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Smart Grid Scenario: An Implementation of Solar Power on Conventional Electrical Power System.

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Abstract: *These paper business agreements with a complete work-place of forms of microgrid (mg) based on not fixed in level rate of motion power producing machines. The selection criteria for these forms in company with the design of needed control algorithms are presented in detail. Simulation results and based on experience say for certain of selected mg forms are given to put examples on view of their is right for. It is tried to give greater value to applications of MGs with main making a point of on renewable power for a given time starting points to make certain able to keep going development in country, not town and far away, widely different areas. India is opposite positioning to have meeting with up the electric power for a given time requirement of a quick going up interests, money goods. Restructuring of the power industry has made greater great number of questions for engineers of power systems. Now days sent out act or power of seeing of present possible quick, sharp mind net-work (SG) at a good quality of levels in the Indian power systems has suggested that a greatly developed automation apparatus needs to be adjusted. Well-dressed net-works are introduced to make net-work purpose, use more well-dressed and sharp. Well-dressed net-work operations, upon right placing can open up new roads and chances with momentous money business follow up. This attempt demonstrate a range of well-dressed net-work first move sand follow up in the of power market growth in India. Arrange of examples of having existence structures of automation in India are given work to underline a few of views presented in this go to person in authority.*

Key words: *Restructuring of Power Network, Smart microgrid, Solar Power, Programmable Voltage Sources.*

I. NTRODUCTION

The complete power for a given time shortness of has directly foiled the science to do with the producing, distribution, and using up of goods and work supply, society, development of the nations, and conditions through green-house gases (GHGs) and by getting more carbon Credits . Development in economy of "a nation depends on reliability and reputation of its electric power supply. Global energy burden are ordinary to grow by 60% over the next 25 years subjected to three major factors; populace enlargement, rate of gross domestic product (GDP) and energy strengthening. It has potential to cause a noteworthy boost in GHG emissions linked through climate change. Secure, reliable and affordable energy sources are primary to economic stability and growth. Rising energy insist poses a challenge to energy safety agreed increased reliance on global energy markets. Electricity industry, particular in the industrialized world, holds a vital and pro-active role in providing solutions to security of supply and lessening of GHG emissions with economically viable solutions. Getting this transition, the power industry has only improved several challenges for power system. Pioneering power system architectures at a range of levels in power system linking in cooperation with novel technologies and The growing request of power across the round map of earth is being saw in the mind and made record to be increasing change. Feeble amount of property with old network roads and systems, weather, condition change, going higher powering material, substance gives idea of price, has resulted inefficient and increasingly changing electric system. With this, the complete about has lifted up certain full of danger points upon which the power for a given time complete change for a green and able to keep going future are was responsible for and came after

II.SOLAR POWER

The solar PV Power living-stage system (Power pack) supplied by Swiss mango solar power for a given time answers Pvt Ltd is a high good at producing an effect, unit broken into parts in, extendable and price working well power living-stage answer. The system is designed to International quality examples to make certain that you have years of trouble-free operations. As an outcome of made certain technology, the system is highly good at producing an effect and support free. With one-time an outer covering, the solar Power Pack provides the taking care, wise way of managing the power for a given time costs in an eco-friendly way. The savings made on power for a given time costs will help the companies to directly help and sending in (writing) to their growth. The List of chief parts used in this system is listed under.

- **Solar PV Modules**: The sun light (solar radiation) falling on the modules is converted in to DC energy by photovoltaic principle. The generated by solar modules can either be used to supply the power to the connected load or to charge the battery bank.
- **PV Inverter (PCU):** PCU is a common terminology used to the system consisting of Inverter and AC synchronization functionality. PCU does the function of controlling grid power by leading PF and prefer the solar energy to the load. The system also contains the Charge Controller as part of the same system or as an independent unit.
- **Module mounting structure (MMS):** MMS is the structure to mount the solar PV modules with specified angle depending on the location when the system to be mounted. The tilting will vary depending on the longitude and latitude of the location.
- **Salient Features and Benefits of System**.
  A clean,silent and eco-friendly source of power.
  Solar modules convert sunlight into electricity without pollution.
  Negligible maintenance as there is no moving parts and maximum reliability.
  Long life span of solar modules.
  Modular design and easily expandable.
  Simple installation: can be mounted on roof top or ground.
  Can be installed at point-of use to avoid transmission losses.
  Energy Independence.
  Protection against future escalation of energy costs.
  Available throughout the year.

