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| **Various Renewable Energies and its Statistical Impact in India** |
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***Abstract – Due to rapid growth in industrialization and population, demand of power is also increases in an alarming rate. So to compensate the power requirement man always depends upon various sources of energy. Basically due to huge availability and lack of advance technology we were depends upon on various fossil fuels as a primary energy source up to twentieth century without considering it's hazardous effects. But at present the reserve of these fuels are come to an dangerous level also with their huge utility they provides a very poisonous environment and creates number of ecological imbalances.***

***Due to these above reasons now we are searching for various energy sources which are in renewable in nature and provide a cleaner environment after its use, thus these are may also called as "Green Energy". Various major renewable energy sources are found from research and explorations are Solar, Wind, Hydro, Geothermal, Tidal and number of these which are underdeveloped stages. By this report we try to focus the generation of various forms renewable energy throughout the country and provide a clear comparison between the development of renewable energy sources over conventional energy utilization by collecting various data's from various sources.***

Introduction

 As we know, sun is prime sources of energy for all leaving object in universes. so, it is taken as the main energy source in nature. But, due to insufficient technological advances we are unable to convert whole amount of solar energy comes from the sun to our utility apart from that scientists are exploring various others forms of renewable energy such as Wind, Hydro, Geothermal, Tidal, Biomass etc. These energies are explained in the later stages one by one.

1. *Fossil Fuel Power Plants*
	1. *Coal Based*

 Coal is the most abundant [fossil fuel](http://en.wikipedia.org/wiki/Fossil_fuel) on the planet. It is a relatively cheap fuel, with some of the largest deposits in regions that are relatively stable politically, such as [China](http://en.wikipedia.org/wiki/China), [India](http://en.wikipedia.org/wiki/India) and the [United States](http://en.wikipedia.org/wiki/United_States). Coal power, an established electricity source that provides vast quantities of inexpensive, reliable power has become more important as supplies of oil and natural gas diminish. In 1995, Coal burning produced about 55% of the electricity generated India. In most coal fired power plants, chunks of coal are crushed into fine powder and are fed into a combustion unit where it is burned. Heat from the burning coal is used to generate steam that is used to spin one or more turbines to generate electricity.

 *a.1.1 Major Causes due to utilization of coal*

* + Coal mining causes severe erosion, resulting in the leaching of toxic chemicals into nearby streams and aquifers, and destroys habitants.
	+ About two-thirds of sulfur dioxide, one-third of carbon dioxide emissions and one quarter of the nitrogen oxides emissions in the U.S. are produced by coal burning.
* Coal burning also results in the emission of fine particles matter into the atmosphere. Nitrogen oxide and fine airborne particles exacerbate asthma, reduce lung function and cause respiratory diseases and premature death for many thousands of Americans.
* Smog formed by nitrogen oxide and reactive organic gases causes crop, forest and property damage. Sulfur dioxide and nitrogen oxides both combine with water in the atmosphere to create acid rain. Acid rain acidifies the soils and water killing off plants, fish, and the animals that depend on them.
* Global warming is mainly caused by carbon dioxide emissions and is responsible for at least half of the warming.

