

# Wind Energy

Fahad Hamed Alghamdi

**Abstract:** The project demands Texas as deployment place where wind energy farm would establish and have chances of success ratio. The Wind energy has potentials and these can lower greenhouse gas emission from the environment. The potentials that can create benefit for population surely until 2020 and most probably until 2050. The climate is consistently devastating due to human activities. There is a consensus in U.S. department of energy about energy efficiency. Such energy can obtain by exploiting renewable energy sources mostly Wind. Wind energy is considered as more important as compared to other resources because wind energy is clean, vastly available, reliable and affordable. There are many projects under the consideration of the U.S. Department of energy including low, moderate and high wind speed areas. Further, onshore Wind energy projects are common and in action, now the concept of offshore Wind energy farms is getting pace in the U.S. as well.

**Key Terms:** Wind Energy, Turbine, Offshore and Onshore wind power, Low-frequency operations, Renewable resources, Megawatts (MW), Leveling costs of energy, Rotors, Decarbonization.

## 1. INTRODUCTION

Production of energy from wind energy is necessary because it is environment-friendly. The concept of wind energy production is increasing, and it will be one of important energy source in 2050. The concept of wind energy from offshore is growing in U.S. when the wind exerts focus on an object; it produces electricity by converting kinetic into mechanical energy. Selection of land is one of important consideration in wind energy, and it is an important, challenging factor in this kind of production. In wind energy production, transmission losses are common. Wind energy should include advanced technology to measure wind potential.

It argued by experts that efficient use of fossil fuel could reduce the need for any alternative in energy production. Wind convection also includes issues like the poor stability of the grid, low operations as per frequency, short circuits, and quality. The economic feasibility of wind energy project determines through financial analysts only. The entire cost of installing the wind energy project is there in detail. Installation of wind power included phases and at every phase, there are few issues discussed. If such issues can control, then it will be considered best alternative for producing electricity. There is the possibility that it will be future of electricity production. Texas is its best example.

My aim is to establish a wind energy project in Texas where I could find enough air for electricity generation. The question about why I go with wind energy plant specifically in Texas, US are due to the rising need of power for the people of Texas. My thoughts about this wind energy electricity generation plan are crucial and needed one for the people of the Texas due to their increased needs of power. Texas is the best place for such a project because Texas is already being served by 40 different wind projects

in the form of 12,212 MW. Texas is the largest producer of wind energy in United States. The wind energy boom in Texas is due to the Renewable Portfolios Standards of the State government. There are 80,000 windmills working in the Texas area. The cost charged regarding royalties would be around \$ 3,000 to \$5,000 for each turbine in one year according to US Government Accountability Office for land acquired. There would be \$30 / MWh costs charged for government or customers.

I have included structure of wind turbine and its working in this project. About 15 different components help wind turbine to produce electricity. Energy production using gas and coal are increasing pollution. Wind energy is the solution to this problem. For the perspective of success, I would like to initiate wind energy plan in Texas.

What causes wind energy is real time evaluation of any initial process. The wind is just a simple motion of air. This movement is so large in intensity that it can move big wind turbine. The wind can cause under different heating conditions on earth. The air of land contains different temperature as compared to the wind at an ocean. This difference is glaring and produces wind energy at different rates. Daily wind cycle causes uneven heating patterns. Due to these various models, the wind can become a source of energy and nations are exploiting it known as wind energy now a day [1].

Global standardization should be applied for installing wind power plant. Regional technicalities differ in U. S. for

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[1] Antonio, J., C., O. A., Ange, O., & Costa, M. (2010). New procedure for wind farm maintenance. *Industrial Management & Data Systems*, 110(6), 861 - 882.

different states. The climate directly effects on wind energy. Wind energy is not considerable in some regions. Climate can be a positive and negative point of producing electricity through the wind in few regions. One mentioned development in technologies for installing wind energy projects. Power capacity should be developed first. In the United States, power capacity has been increased. Now, wind energy is produced in a different way as compared to the previous production. This is due to advancement in technology. Technology is now shifted towards the computer.

