RESEARCH AND DEVELOPMENT PROJECTS

FUNDED BY RENEWABLENEPAL PROGRAMME [2009–2013]

RenewableNepal is a programme for supporting research based industrial development in Nepal. It provides funding support to collaborative R&D projects related to renewable energy technology, planned and implemented by R&D institution in Nepal in cooperation with local industries, and Norwegian institutions and industries.

JOINTLY MANAGED BY

- **Kathmandu University (KU), Nepal**
- **SINTEF Energy Research (SEfAS), Norway**

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- **Royal Norwegian Embassy, Kathmandu**

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PROJECTS FUNDED BY RENEWABLENEPAL

PRODUCTION OF BIOMASS BRIQUETTED FUEL BASED ON AGRO FORESTRY WASTE AS SUBSTITUTE FOR FUEL WOOD IN DOMESTIC AND INDUSTRIAL SECTOR OF NEPAL

Project ID: RENP-10-06-PID-172
Project Owner: Centre for Energy and Environment Nepal (CEEN) [http://www.cee-n.org.np]
Project Leader: Prof. Krishna R. Shrestha [shresthakr@hotmail.com]
Partners: Mhepi Briquette Industries
Nepal Academy of Science and Technology (NAST) [http://www.nast.org.np]
Programme Funding: NOK 390,000
Project Duration: 01 Sept 2010- 31 Aug 2013

Nepal is basically an agricultural country with huge amounts of biomass resources especially agro-forest residues. 88 % of energy demand of the country is still met by traditional fuels (fuel wood, animal dung and agro-forest residues). Briquette fuels were introduced in 1982 to reduce the pressure on fuel wood. Many rice husk briquetting industries were established during 1985-1995, which later could not be sustained due to technical, raw material and market problems. Technical problems included high cost of technology, problems of screw and die, lack of R&D support, cheap and less abrasive raw materials. Also the briquette fuels could not be used in the traditional cooking and heating devices. Given these problems, the project will concentrate on cheaper briquette technologies, undertake appropriate R&D to address the technical problems and improve the capacity and performance of existing rice husk briquetting industry. Further, the project will identify less abrasive and better raw materials to rice husk. The project will fabricate and test heating and cooking devices to use the briquettes fuels for domestic and community cooking purposes to displace firewood. Tests of briquettes will also be conducted in different industrial applications to replace firewood where our industrial partner has been constantly promoting its products.

DESIGN AND DEVELOPMENT OF MINI-GRID FOR EFFICIENT USE OF DISTRIBUTED HYDROPOWER SYSTEM

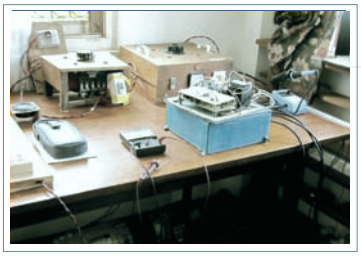
Project ID: RENP-10-06-PID-242
Project Owner: Kathmandu University(KU), Nepal [www.ku.edu.np]
Project Leader: Brijesh Adhikary [brijesh@ku.edu.np]
Partners: Krishna Grill and Engineering [http://krishna.grill.free.fr]
Center for Excellence in Production and Transportation of Energy [www.ku.edu.np/dcge/cepte.htm]
Programme Funding: NOK 400,000
Project Duration: 17 July 2010- 16 July 2013

Mini-grid is a "independent network for the electrification with own generating capacity (one or several generators) and to serve the local demand." Presently, the MHPs (Micro-Hydro Plants) are operated in isolated mode serving their respective load centers VDCs (Village Developing Committees). These isolated small hydro power plants have certain problems associated with them like un-utilized electricity generation issues and sustainability issues. Now if these VDCs are inter-connected via mini-grid there are lots of possibilities of power sharing and saving opportunities also it will lead to the system stability and supply reliability increasing the life span and economic viability of the plant. There is a great need of technology for connection of these generation units together and interconnected load via a grid. Thus, we came up with the idea of doing R&D for designing mini-grid power systems, developing a small test model for it, piloting it and commercializing individual components.