*Table a.1.2 Major Coal Fired Power plants in India [1,2,5,6,7]*

| *POWER PLANT* | *STATE* | *CAPACITY (MW)* |
| --- | --- | --- |
| *Chandrapur* | *Maharashtra* | 2,340 |
| *Neyveli* | *Tamil Nadu* | 2,280 |
| *Vindhyachal* | *Madhya Pradesh* | 2,260 |
| *Korba STPS* | *Chattisgarh* | 2,100 |
| *Ramagundam* | *Andhra Pradesh* | 2,100 |
| *Singrauli* | *Uttar Pradesh* | 2,050 |
| *Talcher* | *Orissa* | 1,970 |
| *Anpara* | *Uttar Pradesh* | 1,630 |
| *Farakka* | *West Bengal* | 1,630 |
| *Obra* | *Uttar Pradesh* | 1,550 |
| *Tuticorin* | *Tamil Nadu* | 1,550 |
| *Raichur* | *Karnataka* | 1,470 |
| *Wanakbori* | *Gujarat* | 1,470 |
| *Kolaghat* | *West Bengal* | 1,260 |
| *Ropar* | *Punjab* | 1,260 |
| *Vijayawada* | *Andhra Pradesh* | 1,260 |
| *Kothagudem* | *Andhra Pradesh* | 1,180 |
| *Trombay*  | *Maharashtra* | 1,150 |
| *Satpura* | *Madhya Pradesh* | 1,143 |
| *Koradi* | *Maharashtra* | 1,100 |
| *Rihand* | *Uttar Pradesh* | 1,000 |
| *Simhadri* | *Andhra Pradesh* | 1,000 |
| *Suratgarh* | *Rajasthan* | 1,000 |
| *Nasik* | *Maharashtra* |    910 |
| *Gandhi Nagar* | *Gujarat* |    870 |
| *Guru Hargobind* | *Punjab* |    860 |
| *Tau Devi Lal* | *Haryana* |    860 |
| *Kota* | *Rajasthan* |    850 |
| *Ukai* | *Gujarat* |    850 |
| *Dadri*  | *Uttar Pradesh* |    840 |
| *Kahalgaon* | *Bihar* |    840 |
| *Khaperkheda* | *Maharashtra* |    840 |
| *Korba West* | *Chattisgarh* |    840 |
| *Mettur* | *Tamil Nadu* |    840 |
| *Sanjay Gandhi* | *Madhya Pradesh* |    840 |
| *Unchahar* | *Uttar Pradesh* |    840 |
| *Bokaro* | *Jharkhand* |    805 |
| *Patratu* | *Jharkhand* |    770 |
| *Chandrapura* | *Jharkhand* |    750 |
| *Angul Smelter* | *Orissa* |    720 |
| *Badarpur* | *Delhi Territory* |    720 |
| *Parli* | *Maharashtra* |    690 |
| *Bakreshwar* | *West Bengal* |    630 |
| *Mejia* | *West Bengal* |    630 |
| *North Chennai* | *Tamil Nadu* |    630 |
| *Renusagar \** | *Uttar Pradesh* |    619 |
| *Dhuvaran* | *Gujarat* |    534 |
| *Bandel* | *West Bengal* |    530 |
| *Budge Budge* | *West Bengal* |    500 |
| *Dahanu* | *Maharashtra* |    500 |
| *Bhusawal* | *Maharashtra* |    483 |
| *Santaldih* | *West Bengal* |    480 |
| *Ennore* | *Tamil Nadu* |    450 |
| *Sabarmati* | *Gujarat* |    450 |
| *Harduaganj* | *Uttar Pradesh* |    440 |
| *Tanda* | *Uttar Pradesh* |    440 |
| *Ib Valley* | *Orissa* |    420 |
| *Rayalaseema* | *Andhra Prdesh* |    420 |
| *Tenughat* | *Jharkhand* |    420 |
| *Durgapur* | *West Bengal* |    405 |
| *Korba East* | *Chattisgarh* |    400 |
| *Durgapur DVC* | *West Bengal* |    350 |
| *Barauni* | *Bihar* |    310 |
| *Amarkantak* | *Madhya Pradesh* |    300 |
| *Bokaro Works \** | *Jharkhand* |    287 |
| *Panki* | *Uttar Pradesh* |    279 |
| *NTPC BALCO* | *Madhya Pradesh* |    270 |
| *Rourkela Works*  | *Orissa* |    269 |
| *Torangallu Works*  | *Karnataka* |    260 |
| *Neyveli Zero* | *Tamil Nadu* |    250 |
| *Surat* | *Gujarat* |    250 |
| *Indraprastha* | *Delhi Territory* |    248 |
| *Bongaigaon* | *Assam* |    240 |
| *Sikka* | *Gujarat* |    240 |
| *Titagarh* | *West Bengal* |    240 |
| *Jamshedpur Works*  |  *Jharkhand* |    238 |
| *Vizag Steel Works*  | *Andhra Pradesh* |    236 |
| *Cossipore* | *West Bengal* |    225 |
| *Muzaffarpur* | *Bihar* |    220 |
| *Paricha* | *Uttar Pradesh* |    220 |
| *Kutch* | *Gujarat* |    210 |
| *Faridabad* | *Haryana* |    165 |
| *Mulajore* | *West Bengal* |    150 |
| *Durgapur Works*  | *West Bengal* |    140 |
| *Rajghat* | *Delhi Territory* |    135 |
| *Southern* | *West Bengal* |    135 |
| *Raigarh Works \** | *Madhya Pradesh* |    112 |
| *Choudwar* | *Orissa* |    108 |
| *Nagda Works \** | *Madhya Pradesh* |    106 |
|  | TOTAL | 35,753 |

* 1. *Oil Based*

 In many power plants runs on Diesel oil because of their low cost and less emissive contribution as compared to coal based power stations.