Due to changes in technology status of producing the wind, the best alternatives may be available in coming years. There is design requirement by considering requirements for onshore and off shores. Offshore power is concluded to be more efficient. Sustainability of environment is an important issue in onshore power despite having many advantages. It is necessary to establish standards of wind projects. Experts were met in Australia for discussion international standards for wind energy. There are many issues in wind projects despite having many advantages.

### 1.1 What Is Wind Energy?

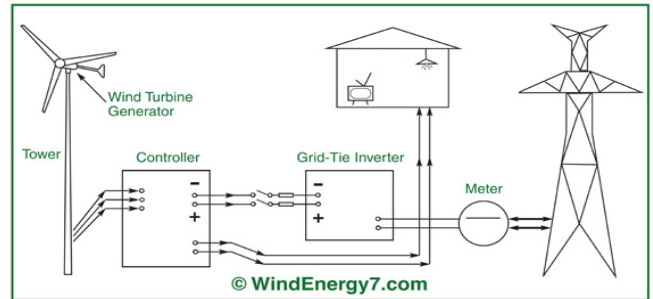
When the wind, which is abundant in the environment, got an object then it exerts a force upon it, to rotate it. The wind energy in such engagement converts on that object and kinetic energy changes to mechanical and then mechanical are being converted into electric one. The wind turbine is the main primary system that is being used to complete such task [2].

### 1.2 How Is Electricity Generated From Wind?

The wind turbine just works as the fan but in opposite way. For example, the fan uses electricity energy to make the wind in a room. A wind turbine uses kinetic energy to convert into mechanical and then ultimately in the electric one. The wind causes to move blades directly attached to the shaft. When shaft starts moving with vital force then

working a generator are about to initiate and here is electricity [3].

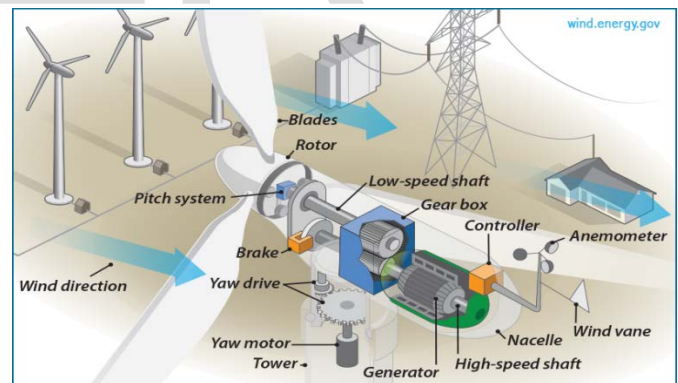
## Grid-Tie Wind Turbine Systems



### 1.3 What is inside a wind turbine?

There are about 15 different types of component in wind turbine including Rotor, Blades, Generator, and Tower. Rotor provides strength to rotate blades. The role of the brake is explicit because brakes apply when something is wrong with the wind turbine. The immediate brake can cause less loss rather continue in the worst situation.

The low-pressure shaft is adjacent with small cogwheel as well as big one. Small Cogwheel is moved faster as compared to large one. The generator is important because it is the last component of electricity process and core as well. Yaw draw is important element because it changes its direction as wind changes for constant working [4].



[3] Wang, Z., & Li, J. (2009). China's renewable energy development. *International Journal of Energy Sector Management*, 3(1), 50 - 61.

[4] Wang, Z., & Li, J. (2009). China's renewable energy development. *International Journal of Energy Sector Management*, 3(1), 50 - 61.

[2] Kumar, A., & Nair, K. (2012). Wind characteristics and energy potentials at Wainiyaku Taveuni, Fiji. *Management of Environmental Quality: An International Journal*, 23(3), 300 - 308.

## 1.4 Advantages of Wind Energy

The biggest advantage of wind energy is more obvious now a day when human activities are vigorous for the climate. The wind energy is environment-friendly energy and causes no pollution, as coal and gas are. The coal and gas are mostly not cost competitive in any aspect because its prices vary. Further, prices of coal and gas are being set by market trends. The atmospheric emissions of elements as mentioned above are uncountable, but wind cannot create such atmospheric emissions so far. The wind energy negates causes of acid rains and helpful in lowering greenhouse effects upon the environment [5].

