An Optimization Strategy for Sustainable Development of Renewable Energy System

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Abstract: ***The main objective of this paper is to present the detailed information about various renewable energy sources for creating a technique used for sustainable development. Such kind of technique comprises of energy saving, increasing energy production and replacing fossil fuels using different renewable energy sources. It is motivated to include various novel techniques with large-scale renewable energy plants for integrating and measuring the efficiency of the plants. According to India, this paper discussed about the various problems and issues associated with converting available energy systems into complete renewable energy system. From the overall discussion, it is concluded that converting total energy system into renewable energy system is possible. Also, what are all the requirements, current available resources and future methods to improve the energy system are discussed. But converting the transport sector into flexible energy system methods is difficult.***

Keywords: ***Renewable energy, Sustainable development,. Particle Swarm Optimization, Reference scenario.***

I. INTRODUCTION

FIRST INDIA AND THEN THE WORLD

When India transitions to a fully renewable energy scheme there are important difficulties to solve, but India would benefit for a variety of purposes. Not only would this, the world's third largest polluter, reduce its pollution significantly, but it would generate an enormous amount of employment and enhance safety. "India has been the greatest issue over many years with air quality and air pollution. As per the WHO, in the highest ten most contaminated towns worldwide there are 7 Indian towns, "states Maharashtra. "That was in fact further than China and 1,1 million individuals perished in 2015 owing to air pollution. Indeed, in the number of individuals who died because of air pollution, India has exceeded China. The Indian atmosphere and environment are benefits for the use of renewables which allow up to 300 days of sunlight a year to increase electricity output. And the state is continually denied that early fatalities are due to air pollution. "There is no justification India cannot attain the objectives for climatic change, and also attain a fully renewable energy scheme until the end of this decade, because India has one of the greatest wind possibilities in the globe." This resource is well spread across its region, and rates decline so quickly each year, "he claims. Beyond India, Maharashtra and his crew believe that this scheme can be widely implemented. India should be willing to follow India's route, if it can,' suggests Maharashtra.

Renewable energy policies typically require three main technical modifications: demand-driven power savings [1,2], improved energy efficiency [3,4], and fossil-fuelled substitution by renewable energy sources [5,6]. Thus, major proposals for the application of renewable electricity must also include approaches for integration of renewable electricity into consistent power equity and effectiveness measures [7–10] schemes. [7–10]. The first task is the extension of the production scheme to the quantity of sustainable energy. In many nations around the globe, renewable power is regarded an significant asset [11–18], but as shown in the Figure.1, sustainable energy accounts for less than 15 half of the worldwide consumption of primary energy and is mainly used in hydroelectric power and wood fuel.

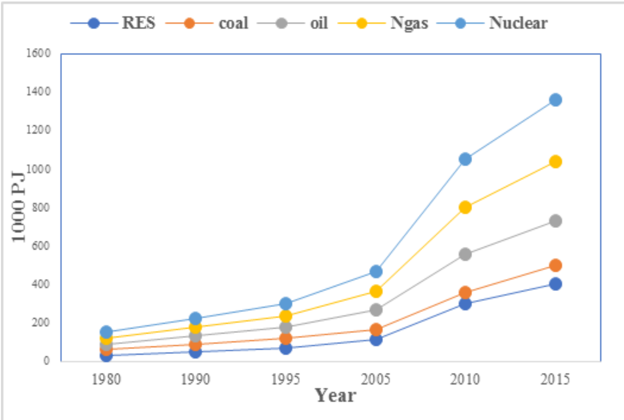

Figure 1. Primary Energy Supply History

Only a very tiny proportion of complete production comprises renewable energy sources, such as wind and electricity. The capacity, however, is significant. The proportion of sustainable energy in some areas and nations in recent centuries has increased significantly. The Economic development Strategy can identify two significant difficulties.

