POWER TRANSMISSION AND DISTRIBUTION

PROJECT REPORT

MODELING AND SIMULATION OF TRANSMISSION LINE USING SMART GRID TECHNOLOGY

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INTRODUCTION

In this project we will be focusing on modeling a real time power transmission model and perform various tasks as per the customer usage and their activities and we will performing following tasks:

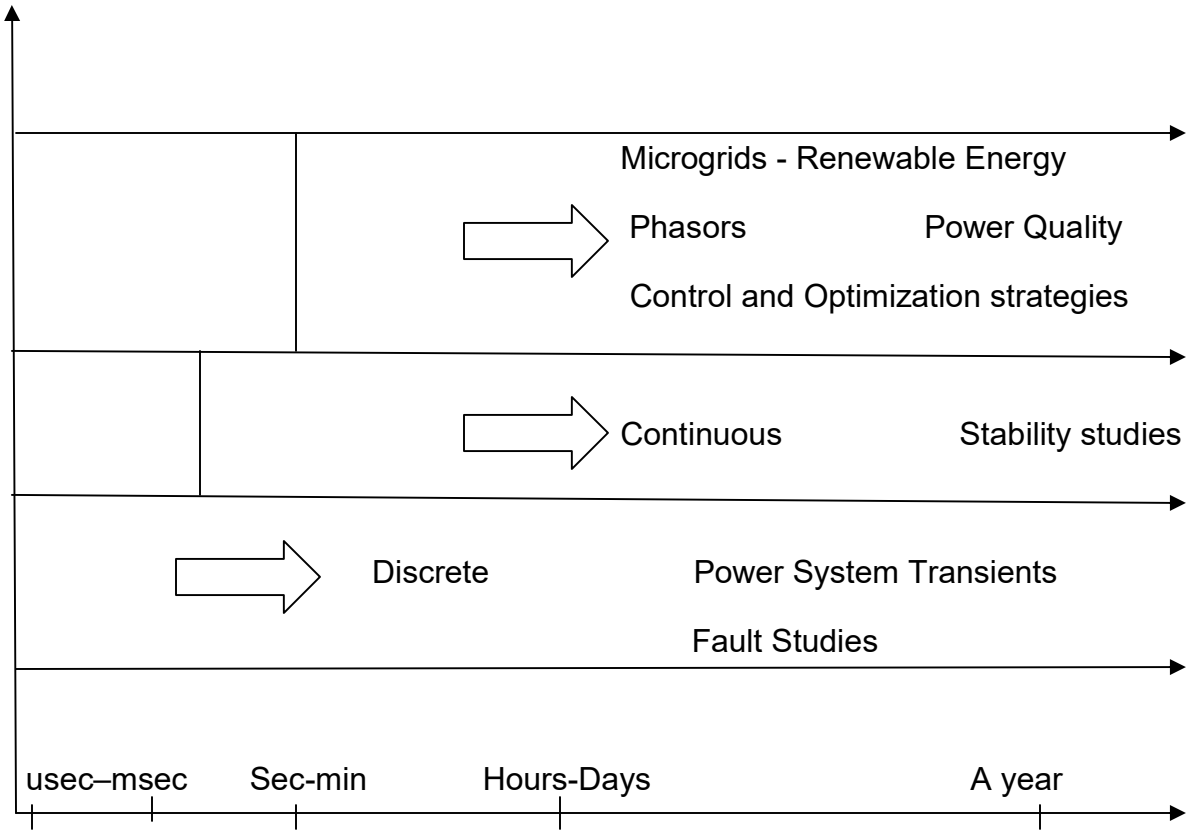
- Modeling of simulation model for varying time-periods.
- Developing Customized Simulation Components.
- Replaying recorded data through a simulation model.
- Monitoring the various activities that leads to demand fluctuation.
- Providing smart approach for efficient fault analysis.
- Analyzing large amount of simulation data.

With the modernization in technology, demand for power has increased considerably that needs efficient analysis and control of the power system through the help of various modern grid applications like simulation based approach.

Modern grid technology makes installation and utilization of renewable resources efficiently. Now a days solar and wind energy micro plants are being installed near the consumer sites in order to reduce or eliminate the power loss and use of renewable energy in lesser cost.

Hence in this project we will put light on various modern day methods and improvements in power grid operations to make the energy generation, transmission and consumption more economic and efficient as compared to traditional power grid.

Developing Simulation Models Suitable for Various Time-Periods



This chart shows the use of various time-domain approaches I order to measure various aspects of power generation.

- In this project through the help of SIMULINK the power will be generated and then it will be Step up for transmission and then power will be transmitted through the feeder and then after reaching consumer ends power will be step down and distributed to the consumers.
- The main problem occurs when there is fluctuation in power usage at consumer ends that causes unsymmetricities at the load end and here smart technology comes into picture where various automation and optimization techniques are used to overcome such issues.
- We will be analyzing the power consumption for the running the simulation model for the whole year to analyze the load curves so that power can be generated according to the consumer demands and it can be transmitted efficiently. In this