## 1.5 Disadvantage of Wind Energy

The selection of land is a little bit costly task. The land should consider strong wind as the core consideration. The building of wind farm at such land is not a cost competitive idea, in any way to generate electricity. The wind energy cannot be stored unless batteries are there to store it. Therefore, transmission losses are more frequent in a supply chain of such energy.

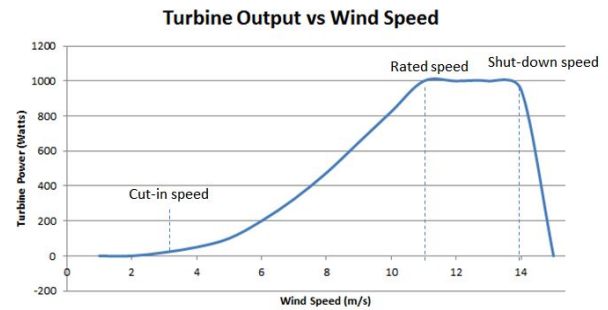
## 2. REQUIRED RESOURCE POTENTIALS

The potential of wind can measure through a reality that it is abundant in the environment and can exploit quickly. There is no fixation of potential from the wind until now because it highly depends on technology that is being used for it. The global technology potential is always there because the status of technology is repeatedly rising. Wind energy development is the new paradigm to think because there is the huge gap of technology in it. There are constraints in exploiting the full range of the wind but those resistive elements are cannot supersede over advantages [6].

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[5] Lehtovaara, M., Karvonen, M., Kapoor, R., Sakari, T., & Pyrhönen, K. J. (2014). Major factors contributing to wind power diffusion. *Foresight*, 16(3), 250 - 269.

[6] Egbue, O., & Long, S. (2012). Critical Issues in the Supply Chain of Lithium For Electric Vehicle Batteries. *Engineering Management Journal*, 24(3).



## 2.1 Global Technicalities

There are many studies at the global paradigm that can evaluate the technical requirement for wind energy project. These studies have endorsed that global standardization while selecting installations for wind energy is necessary as well. The installations that can measure wind speed and its possible impacts. The surface-based wind farm requires less technical facilities. Land competition to build the wind farm is globalized think tank considered by various engineers.

## 2.2 Regional Technicalities

The United States have composite information about technical potentials required while initiating the project of wind energy. Different regions of U.S. require different techniques things to consider. The regional technicalities include density of the wind at first aspect.

## 2.3 Regional Assessment of Technicalities

The minimum wind speed is adequate as raw material for modern technologies as compared to moderate and intense winds. There are necessary instruments that can measure data and utilization of such tools can assume possibilities of energy output. The amount of electricity that is being generated by wind installations depends upon capacity development. The use of land is necessary because the project that can produce more output of energy will be at land with lots of characteristics. The characteristics assessment with regional settings is necessary. Further, core aspect is to choose the location that is less mobile.

The recent figure endorses the selection of Texas as pre-success age. Success Ratio can assess from the current

number of Texas in generating and powering homes [7].

Rank	State	Wind Generation in 2013	Equivalent Homes Powered
1	Texas	35,937	3,315,000
2	Iowa	15,571	1,430,000
3	California	13,230	1,220,000
4	Oklahoma	10,881	1,045,000
5	Illinois	9,607	880,000
6	Kansas	9,430	870,000
7	Minnesota	8,065	744,000
8	Oregon	7,452	687,000
9	Colorado	7,382	681,000
10	Washington	7,008	646,000

### 2.4 Possible Influences of climate change

The geo-distribution is the primary element that can explore various hidden potential in a land that requires for the wind farm. The variability of wind resource depends upon climate and its variations. This is a fact that some changes in climate are beneficial for wind energy, and sometimes it may have the adverse impact of wind power production. However, it depends on the area, nature of use and engineering skills that different people have to put in this effort. The purpose is to make wind energy reliable in multiple climate conditions in different areas.

Climate change can affect wind energy operations and resource. Also, it has been seen that in some regions wind energy is not considerable. Different projects have been started in Europe and other countries regarding wind energy. Climate change is a big issue for some regions and beneficial for some areas. This is necessary for scientists and countries around the globe to sit and think about the standard wind energy process that can be implemented in all areas [8].