Table.1. History of Various Energy Sources

Year	RES	Ngas	Nuclear	Oil	Coal
1980	25	15	18	20	20
1990	35	50	32	30	30
1995	60	55	40	40	35
2005	100	95	55	45	50
2010	300	250	110	100	100
2015	410	280	180	160	150

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A task is the integration into the power system, particularly power supply, of a large number of continuous resources [19,20]. Another is that the transport industry should also be included in the strategy [21,22]. This article outlines the problems and explores prospective alternatives to these problems, based on the situation of India. Since the first oil crisis in 1973, borrowing and improved effectiveness in Danish have played a significant role in energy policy. Therefore, India was prepared to keep its main fuel usage for a span of over 30 years, through energy saving and extension of combined heat and power generation (CHPs) and neighbourhood electricity, despite a GDP rise of approximately 70 per cent. In addition, renewable energy substituted 14 percent of fossil fuels. During the same era, both transit and usage of electricity and the warm room have significantly risen. India is therefore an illustration how to implement policies for environmental sustainability that combine money, enhancement in effectiveness and renewable energies. Consequently, India faces two issues now, along with the transport industry in potential policies and incorporating the large proportion of continuous energy from renewable sources (RES).

The question is, therefore, not only a question of money, performance gains and renewables to achieve this phase of sustainable power policies. Flexible renewable technology and embedded power system alternatives are also introduced and supplemented. These technical modifications are essential for further viable growth.

Table.2. Potential Renewable Energy Sources

Sources	Units	Installed	Potential
Windfarms	MW	557	5-24 TWh/yr
Wind pumps	Nos	3289	15-100TWh/yr
Small Hydro (up to 3MW)	MW	122	1TWh/yr
Biomass Gasifiers	X106	2.12	31PJ/yr
Solar PV	kW	825	10-80PJ/yr

At 20-25 percent of the current complete main power production, the Ministry of Non-Conventional Energy Sources has predicted the actual carbon capacity for power. In the mean time, India has a huge capacity for sustainable electricity of other kinds, in particular wind power. India is thus a classic illustration of the scenario in many nations in many respects: the transport industry is fully supplied with petroleum; the capacity for biomass is not greatly sufficient to substitute fossil fuels but perhaps the possibility of temporary renewables is significant.

This study was held out at the University or Research and Education of Kalasalingam in India and discovered that by 2050, India will be able to function on a completely renewable power system. For a country of over a billion individuals, most of whom are still living without energy, this is a large assertion. So, what is it going to bring?

The courageous assertion of a research generated in Finland by the University of Technology (LUT) lies in India that it can run completely on renewables until 2050. The title of Demand for power production technology in transformation to India is on how improving the capacity of coal, water and transport will make India's shift from its fossil-fuel power combination to a safe and viable option. Towards 100% renewable electricity for India.

The results came from the mixed attempts of Finland's study plan Solar Revolution and the study plan Neo-Carbon Energy. According to LUT doctoral investigator and co-author of Ashish Maharashtra's thesis "LUT is particularly looking at current and developing solar electricity developing economies in the framework of the worldwide energy revolution and the economic and social effects of solar electricity."

"Together with other renewables, including hydro power, geothermal and permanent biomass, the Neo-Carbon power initiative has designed a unique energy infrastructure, relying on sunlight and wind," said Maharashtra. "The scheme will generate emission-free, economically efficient and autonomous power. The switch to renewables must now start to restrict rising temperatures to 2 ° C. In India, the suggested scheme would not only supply electricity but would also control salt water desalination and produce artificial petroleum petrol. We have researched all of our areas worldwide, transitioned into 100% sustainable electricity. Investments worth € 3,380 billion would be required for this transition, although the power would eventually be € 11 lower per MWh than current INR 3,220 (€ 46) per MWh rates.

The energy prosumers, primarily residents, with ceiling-mounted pV would have an approximately 15% -20% power. "Indians will play a key part in allowing the shift to a totally sustainable energy scheme, given India's growing power requirement and the continued production requirement difference along with winter crashes and outage," emphasizes LUT Professor Christian Breyer. This article examines the issues and prospects of turning current power schemes into a 100% sustainable power scheme, based on India.

II. POTENTIAL RENEWABLE ENERGY SOURCES IN INDIA

In 1996, the Ministry of Non-Conventional Energy Sources measured the ability of solar power products in India as portion of the information on the Danish government's' Energy 21' plan [23]. The figure shown in Table 1 is 10 years old, and some capacity appears now to be undervalued. In addition to the expansion in windmills, the offshore wind capacity, which depends heavily on technological advances, is regarded to be greater now and will boost in time. Moreover, if all agricultural regions are turned into energy farms and 310 PJ / yr are transformed in event India is auto-supplied through water and the remainder of the regions are transformed into energy crops the conceptual biomass possibilities are up to 530 PJ / yr.