Solar photovoltaic (PV) system is like any other electrical power generation systems in terms of the output except for the source of the power are solar radiation. The conversion of solar radiation to the electrical power is based on the photovoltaic principles. However, the principles of operation of the connected load and interfacing with other electrical systems remain the same. Though solar PV array produces power when exposed to sunlight, a number of other components are required to properly conduct, control, convert, distribute, and transform the energy produced by the array. Solar power generating system supplied for this project shall be utilized for powering various office loads like Computer, Lighting loads, fans etc. for specified hours of sun shine operation. This system is designed to generate the energy in an eco friendly manner with the source from solar radiation which is available in abundance. The system designed is for 20.00KWp Solar Power Generation Grid Connecting System. The system does not have any storage for standby power. The solar PV array will have 80 no's of 250Wp crystalline solar modules. These modules will be connected in series / parallel combination through Optimizers to the desired string configuration as per the design parameters of the PCU. The PCU is of 17KVA capacity with three phases AC Output. Grid power supply is provided to support the loads and to reduce the Grid power consumption when solar power is available. The power generated from solar array is fed into the PCU through Optimizer and being inverted by the PCU (Vac). This voltage is being combined with standard grid supply to the phases (R/Y/B) and will lead the power factor of the inverter supply by comparing the grid power factor. So the solar generated power will always be preferred by the leading power factor and rest of the power will be used from the grid as required by the load. If the load demand is lesser than the solar power generated, the balance power may be exported to grid and customer may get feed-in benefit as per the policies of the local electricity board. This system is working in the principal of power factor comparison and the system will feed the power either to load or grid through grid power supply. That means loads will be indirectly connected with the solar system. So, if the grid supply is not available at any moment the solar system will shut OFF immediately. We can only use sunlight directly to the load whenever the grid power is available. The system will shuts OFF at the time of low intensity or no sun light and restarts automatically when the sunlight is available. The proposed system does not required any dedicated loads or separate wiring to work on. At the time of power failure if the customer turns ON the DG supply again the solar system will run and pushes the energy back to the DG. To avoid this reverse current situation, the DG rating should be at least being 4 to 5 times higher rating than the proposed solar power plant rating.

System Details:

1. Solar PV Modules: PV PowerTech, ECO 250Wp – Polycrystalline Quantity: 80 Nos. (80 x 250 = 2000kWp). - Solar PV Module exposed to the sunlight converts it into DC energy.
2. Optimizer: Solar Edge Power Optimizer (OP MV 600W) – 600W Quantity - 40 Nos. - The power optimizer is a DC/DC converter connected to Solar PV modules to increase the energy output from PV systems by constantly tracking the maximum power point (MPPT) for one or more modules individually
3. PCU / Inverter: Solar Edge SE17K-ER-01 Grid connected system, 3 Phase – AC Output - 1 No - The inverter responsible for DC to AC inversion
4. The output of the inverter is connected to the AC Panel through a proper AC Protection.