*Table a.2.1 Major Oil Fired Power plants in India[8]*

|  |  |  |
| --- | --- | --- |
| *POWER PLANT* | *STATE* | *CAPACITY (MW)* |
| *Chennai Vasavi* | *Tamil Nadu* |    200 |
| *Whitefield Ind. Park* | *Karnataka* |    158 |
| *Yelahanka* | *Karnataka* |    132 |
| *Kozhikode* | *Kerala* |    128 |
| *Brahmapuram* | *Kerala* |    110 |
| *Samayanallur* | *Tamil Nadu* |    106 |
| *Samalpatti* | *Tamil Nadu* |    105 |
| *Tanir Bavi Barge* | *Karnataka* |    208 |
|  *Kovilkalappal* | *Tamil Nadu* | 108 |
|
| *Pampore* | *Jammu & Kashmir* | 175 |
| *South Bassein* | *Maharashtra* | 152 |
|   | TOTAL | 152 |

* 1. *Gas Based*

 Natural gases also take part in the generation of power in various gas turbine power plants. They are came into use from 2oth century because of their very less emissive effects. But since for high cost and low availability it is rarely used in power generation sectors.

*Table a.3.1* *Major Gas Fired Power plants in India[8]*

| POWER PLANT | STATE | CAPACITY(MW) |
| --- | --- | --- |
| *Uran* | *Maharashtra* |    912 |
| *Dahbol* | *Maharashtra* |    826 |
| *Dadri* | *Uttar Pradesh* |    817 |
| *Kawas* | *Gujarat* |    656 |
| *Auriaya* | *Uttar Pradesh* |    652 |
| *Paguthan* | *Gujurat* |    655 |
| *Gandhar* | *Gujarat* |    618 |
| *Hazira Essar* | *Gujarat* |    516 |
| *Faridabad NTPC* | *Haryana* |    430 |
| *Anta* | *Rajasthan* |    413 |
| *Kayamkulam* | *Kerala* |    349 |
| *Kondapalli* | *Andhra Pradesh* |    368 |
| *Pillaiperumalnallur* | *Tamil Nadu* |    330 |
| *Kathalguri* | *Assam* |    291 |
| *Vijjeswaran* | *Andhra Pradesh* |    272 |
| *Indraprastha GT* | *Delhi Territory* |    282 |
| *Peddapuram* | *Andhra Pradesh* |    220 |
| *Godavari* | *Andhra Pradesh* |    210 |
| *Jegurupadu* | *Andhra Pradesh* |    205 |
| *Trombay* | *Maharashtra* |    180 |
| *Kochi-Kerala* | *Kerala* |    173 |
| *Hazira GSEG* | *Gujarat* | 159 |
| *Utran* | *Gujarat* |    135 |
| *Lakwa* | *Assam* |    120 |
| *Perungulam* | *Tamil Nadu* |    105 |
| *Vatwa* | *Gujarat* |    100 |
| *Baroda GIPCL* | *Gujarat* | 216 |
| *Hazira RIL* | *Gujarat* |    165 |
| *Jamnagar RIL* | *Gujarat* |    132 |
| *Basin Bridge* | *Tamil Nadu* |    124 |
| *Haldia Chemicals* | *West Bengal* |    104 |
| *Anola* | *Uttar Pradesh* |    100 |
|  |  Total |  1501 |

Besides all these above reputed and leading power stations data collected there are no of industries whose data are not taken into consideration due to un availability. But it is assumed that near about 8000 MW to 12000 MW of Fossil fuel energy are consumed in various industries throughout the country except power generation Purposes.

1. *Nuclear Power Plants*

 In India, Nuclear power holds the fourth position among the different resources of electricity, Thermal, hydro and renewable resources being first, second and third respectively. Presently 19 nuclear power plants in India are there, which generates 4,560 MW (2.9% of total installed base) and 4 such power plants are in the pipeline and would be generating around 2,720 MW. India's contribution in fusion development is done through its involvement in the ITER project. Rapid usage of Uranium deterioration of domestic uranium resources caused the decline of electricity production from nuclear energy in India by 12.83% during 2006 to 2008.