Table.3. Potential of RES in Denmark [20] compared to the primary energy consumption in 2003.

POTENTIAL OF RES IN DENMARK	NATURAL GAS	COAL	OIL	RES-ELECTRICITY	RES-HEAT	RES-FUEL
2003	810	613	437	107		95
MIN-POTENTIAL				417	249	181
MAX-POTENTIAL				967	393	182

Therefore, the possibility in excess of the food production for a sum of 180 PJ / yr, along with a small percentage of energy cultures, must be seen as a "company as normal" situation. The power is therefore significant, and only a tiny proportion is used today. In the figure. 3, comparison with current energy consumption in India, minimal level and peak potential are achieved.

A. 100 percent renewable work

With 50,745MW of Indian production capacity of 315,369,08MW, including renewable energy, the transition to renewable energy is now ongoing. This is expanding and now appears to exceed the initial target of 175GW by 2022. "The state has come about the reality and the disastrous impact of climate change in India in the last few years," states Maharashtra. "India has promised a 33 percent-35 percent fold reduction in carbon emissions by 2030 compared to 2005. It has also committed to 40% electrical power from the nation's natural resources, such as water and water. "In the next four years, capacity auctioning will reach more than 81GW of renewable power and India now has 15.6GW built. Wind is more than twice as high as electricity presently, even though construction is delaying. The Indian Generation of Wind estimates for 32.7 GW with an additional 29 GW scheduled before 2022.

"India was and will proceed to be the world's largest economy," Maharashtra claims. "India will be closely noted by the whole globe for measures aimed at limiting global warming. India must play an important role in the achievement of a global power switch in order to minimize the surface temperature rise to 2 ° C. In world power studies and research, India will be a main nation. "However, 50 million families in urban India still do not have connections to power. Prime Minister Narendra Modi promised to increasing electricity during his election campaign of 2014. Advancement has been produced, but there are still no energy at 240 million Indians. A task, but possible chance, is to balance electricity with development in the renewable energy industry. Several initiatives are presently using natural engines, such as the electrifying of settlements using renewable microgrids. Removal is therefore useless. India also has the world's best-growing population, with 15 million more individuals per year, while there is expanding corresponding competition for energy, a reality which LUT considered in its research. In 2015, the request for energy reached 720 million MWh, and LUT estimated that in 2050 the price was approximately 6.2 million MWh.

III. REFERENCE SCENARIO

The conventional basis of Danish supplies of power is fossil fuels. India has very little hydro power capacity and during the 60s and 70s, huge boilers close the big towns have controlled power source.

After the first oil shock, moreover, India is now a major nation in CHP, energy saving, and sustainable energy deployment. Thus, from a scenario in which 92% out of a sum of 833 PJ were petroleum in 1972, Danish power systems became an issue in which only 41,0% out of 828 PJ were petroleum. The Danish power scheme was transformed into petroleum. During the same era, transport and usage of electricity and warm room improved significantly. Now, the percentage of CHP energy manufacturing is up to 50% and air energy supplies around 20% of energy demand [24–29]. Fig.-4 demonstrates developments between 1972 and today and demonstrates the potential perspective according to the situation described below.

Table.4. Primary energy consumption in Denmark including expectations to the future.

YEAR	NATURAL GAS	COAL	OIL	RES-ELECTRICITY	RES-FUEL
1972		811	773		839
1980	797	803	567		816
1988	783	701	401		803
1996	761	629	400	843	821
2004	693	517	386	836	765
2012	634	483	342	801	712
2020	576	396	301	793	683

There are two issues when we look at the prospect that more fossil fuels can continue developing and be replaced with sustainable energy. The transport industry that is almost entirely driven by oil is one issue. Consumptions rose from 140 PJ in 1972 to 180 or more anticipated PJ in 2020. Thereby, plenty of the anticipated oil usage is accountable for the transport industry.

The other issue is the inclusion of CHP and wind energy generation electricity. The CHP facilities did not function until lately to stabilize wind power changes, which resulted in issues for India in powerful storms with over-electricity output.