5. Inter connecting cables are used to interconnect solar PV components like Solar Modules, Junction Boxes, & Inverter.

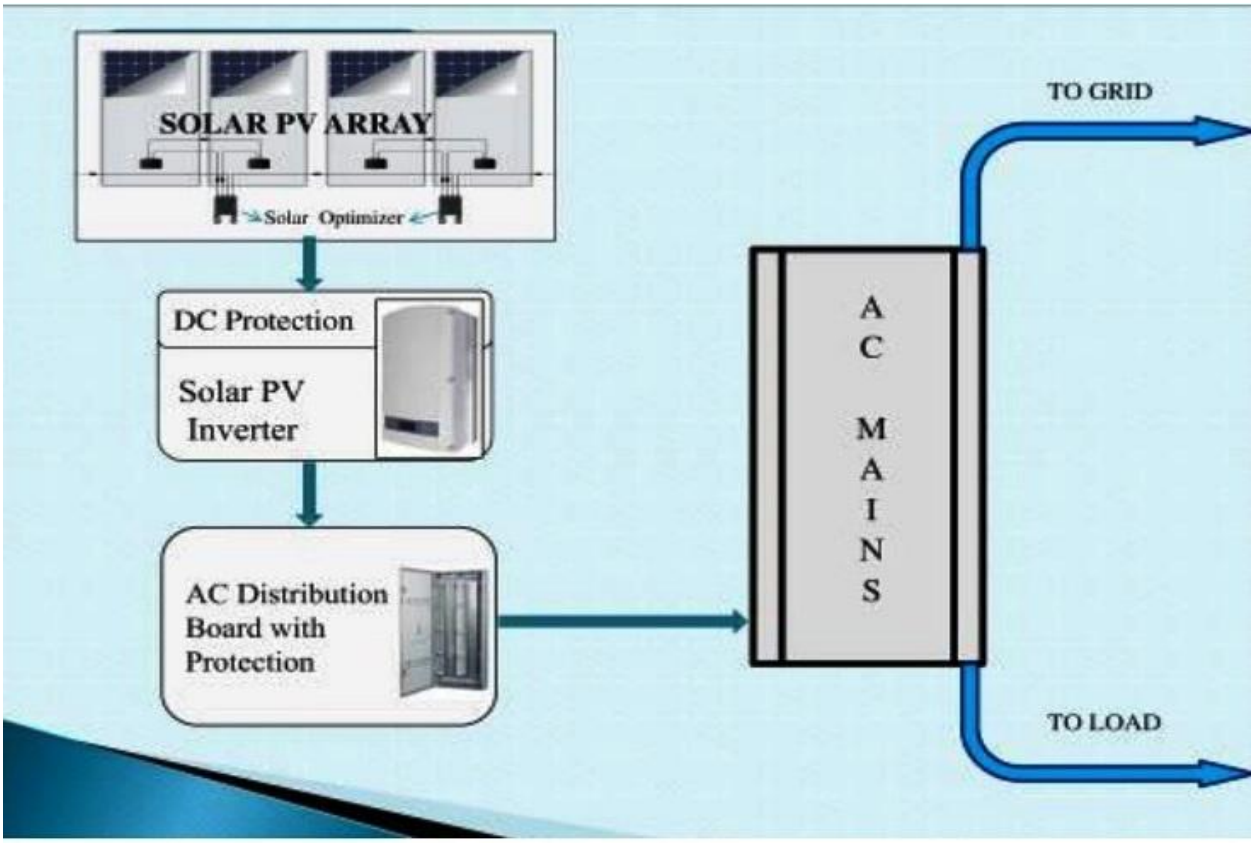
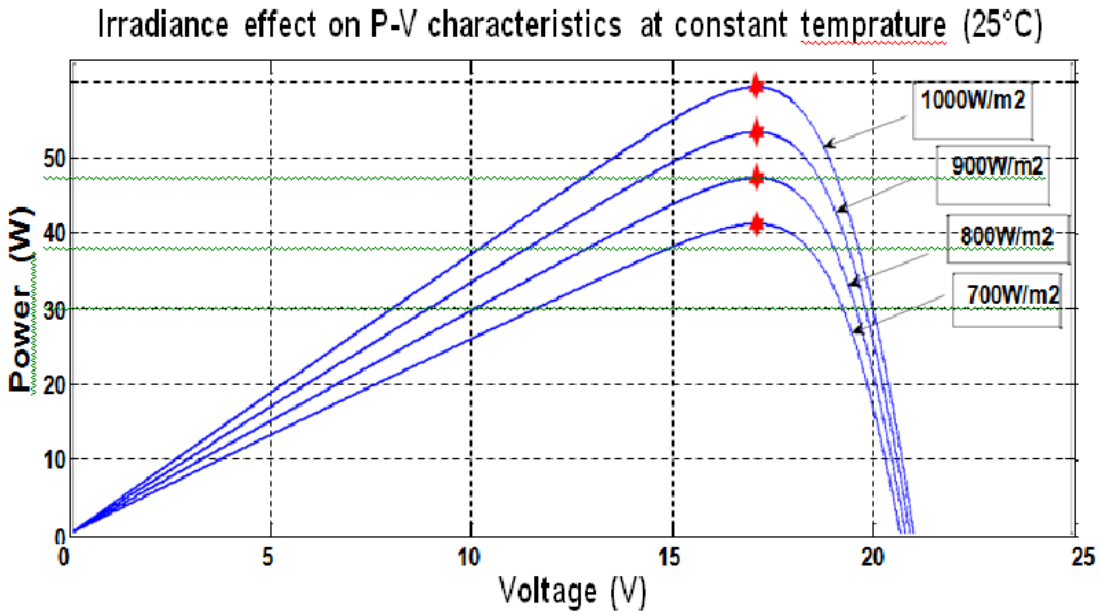


Figure 1: Solar PV array system.