 But still there are some major Nuclear Power plants are working in India whose data are mentioned in the table below.

*Table b.1 Major Nuclear Power plants in India[20]*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Power station | Operator | State | Type | Units | capacity (MW) |
| [*Kaiga*](http://en.wikipedia.org/wiki/Kaiga_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Karnataka*](http://en.wikipedia.org/wiki/Karnataka) | [*PHWR*](http://en.wikipedia.org/wiki/CANDU) | 220 x 4 | 880 |
| [*Kakrapar*](http://en.wikipedia.org/wiki/Kakrapar_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Gujarat*](http://en.wikipedia.org/wiki/Gujarat) | [*PHWR*](http://en.wikipedia.org/wiki/CANDU) | 220 x 2 | 440 |
| [*Kalpakkam*](http://en.wikipedia.org/wiki/Madras_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Tamil Nadu*](http://en.wikipedia.org/wiki/Tamil_Nadu) | [*PHWR*](http://en.wikipedia.org/wiki/CANDU) | 220 x 2 | 440 |
| [*Narora*](http://en.wikipedia.org/wiki/Narora_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Uttar Pradesh*](http://en.wikipedia.org/wiki/Uttar_Pradesh) | [*PHWR*](http://en.wikipedia.org/wiki/CANDU) | 220 x 2 | 440 |
| [*Rawatbhata*](http://en.wikipedia.org/wiki/Rajasthan_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Rajasthan*](http://en.wikipedia.org/wiki/Rajasthan) | [*PHWR*](http://en.wikipedia.org/wiki/CANDU) | 100 x 1 | 1180 |
| 200 x 1 |
| 220 x 4 |
| [*Tarapur*](http://en.wikipedia.org/wiki/Tarapur_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Maharashtra*](http://en.wikipedia.org/wiki/Maharashtra) | *BWR  (PHWR)* | 160 x 2 | 1400 |
| 540 x 2 |
|  |  |  | **Total** | **20** | **4780** |

Beside these there are some number of power plants which are in under constructions are[21]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Power station | Operator | State | Type | Units | Capacity (MW) |
| [*Kudankulam*](http://en.wikipedia.org/wiki/Kudankulam_Nuclear_Power_Plant) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Tamil Nadu*](http://en.wikipedia.org/wiki/Tamil_Nadu) | [*VVER-1000*](http://en.wikipedia.org/wiki/VVER) | 1000 x 2 | 2000 |
| [*Kalpakkam*](http://en.wikipedia.org/wiki/Madras_Atomic_Power_Station) | [*Bhavini*](http://en.wikipedia.org/wiki/Bhavini) | [*Tamil Nadu*](http://en.wikipedia.org/wiki/Tamil_Nadu) | [*PFBR*](http://en.wikipedia.org/wiki/PFBR) | 500 x 1 | 500 |
| [*Kakrapar*](http://en.wikipedia.org/wiki/Kakrapar_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Gujarat*](http://en.wikipedia.org/wiki/Gujarat) | [*PHWR*](http://en.wikipedia.org/wiki/CANDU) | 700 x 2 | 1400 |
| [*Rawatbhata*](http://en.wikipedia.org/wiki/Rajasthan_Atomic_Power_Station) | [*NPCIL*](http://en.wikipedia.org/wiki/Nuclear_Power_Corporation_of_India) | [*Rajasthan*](http://en.wikipedia.org/wiki/Rajasthan) | [*PHWR*](http://en.wikipedia.org/wiki/CANDU) | 700 x 2 | 1400 |
|  |  |  | Total | 7 | 5300 |

1. *Renewable energy Power Plants*

*c.1 Solar Based power plants*

 Solar energy is one of a cleanest energy source at free of cost. In early days these energy was absorbed by the living bodies only. Due to rapid advances in technology various artificial solar energy absorbing techniques are generated now a day such as photo voltaic cells. [India](http://en.wikipedia.org/wiki/India) is densely populated and has high solar [insolation](http://en.wikipedia.org/wiki/Insolation), an ideal combination for using solar power in India. India is already a leader in [wind power generation](http://en.wikipedia.org/wiki/Wind_power_in_India). In the solar energy sector, some large projects have been proposed, and a 35,000 km2 area of the [*Thar Desert*](http://en.wikipedia.org/wiki/Thar_Desert)  has been set aside for solar power projects, sufficient to generate 700 [GW](http://en.wikipedia.org/wiki/Gigawatt) to 2,100 GW. Also India's Ministry of New and Renewable Energy has released various Policies by which the Government aims to install 10GW of Solar Power and of this 10 GW target, 4 GW would fall under the central scheme and the remaining 6 GW under various State specific schemes. Beside these major solar power plants data which collected from various sources are installed throughout the country is represented below.