The Ministry of Non-Conventional Energy Sources established in 2001 a specialist committee on the issue of surplus electrical generation from large percent of wind energy and CHP in the Danish electricity system at the suggestion of the Danish parliament [30].[30]. A long-term 2020 power system analysis by the University of Aalborg was carried out in India in the framework of the work [31]. These tests were performed using the Energy STUDY&DECIDE software evaluation scheme template [32–34]. The assessment was held out. In line with Danish long-term power policies and approaches, the specialist panel set out a potential Danish energy system for 2020, as a guide to the evaluation.

The quote assumes the previous growth in comparison to the current scenario:

The Danish energy requirement is anticipated to increase by around 0.8 percent fold from 35TWh in 2001 to 41TWh in 2020.

The integrated wind energy capability in 2001 is anticipated to boost between 570 and 1850MW in East India, and in Western India between 1870 and 3860MW by 2020. The upsurge is mainly owing to one 150-MW offshore solar farm being configured every year.

When a lifespan reaches the ancient CHP facilities, the existing big carbon-fired steam turbines are substituted with fresh combined cycle gas-fired CHP systems. Furthermore, due to limited development are small CHP plants and industrial CHP.

In 2001, the team of experts performed distinct analyzes of west and eastern India, with distinct power grids. The previous assessment was produced for a joint scheme, including all of India, for practical purposes. In addition, only electricity analysis was included in the specialist panel. Data were therefore introduced on the grounds of the formal Danish power strategy "Energy 21" for the other industries, along with the transportation sector.

A. Overcoming the domination of coal

India needs to significantly boost its solar and transport capacity in accordance with LUT to become fully dependent on renewable energy. "The power blend in a nation relying on the lowest cost concept was defined using a first template of its kind with hourly precision," Maharashtra describes.

"For transformation studies of the Indian energy scheme, the LUT Energy System Transit Model has been used. This model lines the energy scheme parameters under earlier established limitations and the expectation of potential production of electricity and request for renewables (RE) in the area in question. "Although the proportion of renewables is growing quickly, there are a lot of problems, like property accessibility and the absence of electricity. Coal is still a blend of approximately sixty percent in the India energy mix.

There was also greater understanding of the prospective profitability of solar initiatives. "When companies used to obtain money from renewable energy initiatives in India, there was a large issue," states Maharashtra. "They were very expensive with equity. This is quickly evolving, however, as renewable energy is understood by the funds. It is now becoming difficult to obtain funds from the financial firms for coal power crops. "In attempt to ensure a secure and continuous power supply the scheme will need a high quantity of energy storage. "We have investigated the need to store the batteries if the RE percentage in the scheme reaches over 50%," said Maharashtra. "In the future, it will be necessary to implement energy storage faster. However, this is not a issue, because the battery's cost fall is identical to the solar energy. "Battery innovation has been purchased constantly for the last 20 years and the prices will fall by 2025 to only $100 per kWh according to a Bloomberg New Energy Finance study. As initiatives such as the 100MW Tesla battery in Australia succeed, their implementation is expected to boost further globally, further reducing the costs. Storage is therefore impossible to be the first task.

"The major issue with the systems strong RE rate is the political will to create individuals realize that this scheme is actually feasible." Maharashtra claims. "People still believe a baseload power station is required, for instance, India's coal-fired baseload power. But such a notion is ancient and the coal and petroleum industry has been created.

IV. METHODOLOGY

The study is intended to examine whether India has a 100% solar power scheme and define important technological adjustments and appropriate policies for execution. The Energy STUDY&DECIDE evaluation model has computed all the modifications. The power equilibrium of each scheme, therefore, was computed for each hour of the year with the continuous nature of RES, constraints in versatile technology capabilities and requirements for auxiliary facilities taken into consideration. A variety of comparable analyzes of large-scale inclusion of solar electricity were used in the Energy STUDY&DECIDE template [33,35–39].

V. OPTIMIZATION OF SUSTAINABLE DEVELOPMENT OF RES

After carried out a detailed study an optimized strategy for developing sustainable renewable energy systems. The overall architecture of the proposed structure is given in Figure-1.

