



UNNAT BHARAT ABHIYAN

Compendium (2) on Rural Energy Systems



Rural Energy Systems

Cookstoves/ Biogas/CBG/ Solar Systems/Biodiesel/Wind Energy/Hydro Energy

Prepared by the Subject Expert Group on Rural Energy Systems

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Year of Publication: June 2024

ISBN:

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FOREWORD

Unnat Bharat Abhiyan, the flagship program of the Ministry of Education, Government of India, was initiated in 2014 with a vision of bringing transformational change in rural development processes by leveraging knowledge institutions to help build the architecture of an Inclusive India. The idea behind this ambitious program is to involve the country's higher educational institutions (technical / non-technical / public/private) in the indigenous development of self-sufficient and sustainable village clusters.

Through Unnat Bharat Abhiyan, the educational institutions in the country will be able to help the nation's overall development by adopting villages. The educational institutions will also be able to understand and participate in the development process by employing technologies in rural areas. In turn, students of the academic institutions and faculty members will enrich themselves.

To provide the knowledge and technology support to improve livelihoods in rural areas and upgrade the capabilities of public and private organizations in society, 14 Subject Expert Groups (SEGs) were created under Unnat Bharat Abhiyan. In Rural Energy Systems, we have covered all energy themes like Improved Biomass Cookstoves/ Biogas and Biogas plants/Compressed biogas (CBG)/ Toilet-linked biogas plants/Solar Light systems /Solar cookers/Solar water heaters/ Solar Dryers and Biodiesel and Implementation of Various Government Schemes headed by the Centre Of Rural Development And Technology (CRDT) is one of those Subject Expert Groups where the focus is levied on building the capacity of the rural sector through various technologies, creating opportunities through convergence, and disseminating the right information and application of the government schemes at the grassroots level.

I see great potential in this SEG Compendium designed and drafted deliberately while holding the dexterity of various experts at one single platform. This compendium will help the Higher Educational Institutions (HEIs) in creating a foundation for how they can improve their adopted villages through Capacity Building, Strategy for Convergence, and Implementation of Various Government Schemes.

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PREFACE

Unnat Bharat Abhiyan (UBA) aims to enable Higher Education Institutions (HEI) to work with rural India's people to identify development challenges and evolve appropriate solutions for accelerating sustainable growth. Thus, it aims to create a virtuous cycle between society and an inclusive academic system by providing knowledge and practices for emerging professions and upgrading the capabilities of both the public and the private sectors in responding to the development needs of rural India.

UBA demands a connection between HEI and local communities to address the development challenges through appropriate technologies/management models. Several universities and science & technological institutions already have community service integral to their academic programs. Nevertheless, sometimes it ends up as an NSS camp in the surrounding villages, where students clean up village streets - when the villagers look on; or arrange games and play with local school children, etc.

Possibly, this is because of a lack of understanding about what community engagement is all about; or what are the modes through which meaningful community engagement can be taken up by Universities and Science & Technology Institutions. This handbook provides the approaches and strategies HEIs can put to use so to get started with meaningful community engagement in the neighborhood.

July 2024

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INTRODUCTION

Cook stoves are commonly used for cooking and heating food in rural households which can run with locally available biomass. Cook stoves are super clean, efficient, affordable, and low-cost means of renewable rural energy and are greatly adopted by people in rural areas as they require low maintenance and are suitable for average and large households.

Biogas has emerged as a reliable and efficient energy asset in the development and quality of life of people in rural areas. Biogas is a type of biofuel that is naturally produced from the decomposition of organic waste such as agricultural waste, manure, municipal waste, plant material, sewage, green waste, or food waste and can be used as a fuel for transportation, cooking and the leftover from biogas plant can be used as fertilizer for plants and crops. The production and utilization of biogas from anaerobic digestion (AD) provide environmental and socioeconomic

benefits for the society as a whole as well as for the involved farmers.

The use of solar energy and its utilization has been gaining attention and is a long-lasting source of energy. Solar power is energy from the sun that is converted into thermal or electrical energy. Solar energy is the cleanest and most abundant renewable energy source available. Solar energy can be used for cooking food with the help of solar cookers, lighting purposes with the help of solar street lights, and solar heating systems for hot water purposes. Thus solar energy system plays a very important role in providing basic facilities such as light, food, and warm water and help in providing better life to the people especially rural areas.

Thus, cook stoves, biogas, solar cookers, solar heating systems, and solar lights are efficient tools that can prove a boom to the lives of rural areas peoples. Still, there are many villages or rural areas that are still far away from basic facilities of life such as electricity, and fuel for cooking and are helpless to live their life in darkness. By using these renewable energy resources, we can easily help them improve their life so that they can get gas for cooking from biogas, lighting facilities from solar lighting systems, etc., which is the basic aim of rural development. Therefore, efficient utilization of these renewable energy sources can be a great aid to the quality of life of rural people, so that they can get their basic requirements of life easily such as light, cheap fuel, and warm water, making their life easier and convenient.

**“Appropriate utilization of renewable resources is a key
for sustainable energy for rural development”**

Biogas and biogas plants



Fig. 1. KVIC model biogas plant at IIT Delhi

1. Introduction

For a long time, the rural peoples of our country have used biomass and wood for cooking and other energy purpose. Animals are also part of their life and the dung collected from them is dried properly and used for energy. This way of utilizing dung emits harmful pollutants upon burning and negatively impacts the health of women around the cook stoves. There exists another to utilize the dung, which can be converted into biogas via an anaerobic digestion (AD) process. Anaerobic digestion of dung produces biogas and digested material as sludge. Biogas is a mixture of methane and carbon dioxide mainly as well as traces of hydrogen sulfide, ammonia, oxygen, hydrogen, water vapor, etc. depending upon the feed materials and other conditions. Methane produces energy upon burning and the digested materials can be used in the farms to enrich the soils.