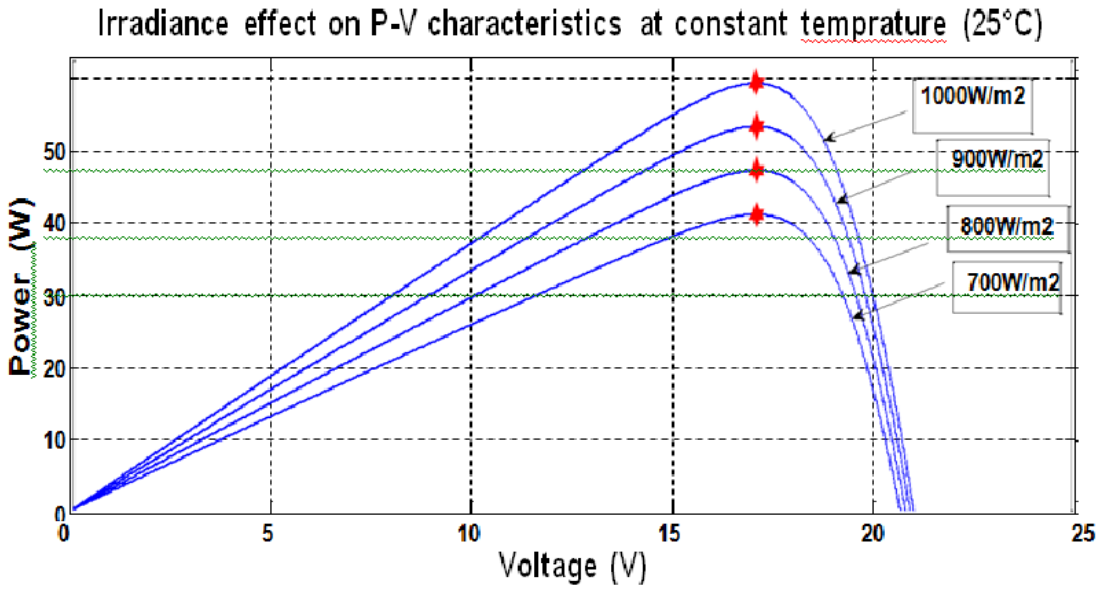


Figure 2: For different value of irradiance level and constant temperature (25℃).

III.SOLAR MICRO GRID AND ITS SIMULATION

The diagram shown in Figure 3 represents schematic arrangement of solar micro grid in matlab/simulink. Solar panel is connected at every home1 to home5 with individual power rating. As shown in figure utility supply is also connected with every home so there will be directional power flow can be possible. As shown in figure street houses are connected to distribution transformer, rating of which is 50 KVA, 13.3kv/120v with centre tape two secondary winding.