### 3. TECHNOLOGY AND IMPLICATIONS

This is clear that technologies use the wind to make energy or electricity. We can take numerous benefits from wind energy technology such as charging batteries were grinding

the grains and water pumping. We can see numbers of wind energy technologies, which are stand-alone applications. Large sized turbines are used to revolve with the wind and make energy.

Technology is good, usually provides energy to different grid power or stations. Apart of this, there are different providers in the various countries, which provide wind energy to their customers at homes. The role of standalone turbines is prominent, as these turbines are also used for communication process and water pumping. Some people living in small towns make energy with the light use of wind energy technologies [9].

### 3.1 Technology development

The first thing, which is to develop, is power capacity regarding wind energy. This is seen that wind energy capacity has been the increase in the United States of America in recent years. Astoundingly, wind turbines are more efficient than before. These turbines are more affordable, reliable and efficient than any other source of energy [10].

OPERATIONAL DATA	
Rated power	IEC IIA - 50 Hz: 1,800 kW; IEC IIA - 60 Hz: 1,815 kW; IEC IIIA - 50 Hz: 2,000 kW
Cut-in wind speed	4 m/s
Rated wind speed	12 m/s
Cut-out wind speed	25 m/s
Wind class	IEC IIA (V90-1.8 MW); IEC IIIA (V90-2.0 MW)
Operating temperature range standard turbine	-20 °C to 40 °C
Operating temperature range low temperature turbine	-30 °C to 40 °C
SOUND POWER	
Max 104 dB (Mode 0, 10 m above ground, hub height 80 m, air density 1.225 kg/m³)	
ROTOR	
Rotor diameter	90 m
Swept area	6,362 m <sup>2</sup>
Air brake full blade feathering with 3 pitch cylinders	
ELECTRICAL	
Frequency	50/60 Hz
Generator type 4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings	
Nominal output	50 Hz: 1,800 kW/2,000 kW; 60 Hz: 1,815 kW

[7] Awea.org. (2015). *Wind Generation Records & Turbine Productivity*. Retrieved November 27, 2015, from <http://www.awea.org/generationrecords>

[8] Solari, P., & Minervini, G. (2004). Exploitation of renewable energy sources and sustainable management of the territory. *Management of Environmental Quality: An International Journal*, 15(1), 41 - 47.

[9] Bonilla, O., & Merino, D. N. (2010). Economies of a Hydrogen Bus Transportation System: Case study Using an After Tax Analysis Model. *Engineering Management Journal*, 22(3).

[10] Bozo, M. G. (2008). Energy policies in Latin America and the Caribbean and the evolution of sustainability. *International Journal of Energy Sector Management*, 2(1), 8-35.

Energy production is quite different from energy produced ten years back. Technologies such as rotors, electronics devices, and different gearboxes have been updated. We can say that all technology has been shifted to computers. The purpose of these technology advancements is to make alternative energy and a unique choice of electricity around the globe.

It needs more powerful and large turbines to create energy. Large size turbines need the high and significant amount of steel, which is challenging for manufacturers. F8 engines have been introduced, which can manage the load and additional thrust. The wind generates the thrust, which is to control by anti-lock braking systems.

### 3.2 Technology status

Wind production is more efficient than before, and it is clear that the world has the best alternative to power in coming years. Technology will play its role; it will become more advanced with the passage of time. This technology is reliable and holds corporate social responsibility. This technology is best to produce energy because it does not impair environment and land. This is a quick and easy alternative for power generation around the globe. Recent ten years were great regarding technology advancements, and the world is expecting something more and extra regarding technology and its advancements [11].

Turbines are great in wind energy and play a significant role in extracting energy. Fifteen prominent parts are included in the turbine. These components include the rotor, anemometer pitch, brake, gearbox, shafts with low speed, blades, generator, wind vane, yaw drive controller, nacelle, a shaft with high speed, tower, and yaw motor.