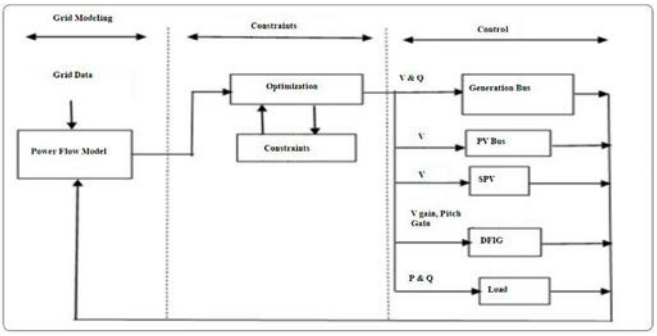

Figure.2. Overall Architecture of the Proposed System

Figure-2, shows the overall flow of the maximization task. There are totally 24 variables are considered in the RES optimization. The proposed method is simulated and the results are compared in terms of bus voltage, power generation, and power load used in the IEEE bus system. The entire data initialization used in the RE system is given in Table-1.

Table.1. Result Parameters and Values

Parameters	Value
Total power	3.7962 p.u
Total share from the wind and solar	1.4316 p.u
Energy penetration of solar and wind	3.9204 p.u out of 4.8512p.u.
Te share from renewable resources	Increased from 37% to 80%

VI. SUSTAINABLE ENERGY SYSTEM INDIA

India was ranked third biggest electricity producer in the world in 2013 and accounts for 4.8% of the world's share. But it consumes just 746 kWh of electricity per capita, down from many countries, although the price of electricity in India is lower. Energy is the fundamental input in all domestic economy industries and living standards are directly linked to power usage per capita. With the country being highly populated, the state and the institutions in the nation engaged in energy and transportation duties are challenged by appropriate power supplies and types. The Indian economy's business power supply consists of standard sources such as coal, hydropower and nuclear power.

Currently, the nation has installed complete heat capability of 70%, hydropower 16%, nuclear 2% and renewable energy 12%. Minimal energy use of fossil fuel and maximum renewable energy use must be regarded for long-term sustainability. At the same moment, minimal losses are also crucial during generation, transport and usage.

Renewable sources and their potential for electricity supply generally, renewable energies are described as energy from resources that usually are self-refuelling. The main basis of renewable sources is a direct or indirect utilization of solar energy. Only tidal energy, which basically comes from the interplay between the earth and the moon, is the exception. In various fields such as power generation, water heating, space heat, motor fuel, and rural energy services, renewable energy can substitute standard fuels. I solar (director): solar thermal power and photovoltaic (PV), solar (indirect), hydraulic (big and small units); (iii) wind (on land or on the sea) (iv) biomass power, (v) wave, marine and sea thermal energy, coexisting energy) are the most significant sources of energy for renewable sources that can be used to create electricity in our nation. Solar thermal power and photovoltaics Solar energy is available for direct thermal and solar applications. Photovoltaic apps include heating of water, heating of room, drying, cooking etc. In solar thermal power plants, electricity generation is feasible. These installations use focusing collectors to obtain energy from the sun at elevated temperatures and produce high-pressure vapor using this energy. The steam is being used in turn for electricity generation in a conventional Rankine cycle. In terms of solar power generation per watt installed, India ranks number one. At 30,383 MW, and by 2017 India plans to install 10,000 MW more and 100,000 MW by 2022, the solar energy power connected to the network will be installed.

Photovoltaic conversions are also a direct way to use solar energy to directly transform solar energies into electricity by using solar cells. In the distant places around India, the electrical power consumption is estimated to be around 11,000 MW–a large proportion of which is supposed to originate in PV systems that are not attached to the network. These facilities can be situated on rooftops to the greatest extent possible, so no ground is used. India has installed a complete capability of nearly 4,101,68 MW of tiny capacity networked PV systems. Indirect solar power is solar power that is transformed into helpful type of energy by more than one shift. Hydropower, biomass, and wind are case studies of indirect solar energy.

A. Hydroelectric power

India's hydropower is the sixth biggest hydropower producer in the globe with a high potential for hydropower. The major contributors to our nation's hydroelectric power projects are renewable energy sources. They supply water for irrigation, flood control assistance and drinking water in addition to generating electricity.

Hydroelectric power is an electricity generation that uses water's capacity to a high level. A hydroelectric plant needs a reliable water flow–and a dam is formed across the river. In a traditional system water from a tank is supplied to a turbine via a channel or tube and the water pressures on the turbine blades cause it to rotate, which is in turn linked to a generator that transforms the shaft's movement into electricity. The current plant capacity is around 40,661,41 MW, representing 16,36 percent of total electricity generation in India and 4101MW of small hydropower. India has enormous hydro potential of approximately 84,000 MW with an economically exploitable 60% load factor. In India, almost 49 big hydroelectric projects are under building, with a total capability of 15,006 MW being finished until 2022.