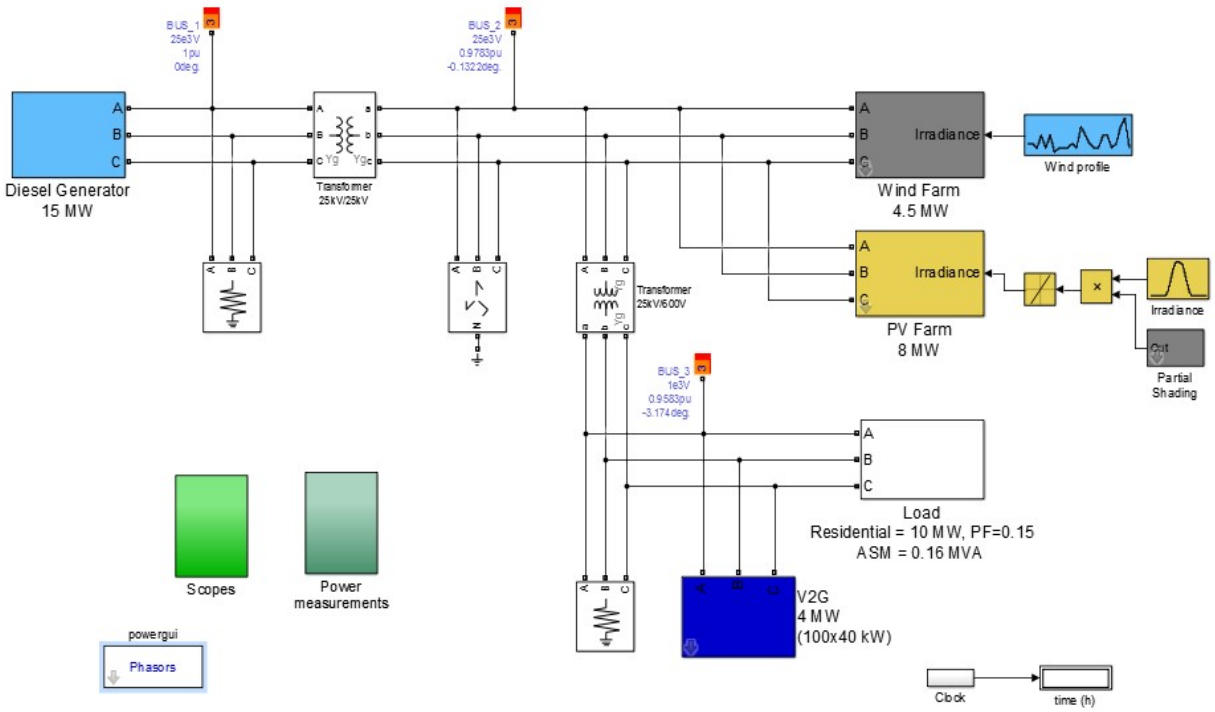
way we can reduce the wastage of power because storing electrical power is not economic in nature.

Objective:

- The objective of this simulation it to demonstrate power system capabilities to simulate an electric circuit in “phasor mode” for a whole year period in few minutes.
- It also illustrate concepts related to energy storage system by showing how to use solar cell and data time series and how to create typical load profile.
- **The model is divided into four major components**:
    1. The Electrical generation and distribution system- This component contain a diesel generator that is responsible for generation of power.
    2. The dynamic load model that represents residential load- This component implements a three phase, three wire load on load profile and shows the active power (P) and reactive power (Q) absorbed on a daily load profile on hourly basis.
    3. The typical solar cell block feeding power signal to PV farm model and a wind farm Model- This component contains meteorological year data system that converts solar irradiance data to power, this power is then fed to power system model PV Farm that converts power signal to current and wind mills that generate electrical energy through kinetic energy of the wind.
    4. The vehicle charging model- This component contains a model to charge the car of the consumers.
- This electric grid represent a typical Indian Energy grid in which transmission is carried out at 220kV and distribution is carried out at 11kV. So all the feeders are connected to the 11kV bus at the substation.
- One these feeders supply electricity to a community that owns a PV farm and energy storage system.
- Here we don’t need to solve complex differential equations resulting from R, L and C elements to analyze the transient response, here we use a special control block that is designed to control fault breaker for given period of time. This block allows simulation model of power system to capture the transient response up to milliseconds accuracy.
- Here the significance of introducing renewable energy sources it to meet the demands of consumers at the peak load conditions when there is more demand at consumer end side and sometimes generator is not able to produce this

much energy while under base load condition energy supplied through the generator is sufficient.

Simulink Model:



24-hour Simulation of a Distribution System with PV and Wind Farm

The microgrid is divided into four important parts: A diesel generator, acting as the base power generator; A PV farm combined with a wind farm, to produce renewable energy; a V2G system installed next to the last part of the system which is the load of the grid. The size of the microgrid represents approximately a community of a thousand households during a low consumption day in spring or fall. There are 100 electric vehicles in the base model which means that there is a 1:10 ratio between the cars and the households. This is a possible scenario in a foreseeable future

Diesel Generator

The diesel generator balances the power consumed and the power produced. We can determine the frequency deviation of the grid by looking at the rotor speed of its synchronous machine,.

Renewable Energy

There are two sources of renewable energy in this microgrid. First, a PV farm produces energy proportional to three factors: the size of the area covered by the PV farm, the

efficiency of the solar panels and the irradiance data. Second, a simplified model of a wind farm produces electrical power following a linear relationship with the wind. When the wind reaches a nominal value, the wind farm produces the nominal power. The wind farm trips from the grid when the wind speed exceeds the maximum wind value, until the wind gets back to its nominal value.

Vehicle-to-Grid

The V2G has two functions: Controls the charge of the batteries connected to it and uses the available power to regulate the grid when an event occurs during the day. The block implements five different car-user profiles:

Load

The load is composed of residential load and an asynchronous machine that is used to represents the impact of an industrial inductive load (like a ventilation system) on the microgrid. The residential load follows a consumption profile with a given power factor. The asynchronous machine is controlled by a square relation between the rotor speed and the mechanical torque.