

CHAPTER 1

INTRODUCTION

1.1. Renewable Energy Sources:

Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services.

Based on REN21's 2014 report, renewable contributed 19 percent to our energy consumption and 22 percent to our electricity generation in 2012 and 2013 respectively. Both, modern renewables such as hydro, wind, solar and bio-fuels as well as traditional biomass, contributed in about equal parts to the global energy supply. Worldwide investments in renewable technologies amounted to more than US\$214 billion in 2013. Many countries are heavily investing in wind, hydro, solar and bio-fuels.

Renewable energy resources exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency is resulting in significant energy security, climate change mitigation, and economic benefits. In international public opinion surveys there is strong support for promoting renewable sources such as solar power and wind power. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20 percent of energy supply. National renewable energy markets are projected to continue to grow strongly in the coming decade and beyond.

In this project, we are making use of two renewable energy sources: Wind and Solar energy, which are the most commonly available renewable energy sources.

Wind power is the conversion of wind energy into a useful form of energy, by using wind turbines to make electrical power, windmills for mechanical power, windpumps for water pumping or drainage, or sails to propel ships. Wind power, as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during

operation and uses little land. The effects on the environment are generally less problematic than those from other power sources.

Solar energy is radiant light and heat from the sun harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaics, solar thermal energy, solar architecture and artificial photosynthesis. It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on the way they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

1.2. Top-Level Block Diagram

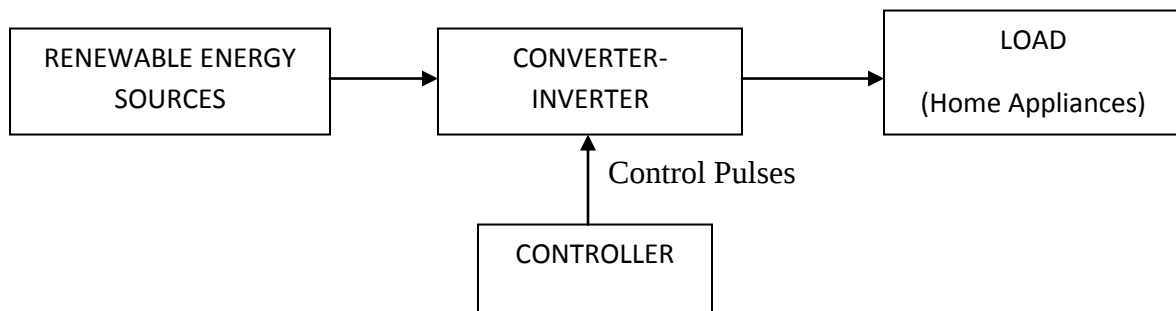


Figure 1.1:Top level block diagram of Hybrid Renewable Single Phase Power Generation System

The figure shows the overview diagram of this project. Solar and wind energy are the renewable energy sources used. Two boost converters are being used to supply a input of 300V to the inverter. Home appliances are being used as the load to the inverter.

This project is an enhancement to a 2014 project with the title “DSP Based Converter-Inverter Control Strategy for Single Phase Wind Power Generation System”. The enhancement is being planned in the following ways:

- The DSP employed in the project was an evaluation module which cannot be controlled without the help of a computer. Therefore, it can be replaced either with an equivalent DSP or a Microcontroller which can produce PWM and placed on board.
- The power to the DSP is provided externally, this can be replaced by using a Feedback from the designed system.
- Previously, the system was not integrated with the windmill grid. The windmill grid integration is supposed to be done if a windmill is employed and similarly any other interfacing if there are any other power sources employed.
- The input and output current levels are to be measured such that the system can produce a minimum of 2A output current.

A switching strategy to control the inverter to which the load may be grid supply system has to be properly developed. The control strategy for the inverter should be such that, the required voltage amplitude and frequency (50 Hz) has to be supplied by the system.

In this project PICOLO has been used to control the duty cycle of the converters and inverters.