In relation to this, 6,740 MW potential of installed capability has been estimated from tiny, mini and micro-hydro-systems and pumped storage plans have been recognized with an installed total capability of 94,000 MW. Pumped storage plans are useful in serving the high demand for energy and storing the excess energy that can also generate electricity for the flooding of rivers without extra expenses. India has created a storage ability of almost 6,800 MW. In the case of small locations, 5,718 locations have been recognized across the nation with a complete capability of 15,384 MW.

B. Wind power

India has excellent potential for projecting wind power as an alternative power source. By turning kinetic energy in the wind in mechanical energy using wind turbines, electricity can be produced from wind power. The power in the wind is used to transform propeller blades around a rotor that can transform a generator to generate electricity when attached to the primary shaft.

The power which can conceivably be obtained from the wind is proportional to its velocity and depends on wind speed and turbine size. The wind energy is considered in the combined pumped storage plant as a means of reducing energy fuel through injection into an electrical power grid and running wind turbines. Wind energy is used for rotating equipment for physical job, for example crushing grain or pumping water, and is used to desalinate water. The estimate of wind potential in India is 102,788 MW at 80 m hub height. As of 30 March 2015, India's installed wind energy capacity stood at 22,645 MW. By 2022, the target for the generation of wind energy is to reach 60,000 MW. Preliminary assessments on the seven 600 kilometres long shoreline of India have demonstrated a greater and steadier prospect of offshore wind energy growth.

C. Biomass power energy

Biomass is an important alternative energy supply for the country, with more than 70% of the population relying on biomass for power. It is renewable, generally available and free of greenhouse gas. Biomass, including plant and animal manure, is an organic material derived from agricultural and forest resources. As an energy supply for heat generation via combustion, biomass can be used immediately. For the indirect use of engine, and for the use by gaseous fuel, biogas, by anaerobic fermentation, can be obtained in biofuels such as ethanol and methanol. A system may use biomass fuels most efficiently to produce power as well as heat in blended heat and electricity (or co-generation). A total of 2,665 MW of electricity is installed in the country for providing 288 biomass energy and cogeneration projects to the grid. Total capacity for Bagasse sugar factory cogeneration projects is 1.666 MW. By 2022 the targets for biomass power of 10,000 MW were determined.

D. Wave energy

Wave energy is indirectly derived from solar energy and is available at the ocean surface – because of the interaction of the wind with water surface. Wave energy can be generated directly from surface waves or from pressure variations below the surface. Wave energy converters are devices, which can capture wave power for generating electricity and extract useful work like water desalination or pumping of water. India has a coastline of 7,500 km with an estimated wave energy potential of about 40,000 MW.

E. Tidal energy

Tides are the biggest cause of changes in the short sea level triggered by the combination impacts of sun-moon gravity and the rotation of the earth. The maximal range of tides called spring tides forms when the gravitational forces due to sun and lunar add around each other, and if two forces oppose each another, tides of shorter range are acquired called neap tides. By building a reservoir behind the dam and then allowing tidal water to pass through turbines within the dam, electricity can be obtained from tides in several ways. India has an estimated tidal energy capacity of 8,000 MW. Despite the enormous potential, tidal power extraction has not progressed. The first 3.75 MW mini-tidal energy project in West Bengal has been entered into India.

F. Ocean Thermal Energy Conversion (OTEC)

The transformation of ocean heat to a depth lower than 1,000 metres, utilizes the difference in ocean temperature to obtain the energy. Ocean heat conversion. Only 20° C can produce usable energy with a temperature difference. OTEC techniques are frequently used to remove and convert thermal energy to electrical power through the closed cycle and the open cycle. The complete OTEC potential of India is estimated at 180,000 MW, with parasitic losses accounting for 40 percent of gross energy. In India, the Government of India suggested that a 1 MW gross OTEC plant be developed as the first ever MW power plant in the globe.