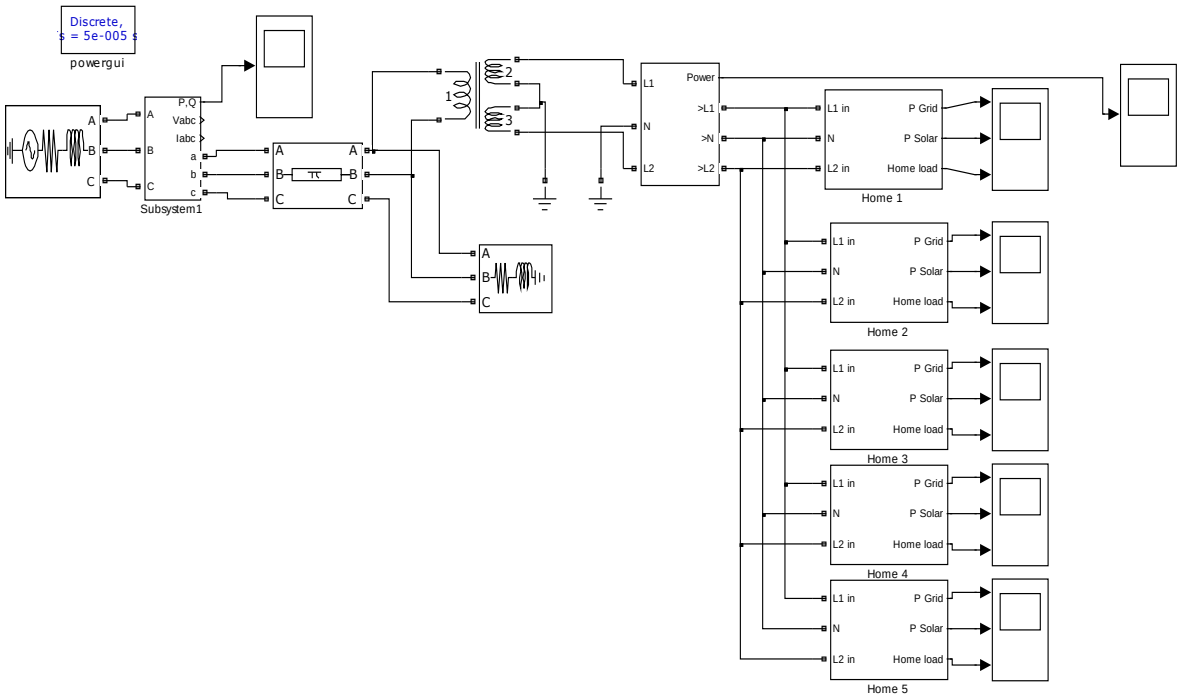


Figure 3: Diagram of solar micro grid.

As shown in Figure 4 connection ac supply block represent main distribution substation of the city. From that point voltage is step down at different city using step down centre tape transformer. Here in the simulation we have connected five homes with the distribution transformer with individual solar system.

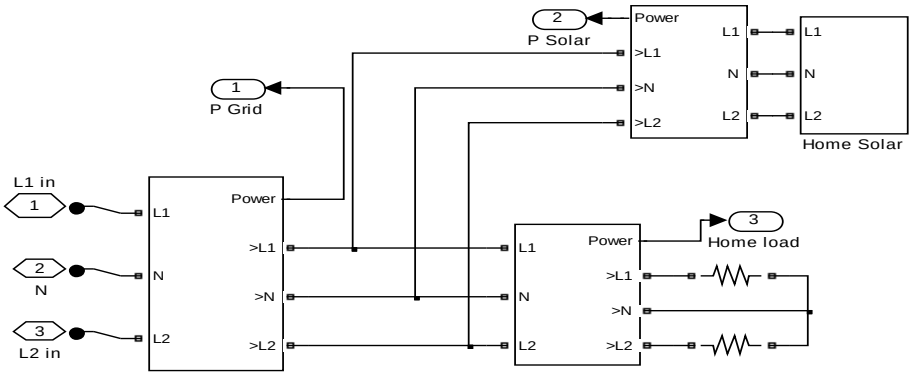


Figure 4: Internal block diagram of home.

The connection of solar system and utility at individual home is shown in Figure 5 It such that during day time when PV panel produces power user will utilize solar energy. If energy produced by solar panel is not enough in that case the remaining energy demand will be compensated of utility. In other case solar energy generation is more than demand of individual consumer can be supplied to utility grid and user can get rewards for that, so in this manner by direction flow of energy can be possible. Simulation is done for 24 hours at the every hour the power generation from solar system is different because of position of the sun and solar insulations.

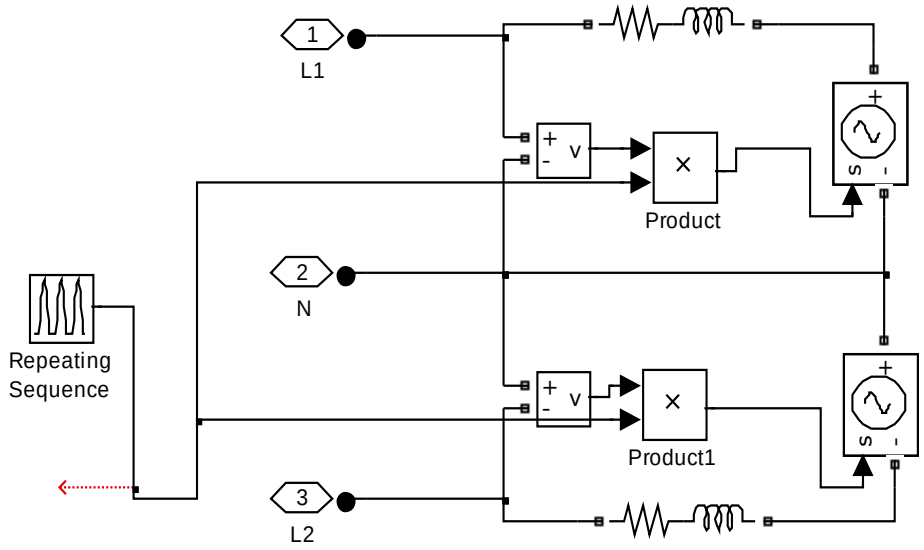


Figure 5: Diagram of solar panel (programmable voltage source)

