5325-5333	2018
5.	K.Sakthivel, S.Anitha	Selection And Data Transmission In Cooperative Systems	International Journal of Pure and Applied Mathematics	119	5101-5110	2018
6.	K.Sakthivel, R.Sathyapriya	Fuzzy Logic Applications on Induction Motor for Axis Control	International Journal of Pure and Applied Mathematics	119	6981-6989	2018
7.	K.Sakthivel, K.Dwarakesh	Implementation Of Moving Detection System And Control Of The Vehicle System	International Journal of Pure and Applied Mathematics	119	5029-5036	2018
8.	K.Sakthivel, Dr.M.Sasikumar	Implementation Of Unbalanced Mass In A Horizontal Drum Washing Machine Using Disturbance Observer	International Journal of Mechanical Engineering and Technology (IJMET)	8	1759-1766	2017

9. Budget

Sl. No.	Equipment	Quantity	Amount in INR
1	Battery – 12V, 300AH	2	50,000
	Sine Wave Inverter – 1000Watts	1	15,000
2	Consumables (Like, testing tools Charge controller, etc.)	As per requirement	20,000
3	Travel support for the purpose of research work.	---	5,000
4	Contingency	---	5000
5	Others	---	5000
	Total		1,00,000

10. Name of at least two subject experts from the Institute and one from the outside Institute with their contact details:


- a) Dr.S.Prakash – Professor, Dept of EEE, BIHER, Chennai-600073.
- b) Dr.A.Suresh – Professor, Dept of EEE, S.A, Engineering College, Chennai.

CERTIFICATE FROM THE INVESTIGATOR

Project Title: Performance Evaluation of Isolated Micro-Grids with Hybrid Renewable Generation System

It is certified that

1. I do hereby agree to submit a complete proposal for financial support to the external funding agency within the time period of SMS-2018
2. I undertake that spare time on equipment procured in the project will be made available to other users.
3. I agree to submit a certificate from Institutional Biosafety Committee, if the project involves the utilization of genetically engineered organisms. I also declare that while conducting experiments, the Biosafety Guidelines of Department of Biotechnology, Department of Health Research, GOI would be followed in to.
4. I agree to submit ethical clearance certificate from the concerned ethical trails/experiments/exchange of committee, if the project involves field specimens, human & animal materials etc.
5. I agree to abide by the terms and conditions of SMS-2018, BIHER, and Chennai.

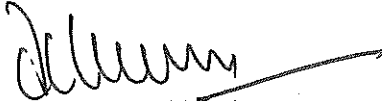

Name and signature of
Principal Investigator

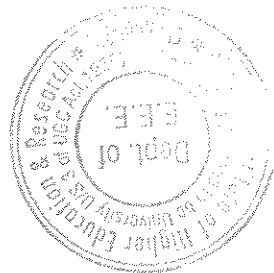

Name and signature of
Co-Principal Investigator

Date: 03.10.2018

Place: Chennai - 73

Forwarded by Head of the Department


Signature of the Head




PROJECT EVALUATION FORMAT

Recommendation Sheet

Name of the Principal Investigator	Mr.K.Sakthivel
Name of the Co-Investigator	Dr.V.Jayalakshmi
Name of the Department	EEE
Title of project	Performance Evaluation of Isolated Micro-Grids with Hybrid Renewable Generation System
Recommendation of the evaluation committee	-Recommended-
Financial allocation recommended	Rs. 1,00,000 -

Sl. No.	Equipment	Quantity	Amount in INR
1	Battery – 12V, 300AH	2	50,000
	Sine Wave Inverter – 1000Watts	1	15,000
2	Consumables (Like, testing tools Charge controller, etc.)	As per requirement	20,000
3	Travel support for the purpose of research work.	---	5,000
4	Contingency	---	5000
5	Others	---	5000
	Total		1,00,000

Name and Signature of the Research Advisory Committee members with date


(Dr. P. Niveen Chandran)