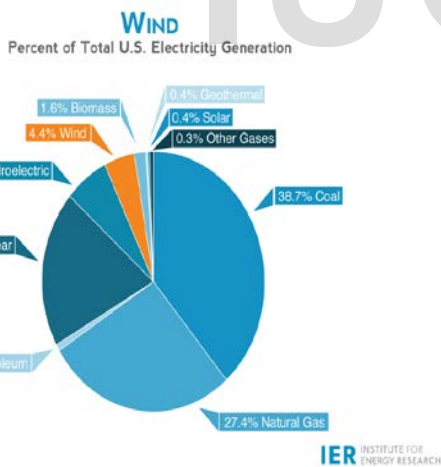
This is a whole structure of turbine and the latest design in recent years. Different dimensions and shape of blades are based on aerodynamic requirements. Speed is also controlled by the wind, as these blades rotate to generate power. This is a fact that these turbines are designed to control the maximum wind speed to produce maximum power [12].

### 4.1 Onshore Vs Offshore design assessment

There are two options regarding offshore and onshore wind energy production. It depends on different conditions and to implement one of design to produce power. This is observed that onshore wind power production is not more efficient and effective as compared to the offshore power. This is a cause of noise and visual pollution and harmful for birds in environments. Even people are not comfortable with the distance of 1000 meter due to a noise of turbines. However, there are numerous benefits of onshore wind power generation, but environment sustainability is also important. Apart with this, there are also many cost benefits but building and installing cost of turbines are dangerous.

The other hand, offshore wind power generation design is unique and effective as compared to onshore. These wind turbines designed for strong concrete platforms at the bottom of the sea. It may be also costly due to additional materials. Also, an effect of wind turbine noise and visual are lower than onshore. Low payback time is great in offshore power.

This is stated that 40.5-meter turbine has requirements of 43,873 GJ. Moreover, offshore and onshore wind power has short environment payback time. Offshore wind power is in the limelight as it contains lesser human effect. However,



## 4. BASIC DESIGN REQUIREMENTS

[11] Antonio, J., C., O. A., Ange, O., & Costa, M. (2010). New procedure for wind farm maintenance. *Industrial Management & Data Systems*, 110(6), 861 - 882.

[12] Kumar, A., & Nair, K. (2012). Wind characteristics and energy potentials at Wainiyaku Taveuni, Fiji. *Management of Environmental Quality: An International Journal*, 23(3), 300 - 308.

this might be costly due to materials, but it is more reliable [13].

## 5. STANDARDIZATION OF WIND PROJECT

This is necessary to set some standards for wind energy safety. Top-level energy experts were gathered in Austria to discuss international safety standards regarding wind power generation. Different plant operators, power generation companies, and top decision makers of experts were planning to have conventional wind power around the globe. International Electronic Commission (IEC) conducted this high-level meeting; wind energy operation management committee is in the limelight and has collaborated with IEC.

They have planned to start trade of high quality and standard wind turbines with effective security standards. Now wind standard has been established which is IEC 61400-26, it will maintain the existence of different wind turbines and parks in different areas. This will provide the benefit to investors as they can get 40 Euros per euro investment. Standardization will lift research, development, creativity, innovation and improvisations in wind power generation. Also, economic efficiency will also be increased [14].

## 6. WIND POWER ISSUES

Many people perceive wind power projects as an extra use of money. Experts think that if they able to be efficient in fossil fuel, then we do not need any alternative. However, wind energy is a good source, but it has some cons. Wind energy is not very constructive for the environment. When we talk about corporate social responsibility, we do not find any useful aspect in this regard. There is a need for an immediate solution of following problems.

Wind industries or factories damage environment and community, as ecosystems are destroyed continuously. Wind plants cause the death of birds, bats and other large

air and land habitats. This is seen that many animal habitats have been driven. Apart of this, noise, visual problems are big things to worry, as these are very disturbing and frustrating for humans [15].

### 6.1 Power Conversion Issues

There are many issues related to this type of conversion. These include poor stability of the grid. Another important issue is operations with low frequency. Another important issue is a low factor of power. Other issues are related to quality and short circuits. These issues exist in conversation through the wind. Grids have to be more reliable in power generation. Most of the grids are not reliable, which is a significant reason for minimal output. A low-frequency operation also affects the outputs of conversion. There is about 5 to 10 % loss due to low-frequency operations. Apart of this, there are some fluctuations regarding wind power have the impact on the power supply. Conversion systems contain some variations related to power, which cause many problems.