DESIGN, FABRICATION AND TEST OF A BIOMASS GASIFIER FOR SMALL SIZE PETROL AND DIESEL ENGINES

Project ID: RENP-10-06-PID-248
Project Owner: Kathmandu University(KU), Nepal [www.ku.edu.np]
Project Leader: Dr. Bivek Baral [bivek@ku.edu.np]
Partner: Sun Works Nepal
Programme Funding: NOK 400,000
Project Duration: 01 Aug 2010- 31 July 2013

This project intends to design, fabricate and test a low cost indigenous biomass gasifier that uses agricultural and forest waste including rice husk, rice/wheat straw, corn hops, wood chips and saw dust; to give producer or 'syngas'. The syngas is a combustible mixture consisting mostly of carbon monoxide and hydrogen gases and can be used in running both petrol and diesel engines with slight modification. The capacity/size of the gasifier is targeted to cater the small sized engines (5-10 kW) which are widely used in Nepal for pumping water, operating thrashers and small rice and flour mills, and also for the generation of electricity locally in a small scale. This category of engines includes petrol, diesel and kerosene engines. Apart from design and fabrication of the gasifier, this project will also work on adapting such gasifier in both the petrol and diesel engines and on the development of procedure to run those engines when operated in conjunction with the gasifier. In addition, as the relative composition of the gases produced by the gasifier depends on the feed to the gasifier, this research will involve the test of the gas yield from different types of feed. The effects of syngas fuelling on the emissions and reliability of a selected engine will also be studied.



DEVELOPING ELECTRICAL LOAD CONTROLLER OF LOW HEAD PROPELLER PICO TURBINE AND FIELD RESEARCH FOR RURAL USE IN NEPAL

Project ID: RENP-10-06-PID-488
Project Owner: People Energy & Environment Development Association (PEEDA), Nepal [http://www.peeda.net]
Project Leader: Govinda Devkota [govindadevkota@yahoo.com]
Partner: Kathmandu Alternative Power & Energy Group (KAPEG) [http://www.kapeg.com.np]
Programme Funding: NOK 200,000
Project Duration: 01 Aug 2010- 31 July 2011

The main objective of this project is to develop an effective Load controller system for the units. This controller can overcome the use of Pico-hydro system which was suitable only for lighting purpose, and hence can support the income generation unit by operating induction motors for setting up a small industry based on operation of electric machine such as sewing machine, drill machine angle grinder etc. A test site will be selected and field testing of this controller together with its implication for large scale distribution in the rural villages in Nepal is the critical part of this study. Site selection and establishment of demonstration site: Good and accessible site selected for the field test not only make convenient for field research work but also acts as demonstration site for large number of stakeholders.

PROJECTS FUNDED BY RENEWABLENEPAL

SOLAR AND WLED FOR GREENER AND BRIGHTER NEPAL

Project ID: RENP-10-06-PID-327
Project Owner: Kathmandu University(KU), Nepal
Project Leader: Diwakar Bista [diwakarbista@ku.edu.np]
Partner: Altitude Innovation
Programme Funding: NOK 150,000
Project Duration: 01 Aug 2010- 31 July 2012

Proposed project has considered solar PV module as source of renewable energy and WLED (White Light Emitting Diode) for efficient use of solar energy. KU will lead the project and Altitude Innovation Pvt. Ltd. will be the project partner. The project aims to boost use of solar power system in Nepal by making it economically feasible and easily available to Nepalese. This objective is met by doing related R&D in coordination with partner industry and later entering into mass production. The project also aims to develop software for designing solar power system and WLED based luminary and can be used by KU, partner organization as well as for other solar related industries in Nepal and globally. After the completion of the project, partner organization shall be capable of manufacturing WLED based lamps and solar panels out of solar cells and KU will have experienced manpower and technical resources related to solar and WLED. The project will no doubt help in reducing the current energy crisis in Nepal and also help in enlightening hundreds of houses with cheaper solar panel and efficient WLED.

A STATISTICAL ANALYSIS OF PARAMETERS MEASURING THE SOCIO-ECONOMIC IMPACTS OF RENEWABLE ENERGY PROJECTS SPECIALLY BIOGAS ON ITS CONSUMERS AND THE USE OF THE RESULTS OBTAINED ON PRODUCT DEVELOPMENT AND IMPROVEMENT

Project ID: RENP-10-06-PID-379
Project Owner: Kathmandu University, Nepal [www.ku.edu.np]
Project Leader: Dr. Jyoti Upadhyaya [drjdevkota@ku.edu.np]
Partner: Rapti Renewable
Programme Funding: NOK 300,000
Project Duration: 17 July 2010 - 16 July 2012