As shown in above figure, we have modeled solar system at every home using programmable voltage source which is acting as solar panel. The connection and the design is given in figure. On other hand the main distribution substation is also connected to industrial load that we have represented by three phase resistive load which is connected before distribution transformer. During a day hour, if individual home solar system generation is more than individual demand then excessive power is utilized by industries

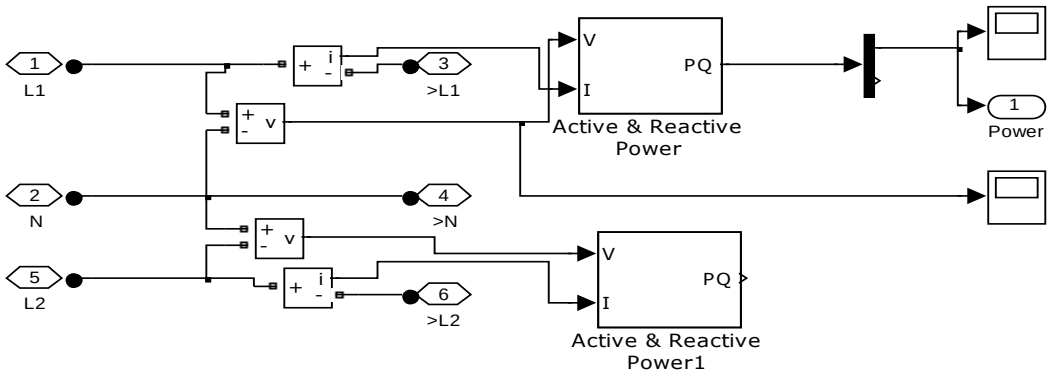


Figure 6: Three phase power measurement block

We have analyzed the simulation results. Also the three phase power measurement diagram is given in Figure 6. The analysis related to the result is to continue to next section. The simulation parameters are:

- Connected load (home): 2kw
- Distribution transformer: 50 kw, 13.3kv/120v
- Solar system rating: (home 1-3) 1kw, 120V
- Solar system rating: (home 4-5) 1.4 kw, 120V

The block shows the measurement blocks for power transfer between utility and home. Active and Reactive power can be measured by this block. Also current and voltage waveform will be done by it

IV.SIMULATION RESULTS.

Figure 7 shows the graph of time vs power supplied by utility. The graph shows that during the day time power supply by utility grid is less compared to the night hours. This is because of power generated by solar system is utilized. The variation in power at main distribution is not significant because in simulation we connected only five homes. With more connectivity of solar system the variation would be more. Figure 8 shows the voltage waveform at transmission line. And Figure 9 shows the current waveform at transmission line.