### 6.2 Power Transmission Issues

Wind power development relies on transmission process. There should be efficient and modern transmission systems. Different issues regarding transmission such as cost allocation, grid integration, and operations, planning and spreading different power lines exist in transmission. Unfortunately, there are lesser transmission projects, which are not effective to double the wind production in the various countries [16].

### 6.3 Grid Issues

The capacity of power is a significant issue. Wind power generation typically depends on wind power penetration level. Blackouts are big risk regarding grids, as this system need to upgrade and modernize. Power should not be divided or stored on a single machine. The use of the locally manufactured grid is the best way that can lower

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[13]Kumar, A., & Nair, K. (2012). Wind characteristics and energy potentials at Wainiyaku Taveuni, Fiji. *Management of Environmental Quality: An International Journal*, 23(3), 300 - 308.

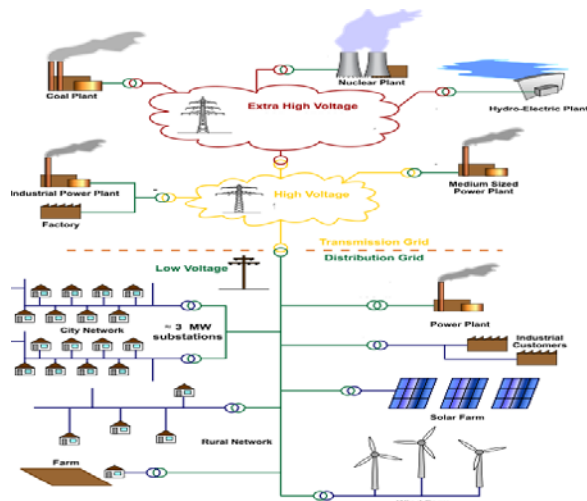
[14] Antonio, J., C., O. A., Ange, O., & Costa, M. (2010). New procedure for wind farm maintenance. *Industrial Management & Data Systems*, 110(6), 861 - 882.

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[15] Amer, M., Jetter, A., & Daim, T. (2011). Development of fuzzy cognitive map (FCM)-based scenarios for wind energy. *International Journal of Energy Sector Management*, 5(4), 564 - 584.

[16] Bozo, M. G. (2008). Energy policies in Latin America and the Caribbean and the evolution of sustainability. *International Journal of Energy Sector Management*, 2(1), 8-35.

issues during the integration process. The highest use of grid because of integration can create optimized work effectiveness.



It can be problematic indeed because it has to deploy or consider undergoing activities. The integration of energy into the electric one inappropriate way is a key activity in which grid has centralized position. The grid that is not dynamic as per dynamic nature of wind penetration can be resistive in working and is not recommendable. In such paradigm, all exploration energy methods are great because all have the issue of integration as wind energy grids. If Wind farm is being developed in such area where the wind is predictable, then there are fewer issues confronted by the grid.

The location where the wind farm is being prepared is essential for the generation of electricity indeed, and there will be no integration issue systematically. For example, China is a country where Grid issues are lowering day by day, and this is main reason that China is increasing its wind farm's energy capacity. The selection of southern coast in China to exploit wind resources is the best way that can decrease issues at grid level ideally. The pre-number one holder that is China is still inducing new ways that can reduce grid issues while exploiting wind resources at a general level.

As earlier said, that construction of grid is essential to phase that can decide success ratio of wind energy project. The construction of grid by using local manufacturer, so that troubleshoot could be easy firstly recognized by China. The usage of local equipment can decrease costs of the project by utilizing subsidies art national level. The other

thing is there will be no or least issue of the integration process of the grid [17].