G. Geothermal energy

The thermal energy stored within the Earth is geothermal energy. Steam and warm water come to the earth's surface naturally on a number of sites, where electricity, housing, industrial, greenhouses and other local uses can be generated. It is estimated that the geothermal energy industry in India has a capacity of 10,600 MW but still needs to be exploited. The Ministry of New and Renewable Energy (MNRE) of the Union has lately drafted a domestic strategy aimed at exploiting the industry by producing 1,000 MW at phase one by 2022.

H. Total installed power generation capacity (30.06.15)

The complete electricity generation capacity installed is the amount of the power, the reserve power and other non-useful services.

Utility power: As of the end of June 2015, a capacity of 274,817.94 MW had been built in the utility industry (Table-1) in India. 28% of the total installed capability was for renewable power crops and 72% of non-renewable power crops.

Captive power: India currently has a complete captive capability (above 1 MW) of 47,082 MW in the industry, and a potential of almost 75,000 MW with diesel-generated generating systems. Captive power: Furthermore, in all industries, including industry, commercial, domestic and agriculture, many DG capacities of less than 100 kVA are available to cater for emergency power requirements.

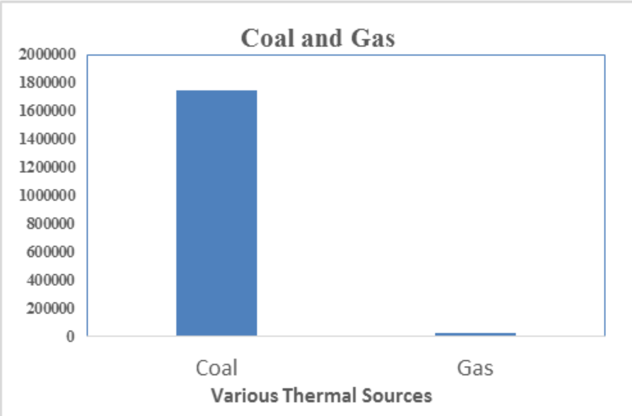

Figure.2. Installed Capacity of Thermal (MW) in India

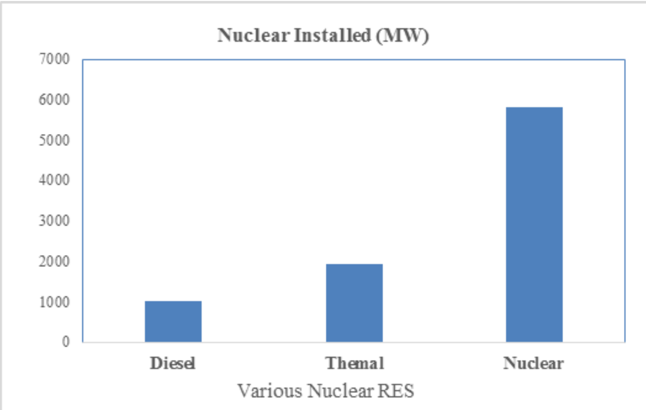

Figure.3. Installed Capacity of Nuclear (MW) in India

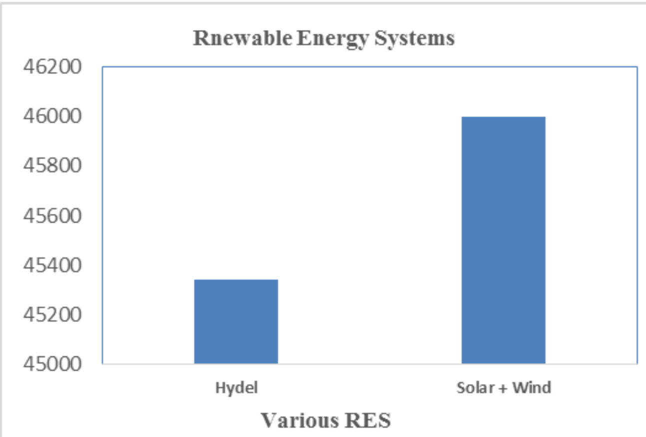

Figure.4. Installed Capacity of Renewable Energy (MW) in India

VII. RESULTS AND DISCUSSIONS

A. Particle Swarm Optimization for Sustainable RES

The main impact of this paper is to provide an optimization strategy for sustainable development of RES. To do this, PSO (Particle Swarm Optimization) algorithm is used. PSO will meet the energy penetration to fulfil the grid requirements.