*Table c.1.1 Major Solar Power plants in India[16,17]*

| Name of Plant | DC Peak Power | Location | State |
| --- | --- | --- | --- |
|  | (MW) |
| *Charanka Solar Park* |   214 | *Charanka village, Patan District* | *Gujarat* |
| *Mithapur Solar Power Plant (Tata Power)*  |   25 | *Mithapur* | *Gujarat* |
| *Waa Solar Power Plant (Madhav Power)*  |   10 | *Surendranagar* |  *Gujarat* |
| *Dhirubhai Ambani Solar Park* |   40 | *Pokhran* | *Rajasthan* |
| *Bitta Solar Power Plant (Adani Power)*  |   40 | *Bitta,**Kutch District* | *Gujarat* |
| *Mahindra & Mahindra Solar Plant* |   5 | *Jodhpur* | *Rajasthan* |
| *Rasna Marketing Services LLP* |   1 | *Ahmedabad* | *Gujarat* |
| *Sivaganga Photovoltaic Plant* |   5 |  | *Tamil Nadu* |
| *Kolar Photovoltaic Plant* |   3 |  *Yalesandra,Kolar District* | *Karnataka* |
| *Itnal Photovoltaic Plant*  |   3 | *Belgaum* | *Karnataka* |
| *Azure Power - Ahwan Photovoltaic Plant* |   2 |  | *Punjab* |
| [*Citra and Sepset Power Plants*](http://en.wikipedia.org/wiki/Solar_power_in_India#cite_note-28) |   4 |  *Katol* | *Maharashtra* |
| *Jamuria Photovoltaic Plant* |   2 |  | *West Bengal* |
| *NDPC Photovoltaic Plant* |   1 |  *Delhi* |  |
| *Thyagaraj stadium Plant*  |   1 | *Delhi* |  |
| *Gandhinagar Solar Plant* |   1 |  | *Gujarat* |
| *Tata Power* |   3 | *Mulshi* | *Maharashtra* |
| *Azure Power - Sabarkantha* | 10 | *Khadoda village* | *Gujarat* |
| *Moser Baer - Patan* | 30 |  | *Gujarat* |
| *B&G Solar Pvt Ltd*  |   1 | *Mayiladuthurai* | *Tamil Nadu* |
| *REHPL - Sadeipali* |   1 | *Bolangir* | *Orissa* |
| *Tata Power* |   1 |  *Patapur* | *Orissa* |
| *Orissa* |   9 | *Patapur* | *Orissa* |
| *Tata Power* |   1 | *Osmanabad* |  *Maharastra* |
| *Amruth Solar Power Plant*  |   1 | *Kadiri,* | *Andhra Pradesh* |
| *IIT Bombay* |   3 | *Gwal Pahari* | *Haryana* |
| *Chandraleela Power Energy*  |   0.8 | *Narnaul* | *Haryana* |
| *Green Infra Solar Energy Limited* |   10 | *Rajkot* |  *Gujarat* |
| *TAL Solar Power Plant*  |   2 | *Barabanki* | *Uttar Pradesh* |
| [*Numeric Power Systems*](http://en.wikipedia.org/wiki/Solar_power_in_India#cite_note-47) |   1 |  *Coimbatore* |  *Tamil Nadu* |
| [*Zynergy*](http://en.wikipedia.org/wiki/Solar_power_in_India#cite_note-48) |   1 |  *Vannankulam village, Peraiyur, Madurai district* | *Tamil Nadu* |
| Total | 363 |   |   |

 *c.2. Wind based power plants*

 The development of wind power in India began in the 1990s, and has significantly increased in the last few years. Although a relative newcomer to the wind industry compared with [Denmark](http://en.wikipedia.org/wiki/Denmark) or the [United States](http://en.wikipedia.org/wiki/United_States), [13-15]India has the fifth largest installed wind power capacity in the world In 2009-10 India's growth rate was highest among the other top four countries.