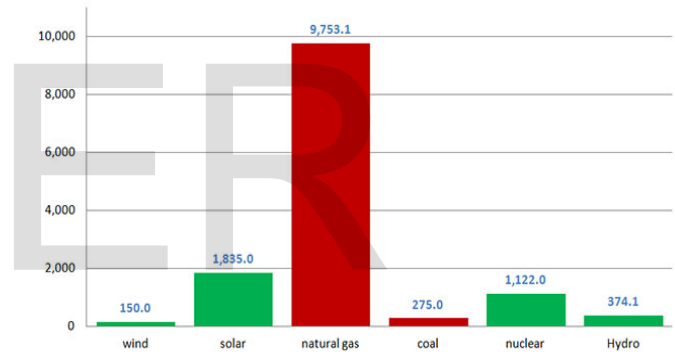
## 7. REGIONAL STATUS OF WIND INDUSTRY

As per consideration about wind power in the United States, there is no ambiguity that recently the United States has increased its attention towards the wind. The Wind energy is affordable as per consumption rates of energy through natural gasses and oil. The domestic electricity is considerable more and highly efficient while developing pollution-free energy from available resources. It is considerable as well that there are ways that can increase the probability to generate electricity and United States endorsed those. The wind is considerable among those concerns in a realistic manner. The United States has greater investment in developing Wind energy farm, and this farm have increased production sharply [18].

### New Electric Power Plants in 2015

Summer Capacity in Megawatts

(Source: author - data: U.S. Energy Information Administration)



The community that is more environment-centered has endorsed such projects because it is no environmental ill in any way. This is the main reason that energy status according to the wind is being increased. Further, medium size income holders in the United States did not endorse

[17] Wang, Z., & Li, J. (2009). China's renewable energy development. *International Journal of Energy Sector Management*, 3(1), 50 - 61.

[18] Silverstein, K. (2015). *Can Wind Energy Be Counted On To Help Meet Obama's Carbon Goals?* Retrieved September 19, 2015, from <http://www.forbes.com/sites/kensilverstein/2015/02/18/can-wind-energy-be-counted-on-to-help-meet-obamas-carbon-goals/>

those energy projects that can increase costs of electricity at domestic level.

The wind is renewable resources that are laterally acceptable for all stakeholders directly and indirectly involved in the usage of such energy as their secondary source. The United States have the monopoly over rates as compared to resources of Japan and Germany. Costs of Japan and Germany while is extracting renewable resources are high as compared to the United States. Japan has cost about 40 cents per kWh (kilowatt-hour), and Germany has 25 cents, these both costs are not comparable in any way with the rate of United States [19].

The United States is one that has cost about 5 cents per kWh (kilowatt-hour). The regional status has boosted because as per costs of renewable resources in the United States and has increased widest usage of energy. These trends of cost in the United States further have increased the status of the wind industry. The almost reckless situation in gas industry has left no option for government considers wind energy as a primary source. The increased population even in the United States is the first aspect that considered the wind only to compensate its daily activities.

Another aspect that there is no regulation in the gas industry that leaves the government in the state where wind energy is the only solution. During reckless situation with nature gas industry like as setting price, supply chain issues, the government has thought considerably about wind resources. Supplies of Gas in Mexico are still there because the government has no concern to exploits those high-cost energy resources.

Recently, Forbes publishes success story of Texas, as best to exploits wind energy resources. The wind farm that was never considered by owners of land to build a wind farm is now considerable in depth. The usage of technology in wind energy is only an element behind such success because energy through the wind is the green one. The retailers in the supply chain have discussed its reservations when in 1999, Texas reacts towards energy deregulations.

The whole energy market was deregulated because there was no study that can consider renewable resources in any aspect. Nationally, those targets were set up, and Texas was first that show out of the performance while achieving those targets. The Renewable Portfolio Standards that is commonly known as RPS was boasted just after United States' pro-policy about renewable resources. The wind was most considerable element while exploiting those targets for goods.

The original target that has set up for Texas was revised accordingly, and Texas was one that exploits those regulations according to their usage. The job creation in the wind industry in Texas first moved after such activity. The job was created in wind industry at large scale and still there are many chances for sustainable growth. Another thing for survival for Texas as the best place for job seekers is the least impact of Great Depression [20].

These are some reasons that Texas is important for wind energy exploration as compared to other states of United States. The job creation is the important element that may give benefits to further objectives of Wind energy in Texas. Historically, Texas has considered wind energy goals more seriously as compared to other states. Now after mission accomplished theory of United States from Texas, still it is important for another wind energy vision. The recent hallmark is being achieved by Texas is available in publishing form as publishers by America Wind Energy Association (AWEA).