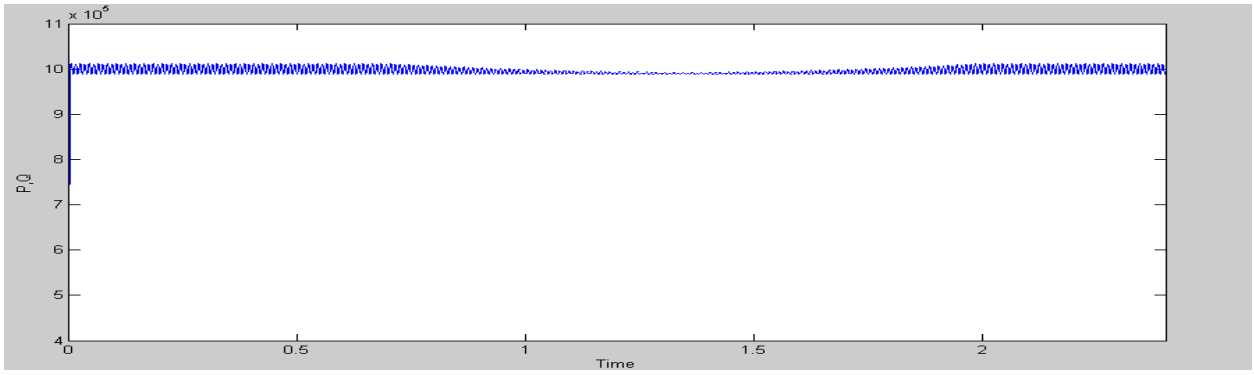


Figure 7: P, Q v/s Time

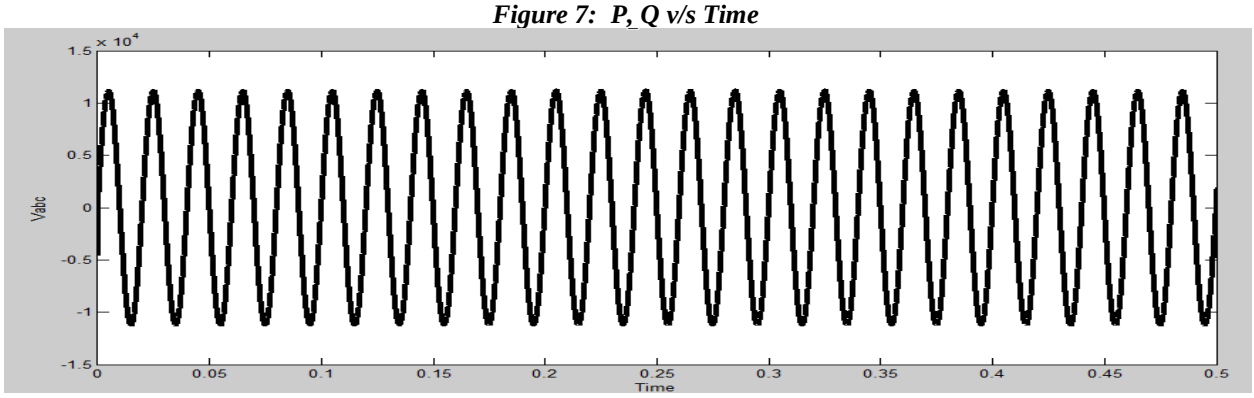


Figure 8: Vabc v/s Time

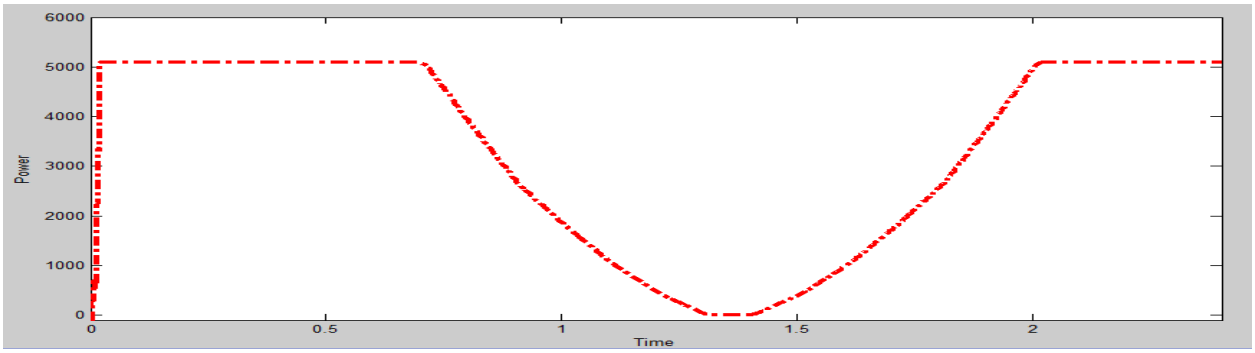


Figure 9: Pabc v/s Time

V.SIMULATION RESULTS OF HOME-1

The Figure10 shows the net power drawn by home 1 from grid during 24 hours. The waveform shows that during the day time the power drawn from the utility is decreasing and it is minimum during the afternoon hours. The load demand of home 1 is 1kw which is considered constant for 24 hours. The Figure 11 shows the power generated by home 1 from solar system during 24 hours. The waveform shows that during the day time the power generated from the solar system is increasing and it is maximum during the afternoon hours. Figure 12 shows the load demand of individual house which is considered as constant for 24 hours and its value is 1 kW. It is supplied by utility grid and solar system.
A same analysis has been done for all homes.