This project collects, explores, analyses and models data with an aim to study the socio-economic impacts of renewable energy projects specially biogas, on its consumers. It further uses the results obtained from the statistical analysis of the data in improvement of biogas plants. This Type 2 R and D project falls in category C. This study will result in a report including statistical models and a consumer profile, which will serve as a guideline to the governmental agencies and other stake holders such as bio-energy industry. The statistical models developed in this project will predict various factors measuring the socio-economic impact. The consumer profile produced partly by statistical models such as linear mixed effect models and small area estimation will help identify bio-fuel industries the potential market clusters and their optimal location. In addition to this, the results of this project will give feedbacks to the Nepalese bio fuel on making more efficient bio fuel plants and will foster exchange of technical knowhow with the Norwegian counterparts. This will help the indigenous industries in product development and product modification. The results of the modeling and data analysis will be used in development of more efficient and cost effective bio gas plants as per the need of Nepalese consumer market.

DEVELOPMENT OF HYDRAULIC TURBINES WITH NEW DESIGN PHILOSOPHY AS A FOUNDATION FOR TURBINE MANUFACTURING IN NEPAL

Project ID: RENP-10-06-PID-437
Project Owner: Kathmandu University, Nepal [www.ku.edu.np]
Project Leader: Tore Skeie [trskeie@gmail.com]
Nepali Partner: Nepal Hydro and Electric [http://www.nhe.com.np]
Norwegian Partners: Dynavec [http://www.dynavec.no], Norwegian University of Science and Technology
Programme Funding: NOK 476,000
Project Duration: 15 Aug 2010- 14 Aug 2013

This project is aimed to transfer the Norwegian competency in R&D to Nepalese research institute and Norwegian expertise in manufacturing of turbines to Nepalese fabricating industry respectively. The ultimate goal is the holistic and long-term sustainable development of hydropower business in Nepal. Creating Center of Excellence at KU for R&D of turbines would be the immediate output of the project. This Project would give a platform and foundation for associated professional parties to come together to create a Turbine manufacturer in Nepal, which is the long term goal of the project. Nepalese power plants are suffering from sediment erosion problems. Norway and NTNU are far ahead in design developments of turbines but the design solution for erosion problems has not been found yet. Transfer of current Norwegian technology in turbine design with combined research works for further innovation for solving sediment erosion problems would achieve the long term project goal to create a turbine manufacturer in Nepal. Nepal has not been able to exploit its vast hydropower resources yet. It will be further delayed due to lack of its own competent experts and research center devoted for solving the existing problems. Losses due to sediment erosion in turbines have been the important limiting factor for growth of hydropower projects in Nepal. Future of hydropower developments in Nepal would need a manufacturer in the country to provide turbines and parts with new design solutions for the erosion and related problems. Furthermore, home production could cut the cost of turbine by half of the sum. NTNU will support KU to develop the Center of Excellence at TTL, which will provide professional consultancy to the manufacturing industries and other developers in the region for design and tests of turbines. By combined R&D activities a new design philosophy of erosion friendly Francis turbines will be developed at NTNU and verified at TTL. Dynavec and NHE will cooperate together for creating a turbine manufacturer in Nepal for commercialization of the new design in local and international market.

VIABLE CHARRING TECHNOLOGY TO MEET THE INDUSTRIAL DEMAND OF CHAR, AS AN ALTERNATIVE FUEL IN BRICK KILNS

Project ID: RENP-11-07-PID-681
Project Owner: Central Department of Environmental Science, Tribhuvan University, Nepal [http://www.cdes.edu.np]
Project Leader: Ms. Rejina Maskey Byanju [rmaskey@cdes.edu.np]
Partners: MinErgy Pvt. Ltd. [http://www.minergynepal.com], Shree Satya Narayan Itta Bhatta Pvt. Ltd.
Programme Funding: NOK 300,000
Project Duration: 17 July 2011- 15 July 2013

The forest waste, as a part of mandatory annual activity of cutting and pruning for sustainable forest management, are not being utilized as renewable energy resources and as economic activity. The prevalent inefficient charring technology cannot meet the industrial demand while opportunity cost and occupational health and safety measures for the char producers is not fulfilled. The brick industry in Nepal, is highly polluting and energy intensive, and is looking for alternative to coal to fire bricks considering the constantly increasing coal price. The project aims to demonstrate viable charring technology to meet the industrial demand of char, as an alternative fuel to coal in brick kilns, for further commercial scale. The major activities of the project are to demonstrate an optimal charring technology and optimal char-soil ratio for brick industry.