*Table c.2.2 Major wind Power plants in India [3, 4, 9, 10, 11,12]*

| Power Plant | State | Total Capacity (MWe) |
| --- | --- | --- |
| *Vankusawade Wind Park* | *Maharashtra* | 259 |
| [*Sipla[8]*](http://en.wikipedia.org/wiki/List_of_power_stations_in_India#cite_note-8) | *Rajasthan* | 102 |
| [*Samana[9]*](http://en.wikipedia.org/wiki/List_of_power_stations_in_India#cite_note-9) | *Gujarat* | 101 |
| [*Theni[10]*](http://en.wikipedia.org/wiki/List_of_power_stations_in_India#cite_note-10) | *Tamil Nadu* | 99 |
| [*Saundatti[11]*](http://en.wikipedia.org/wiki/List_of_power_stations_in_India#cite_note-11) | *Karnataka* | 84 |
| [*Khandke[12]*](http://en.wikipedia.org/wiki/List_of_power_stations_in_India#cite_note-12) | *Maharashtra* | 50 |
| [*Narmada[13]*](http://en.wikipedia.org/wiki/List_of_power_stations_in_India#cite_note-13) | *Andhra Pradesh* | 50 |
| [*Harapanahalli[14]*](http://en.wikipedia.org/wiki/List_of_power_stations_in_India#cite_note-14) | *Karnatka* | 40 |
| *Nuziveedu Seeds* | *Karnataka* | 50.4 |
| *Kayathar Subhash* | *Tamil Nadu* | 30 |
| *Ramakkalmedu* | *Kerala* | 25 |
| *Muppandal Wind* | *Tamil Nadu* | 22 |
| *Gudimangalam* | *Tamil Nadu* | 21 |
| *Puthlur RCI* | *Andhra Pradesh* | 20 |
| *Lamda Danida* | *Gujarat* | 15 |
| *Chennai Mohan* | *Tamil Nadu* | 15 |
| *Jamgudrani MP* | *Madhya Pradesh* | 14 |
| *Jogmatti BSES* | *Karnataka* | 14 |
| *Perungudi Newam* | *Tamil Nadu* | 12 |
| *Kethanur Wind Farm* | *Tamil Nadu* | 11 |
| *Hyderabad APSRTC* | *Andhra Pradesh* | 10 |
| *Muppandal Madras* | *Tamil Nadu* | 10 |
| *Poolavadi Chettinad* | *Tamil Nadu* | 10 |
| *Shalivahana Wind* | *Tamil Nadu* | 20.4 |
|  | Total  | 1084.8 |

*Table c.2.3 State wise wind Power Contribution*

|  |  |
| --- | --- |
| State | Capacity(MW) |
| [*Tamil Nadu*](http://en.wikipedia.org/wiki/Wind_power_in_India#Tamil_Nadu_.287134_MW.29) | 7134 |
| [*Gujarat*](http://en.wikipedia.org/wiki/Wind_power_in_India#Gujarat_.282.2C884_MW.29) | 2,884 |
| [*Maharashtra*](http://en.wikipedia.org/wiki/Wind_power_in_India#Maharashtra_.282310.70_MW.29) | 2310.7 |
| [*Karnataka*](http://en.wikipedia.org/wiki/Wind_power_in_India#Karnataka_.281730.10_MW.29)  | 1730.1 |
| [*Rajasthan*](http://en.wikipedia.org/wiki/Wind_power_in_India#Rajasthan_.282072_MW.29)  | 2072 |
| [*Madhya Pradesh*](http://en.wikipedia.org/wiki/Wind_power_in_India#Madhya_Pradesh_.28275.50_MW.29)  | 275.5 |
| [*Kerala*](http://en.wikipedia.org/wiki/Wind_power_in_India#Kerala_.2832_MW.29)  | 32 |
| [*Orissa*](http://en.wikipedia.org/wiki/Wind_power_in_India#Orissa_.282.0MW.29)  | 2 |
| [*West Bengal*](http://en.wikipedia.org/wiki/Wind_power_in_India#West_Bengal_.282.10MW.29)  | 2.1 |
| TOTAL | 16442.4 |

*c.3 Hydro Electric Power Plants*

 [India](http://en.wikipedia.org/wiki/India) was the 7th largest producer of hydroelectric power in 2008 after [Norway](http://en.wikipedia.org/wiki/Electricity_sector_in_Norway) and 3.5% the world total in 2008. The potential for [hydroelectric power](http://en.wikipedia.org/wiki/Hydroelectricity) in [India](http://en.wikipedia.org/wiki/India) is one of the greatest in the world. India is endowed with economically exploitable and viable hydro potential assessed to be about 84,000 MW at 60% load factor. In addition, 6780 MW in terms of installed capacity from Small, Mini, and Micro Hydel schemes have been assessed.