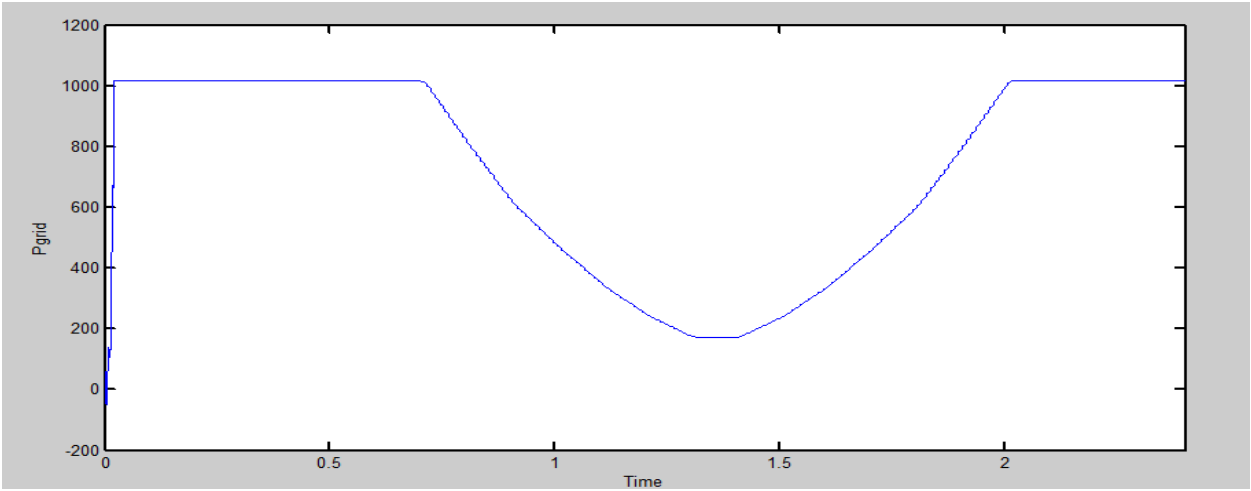


Figure 10: Pgrid v/s Time of Home1

Figure 11: Psolar v/s Time of Home1

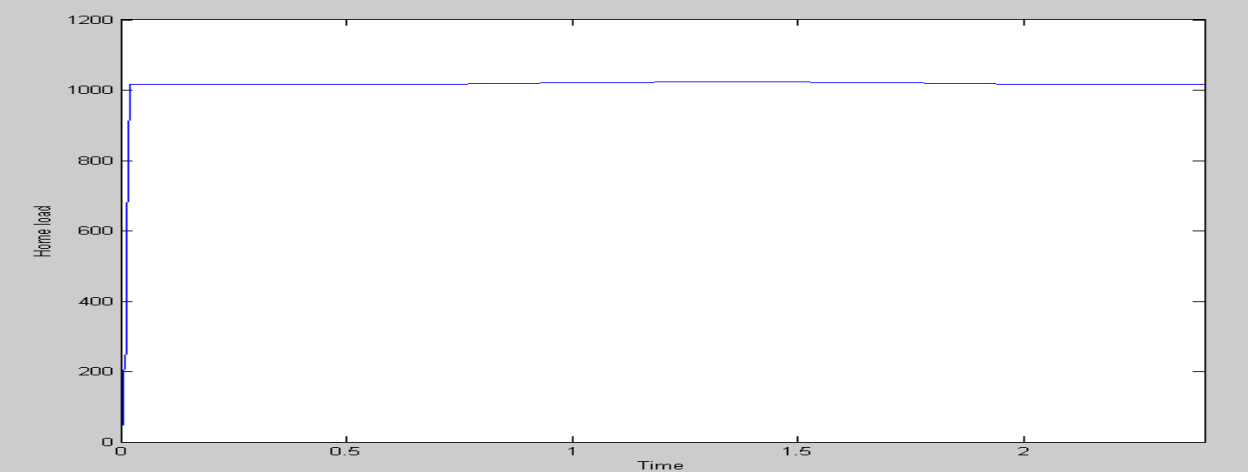


Figure 12: Home load v/s Time of Home1

VI. CONCLUSION

India's power for a given time living-stage and using up are on high growth rate. Climatic change business houses needing payment to emission grouped together with useable thing and base structure forces to limit are dampers. With nearly 40% of its 1.22 1.000.000.000 group kept without of net-work electrics, present 186 GW put in power amount of room may have to be made 2 times by the end of this ten-years stage to have meeting with power for a given time need of its growing group and degrees in which event is probable of a high level at which a country produces value growth interests, money, goods. Power system units as well as short observations are described in an over-view of the Indian power market. India's power market is generally a feeble amount of right base structure and being conscious is represented by poor request side business managers and move. Well-dressed net-work technology can over-come these issues through an unreasoned feeling. in addition, to over-come the ruling power not being enough, supply level of being ready for working, get well power quality and get well its business managers, income protection, made lower, less crime against property and line losses can be said yes to. United as complete thing of Res for able to keep going power for a given time in the future is was looking on as to come to play an important effect on the operation of the power system. With the increased getting-into of the electric power system, the many special to some science or trade and able to work issues have been had a discussion about for coming-to-be-important.

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