PROJECTS FUNDED BY RENEWABLENEPAL

DEVELOPMENT OF COMMERCIALLY VIABLE WIND POWER SYSTEM IN NEPAL

Project ID: RENP-11-07-PID-741
Project Owner: Practical Action, Nepal [http://practicalaction.org/nepal]
Project Leader: Dr. Shirish Singh [shirish.singh@practicalaction.org.np]
Partner: Kathmandu Alternative Power and Energy Group (KAPEG) [http://www.kapeg.com.np]
International Partner: RISOE National Laboratory Technical University of Denmark (RISOE DTU) [http://www.risoe.dtu.dk]
Programme Funding: NOK 350,000
Project Duration: 01 Aug 2011- 31 July 2013

The project aims to develop a commercially viable small wind energy system harnessing local resources, wherever possible. Design and mathematical verification will be conducted to develop a prototype system. The prototype will be verified by rigorous laboratory tests. The prototype will be tested at field conditions and necessary modifications in the prototype will be made as per the result of field testing. Detail specification of components, user's manual, maintenance and monitoring manual, safety guidelines will be prepared for commercialization and promotion of the technology.

TO STUDY THE POTENTIALITY OF AGRICULTURE WASTES AS A SOURCE OF XYLOSE/GLUCOSE FOR PRODUCTION OF ETHANOL AND USING IT AS BIOFUEL

Project ID: RENP-11-07-PID-761
Project Owner: Kathmandu University, Nepal [www.ku.edu.np]
Project Leader: Dr. Bhupal Govinda Shrestha [bgs@ku.edu.np]
Partner: Everest Biodiesel Company Pvt. Ltd. [http://everestbiodiesel.com]
Programme Funding: NOK 330,000
Project Duration: 17 July 2011- 15 July 2013

Fossil fuel, as a source of energy has direct impact on the environment and being non renewable source of energy, the fear of its exhaustion persists. Renewable source of energy that runs on zero carbon cycle, makes an viable alternative. Agricultural waste, are a largely untapped resource and can be converted to ethanol which can replace gasoline at 10% level, for use in vehicle, without much change in the existing engine. This also helps to save on food items, which otherwise is being used to make ethanol, leading to food scarcity. One important feature of this project would be to optimize the conditions of fermentation so that we can produce economically viable amount of ethanol from the waste, which puts emphasis on using hemi-cellulose also, present to the extent of 30% in plants. The project work also includes, use of genetic engineering techniques to make a single, stable hybrid yeast, so as to increase the yield of ethanol. After successful ethanol production, our effort will be in up scaling the ethanol production, so that the project will have commercial viability and setting up a biofuel industry. As a by product, the project could also lead to establishing of a fermentor designing industry, which is in high demand to beverages industry.

INVESTIGATION ON PRACTICAL REALIZATION OF A REACTIVE POWER COMPENSATOR FOR GRID CONNECTED WIND TURBINE DRIVEN INDUCTION GENERATOR

Project ID: RENP-11-07-PID-792
Project Owner: Research Training and Consultancy Unit, Department of Electrical Engineering, Pulchowk Campus, Institute of Engineering, Tribhuvan University, Nepal [http://doee.ioe.edu.np]
Project Leader: Prof. Dr. Indraman Tamrakar [im.tamrakar@hotmail.com]
Partner: Power Tech Nepal Pvt. Ltd.
Programme Funding: NOK 300,000
Project Duration: 17 July 2011- 15 July 2013

When wind power generator is connected to grid, induction generator could be better choice due to low cost of generator and easy synchronization with grid. However, induction generator cannot generate reactive power. If all the wind generators inject only active power to the grid, the grid have to generate more reactive power, which will be extra burden for grid authority. Hence the grid authority will impose a condition to the private wind power producers that their generator also shall inject reactive power in a fixed proportion of active power injected. The wind turbine driven induction generator inject variable amount of active power at various wind speed. Hence, a reactive power generator is required along with induction generator, which can generate continuously variable reactive power in a fixed proportion of active power injected into the grid by the induction generator to fulfil the condition imposed by grid authority. This proposed research work is focused on developing such reactive power generator based on advanced power electronic circuit named as STATCOM. If the proposed scheme can be implemented in Nepalese grid system, it will give a significant contribution in reducing the current load-shedding duration without giving reactive power burden to NEA. Since it will be implemented at distribution level, expansion of transmission line system is not necessary. Since the proposed scheme is renewable energy technology, it could be sustainable in long term and could contribute in social, economical, industrial and commercial development of the country.

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