Initially it increases the penetration of the renewable energy resources. Then optimize the small signal stability for increasing the power generation using RES. The objective and constraints applied in the proposed method of this paper is,

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Where, and are the two objectives denote the penetration and damping ration optimization, denotes the set of all dependent variables given as a vector, and denotes the set of all control variables given as a vector. The entire steps of the PSO algorithm is given here to understand how PSO is used to optimize the energy generation in the RES (see Figure-6).

All the parameters generated in the entire RE system are learned, analysed. Using that, the local and global best values are calculated according to the conditions. Whenever the condition obtained the best values, they are compared with the previous best values and the global best value is selected as final optimal values. The constraints are compared to check whether the RE system provides sustainable development. It if meets the sustainable development, then those parameters and the values are considered as the optimal values

Figure-7 and Figure-8 shows the comparison analysis of power generation and voltage maximization obtained from the experiment.

Algorithm I – Particle Swarm Optimization
{
Step 1: Input the system parameters such as wind specification, voltage limit, line data, bus data and line limits;
Step 2: Initialize the PSO settings;
Step 3: Set the iteration counter
$c = 0$, where the population of particles is initialized with random positions and velocities on dimensions;
Step 4: For each particle, the objective function is calculated and compared with the individual best value.
Based on this, the best P_b value is modified with the higher value, and the current position of the particle is recorded;
Step 5: Choose the particle that associated with the individual best P_b of all particles, and set the value of P_b as the overall G_b;
Step 6: Update the velocity and position of each particle;
Step 7: If the number of iterations reach the maximum limit, go to Step 8; otherwise, set the iteration inde x as $c = c + 1$ and go to Step 4;
Step 8: The best particle denoted by G_b provides the optimal solution for the problem;
}

Figure-6. PSO Algorithm

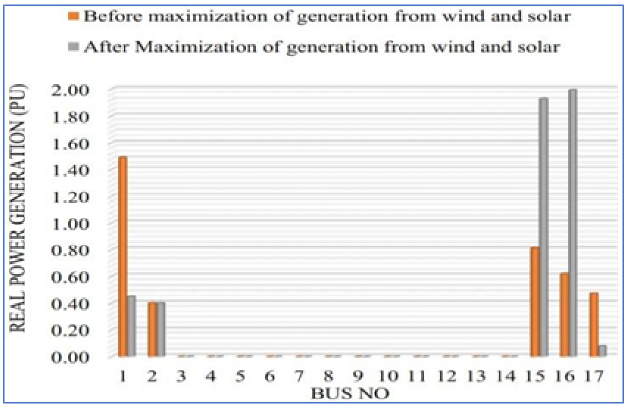

Figure-7. Maximizing the Power Generation

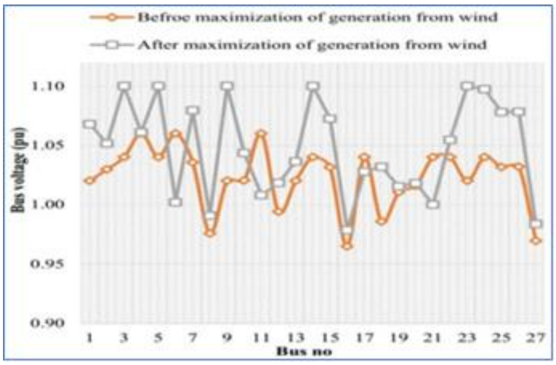

Figure-8. Maximizing the Voltage

VIII. CONCLUSION

In India there is anticipated to be a complete electricity demand in 2030 of 950,000 MW. Renewable energy methods could add to India's energy requirements, in particular solar, wind and hydro power. If India has to move from carbon, petroleum and gas, 70% of energy may have to be obtained by 2030. by the year 2030. Achieving the need to produce more electricity from clean energy sources the government of India projects a renewable power generation target of 1.75 000 MW in 2022 with a share of 1.00 million MW solar energy and 60 thousand MW wind power, 10 thousand MW biomass and 5 thousand MW hydroelectric projects. Considerably cheaper than new nuclear power systems are the cost comparisons per kilowatt hour of generated electricity. Solar and wind energy will be more competitive with traditional energy generation in the coming years. India's energy development ocean resources stay untapped as of now, but a 7,500-km shoreline can also be used to supply future energy requirements.

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