*Table c.3.3 Major Hydro Power Stations in India[18,19]*

| Station | State | Operator | Generatorunits | [Capacity (MW)](http://en.wikipedia.org/wiki/Megawatt) |
| --- | --- | --- | --- | --- |
| [Tehri Dam](http://en.wikipedia.org/wiki/Tehri_Dam) | Uttarakhand | [THDC India Ltd.](http://thdc.gov.in/) | 4\*250, 4\*100, 4\*250 | 2400 |
| [Srisailam Dam](http://en.wikipedia.org/wiki/Srisailam_Dam) | Andhra Pradesh | [APGenco](http://en.wikipedia.org/wiki/Andhra_Pradesh_Power_Generation_Corporation_Limited) | 6 × 150, 7 × 110 | 1,670 |
| [Nagarjunasagar](http://en.wikipedia.org/wiki/Nagarjuna_Sagar_Dam) | Andhra Pradesh | APGenco | 1 X 110, 7 X 100.8, 5 X 30 | 965 |
| [Sardar Sarovar](http://en.wikipedia.org/wiki/Narmada_Dam) | Gujarat | [SSNNL](http://www.ssnnl.com/) | 6X200, 5X140 | 1,450 |
| [Baspa-II](http://en.wikipedia.org/wiki/Power_%28Himachal%29) | Himachal Pradesh | [JHPL](http://en.wikipedia.org/wiki/Jaypee_Group) | 3 X 100 | 300 |
| [Nathpa Jhakri](http://en.wikipedia.org/wiki/Nathpa_Jhakri_Hydroelectric_Dam) | Himachal Pradesh | [SJVNL](http://sjvn.nic.in/aboutus_hydro_power.asp) | 6 X 250 | 1,500 |
| [Bhakra Dam](http://en.wikipedia.org/wiki/Bhakra_Dam) | Punjab | [BBMB](http://en.wikipedia.org/wiki/Bhakra_Management_Board_Karamchari_Sangh) | 5 X 108, 5 X 157 | 1,325 |
| [Dehar (Pandoh)](http://en.wikipedia.org/wiki/Dehar_Power_House) | Himachal Pradesh | BBMB | 6 X 165 | 990 |
| [Baira Suil](http://en.wikipedia.org/wiki/National_Hydroelectric_Power_Corporation#Hydro_Power_Stations) | Himachal Pradesh | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 60 | 180 |
| [Chamera-I](http://en.wikipedia.org/wiki/Chamera_Dam) | Himachal Pradesh | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 180 | 540 |
| [Chamera-II](http://en.wikipedia.org/wiki/Chamera_Dam) | Himachal Pradesh | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 100 | 300 |
| [Pong](http://en.wikipedia.org/wiki/Maharana_Pratap_Sagar) | Himachal Pradesh | BBMB | 6 x 66 | 396 |
| [Uri Hydroelectric Dam](http://en.wikipedia.org/wiki/Uri_Hydroelectric_Dam) | Jammu & Kashmir | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 4 X 120 | 480 |
| [Dulhasti](http://en.wikipedia.org/wiki/Dulhasti) | Jammu & Kashmir | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 130 | 390 |
| [Salal](http://en.wikipedia.org/wiki/Salal_Hydroelectric_Power_Station) | Jammu & Kashmir | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 6 X 115 | 690 |
| [Sharavathi](http://en.wikipedia.org/wiki/Sharavathi_River#Dams) | Karnataka | [KPCL](http://en.wikipedia.org/wiki/Karnataka_Power_Corporation_Limited) | 10 X 103.5, 2X27.5, 4X60 | 1,469 |
| [Kalinadi](http://en.wikipedia.org/wiki/Kali_River_%28Karnataka%29) | Karnataka | KPCL | 2X50, 1x135, 5X150, 3X50, 3X40 | 1,240 |
| [Linganamakki Dam](http://en.wikipedia.org/wiki/Linganamakki_Dam) | Karnataka |  |  | 55 |
| [Idukki](http://en.wikipedia.org/wiki/Idukki_Dam) | Kerala | [KSEB](http://en.wikipedia.org/wiki/Kerala_State_Electricity_Board) | 6 X 130 | 780 |
| [Bansagar Dam](http://en.wikipedia.org/wiki/Bansagar_Dam) | Madhya Pradesh |  |  | 425 |
| [Bargi Dam](http://en.wikipedia.org/wiki/Bargi_Dam) | Madhya Pradesh |  |  | 105 |
| [Madikheda Dam](http://en.wikipedia.org/wiki/Madikheda_Dam) | Madhya Pradesh |  |  | 60 |
| [Omkareshwar](http://en.wikipedia.org/wiki/Narmada_River#Narmada_river_development_.28NRD.29) | Madhya Pradesh | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 8 X 65 | 520 |
| [Indira Sagar](http://en.wikipedia.org/wiki/Indirasagar_Dam) | Madhya Pradesh | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 8 X 125 | 1,000 |
| [Loktak](http://en.wikipedia.org/wiki/Loktak#Loktak_Multipurpose_Project) | Manipur | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 35 | 105 |
| [Khuga Dam](http://en.wikipedia.org/wiki/Khuga_Dam) | Manipur |  |  |  |
| [Koyna](http://en.wikipedia.org/wiki/Koyna_Hydroelectric_Project) | Maharashtra | [MahaGenco](http://en.wikipedia.org/wiki/Maharashtra_State_Power_Generation_Company_Limited) | 4X70, 4X80, 2X20, 4X80, 4X250 | 1,960 |
| [Ghatghar Pumped Storage Scheme](http://en.wikipedia.org/w/index.php?title=Ghatghar_Pumped_Storage_Scheme&action=edit&redlink=1) | Maharashtra | [MahaGenco](http://en.wikipedia.org/wiki/Maharashtra_State_Power_Generation_Company_Limited) | 125 X 2 | 250 |
| [Mettur Dam](http://en.wikipedia.org/wiki/Mettur_Dam) | Tamil Nadu | [TNEB](http://en.wikipedia.org/wiki/TNEB) | 50 x 4 | 240 |
| [Mulshi Dam](http://en.wikipedia.org/wiki/Mulshi_Dam) | Maharashtra |  | 6 X 25 | 150 |
| [Jayakwadi Dam](http://en.wikipedia.org/wiki/Jayakwadi_Dam) | Maharashtra |  |  | 12 |
| [Rangeet](http://en.wikipedia.org/wiki/Rangeet_River) | Sikkim | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 20 | 60 |
| [Teesta-V](http://en.wikipedia.org/wiki/Teesta_River#Proposed_dams) | Sikkim | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 170 | 510 |
| [Tanakpur](http://en.wikipedia.org/wiki/Sarda_River#Development_Scenario.282.2C3.2C4.2C5.2C6.2C7_.26_8.29) | Uttarakhand | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 3 X 40 | 120 |
| [Dhauliganga-I](http://en.wikipedia.org/wiki/Dhauliganga_River) | Uttarakhand | [NHPC](http://en.wikipedia.org/wiki/NHPC) | 4 X 70 | 280 |
|  |  |  | Total | 22917 |

Also, 56 sites for pumped storage schemes with an aggregate installed capacity of 94,000 MW have been identified. It is the most widely used form of renewable energy. India is blessed with immense amount of hydro-electric potential and ranks 5th in terms of exploitable hydro-potential on global scenario. The present installed capacity as on 30-06-2011 is approximately 37,367.4 MW which is 21.53% of total Electricity Generation in India

*D. Comparison between various energy sources*

 Based upon the data available from different sources we analyze the production rates of different sources of energy in India. Thus, we establishes a relation between Renewable and Non renewable energy sources which is represented in the table and graph below.

*Table d.1-Comparison of Energy Sources*

|  |  |
| --- | --- |
| ENERGY SOURCES | Capacity(MW) |
| *Total Fossil* | 45,753\* |
| *Nuclear* | 10,080 |
| *Green Energy* | 39,722 |

*\* considering 10,000 MW by other fossil fuel sources*

**

Fig. : Generated Energy from Various Sources

*E. Conclusion and future scope*

 The above comparison represent that at present according to the data taken and avail from various sources, production of Non Renewable is higher as compared to Renewable energy one . So, still we require more advanced and efficient technology by which all sorts of renewable natural energy sources can be utilized up to its maximum extent by exploring and adopting these energies as a prime energy among all the available energy sources.

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