In that report, that was published in 2014, AWEA responded positively with the production level of Texas through energy resources. About 37 percent energy is being produced only by Texas, and finally used by other states. Texas is still focusing public utilities more than other aspects directly attached to the wind industry. The wind power is not a costly decision and same as regional attentions are getting effectively.

## 8. NATIONAL GOALS

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[19] Mirzatury, M. (2015). *Wind Energy: It's What Texas Does Best, If State Leaders Will Let Us*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/edfenergyexchange/2015/04/29/wind-energy-its-what-texas-does-best-if-state-leaders-will-let-us/>

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[20] Mirzatury, M. (2015). *Wind Energy: It's What Texas Does Best, If State Leaders Will Let Us*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/edfenergyexchange/2015/04/29/wind-energy-its-what-texas-does-best-if-state-leaders-will-let-us/>



The goal to get the move with about 12,700 megawatts (MW) substructure throughout the country is not a small goal in any way. About 37 percent was good starts for Texas and literally, it provides a good start for the national goal to accomplish. The country has the goal, and the same purpose depends upon Texas. About 4699 MW wind energy will come only with the help of Texas if same 37 percent is contributing to the wind industry. There is no surprise that about 17,000 wind industry jobs are being accomplished through Texas only in the wind industry [21].

### 8.1 National Regulations

Renewable portfolio standards commonly known as RPS are significant regulations by the government that are monitoring renewable resources of the country. There is no question about the success of RPS because Texas is still showing significant developments only under this reform. The next level approach is being considered by RPS is major level thinking about federal production tax credit. States of United States are showing excellence in working while considering RPS only. There are many public utilities considerable at major states and these utilities are exploiting through RPS successfully.

### 8.2 National Wind Energy Programs

Energy Management has many concerns in while exploiting wind resources at a glance. Historically wind energy has many national levels programs. The wind industry is growing industry under reforms of energy management of United States. Sustainable growth in the United States was proved as per objectives of wind industry that it has to achieve in coming days. Programs under objectives of energy management have agenda to get sustainable development. The uprising of understandability about wind industry programs is further going with ongoing performance in detail. The success of Brazil while exploiting renewable energy programs is glaring example [22].

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[21] Mirzatuny, M. (2015). *Wind Energy: It's What Texas Does Best, If State Leaders Will Let Us*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/edfenergyexchange/2015/04/29/wind-energy-its-what-texas-does-best-if-state-leaders-will-let-us/>

[22] Silverstein, K. (2015). *Can Wind Energy Be Counted On To Help Meet Obama's Carbon Goals?* Retrieved September 19, 2015, from

## 9. WIND ENERGY CHARACTERISTICS

Wind energy has the potential to produce electricity as much as possible. The national level programs and regional agenda to use wind resources according to characteristics are critical components in the wind industry. The richest wind energy means that the wind at that place has more potential as compared to other wind farms. The wind energy depends upon investment, and these investments can exploit satisfactory through identifying resources. All installation costs of the wind farm can be ruined if there is no pre-study while identifying wind characteristics. If wind resources are satisfying deals with investment, there is satisfaction according to the ratio of profitability [23].

### 9.1 Planning Phase of Electric systems

The planning phase of the electric system, directly and indirectly, deals with the wind turbines are being exercised in required way. The selection of turbine is necessary to get as much energy as one thought to get. The wind energy resources are fundamental phenomenon and selection of the electric system is being monitored accordingly. The modern technology while selecting electric systems apparently consumes less time and more efficient. The latest field is important in selection-n that is commonly known as European Wind Atlas Methodology. Electric Instrument that acts upon such methodology is highly effective in grasping energy as compared to other.

### 9.2 Standards models of Wind Electric systems

Standardization while selecting wind electric systems is important element because there is system approach that is above all. There are many individuals' turbine forces that can tackle issues with some important features in it. For example, standards of an electric system can be determined through the selection of local installation with modern technology. There is lots of difference between the productivity of turbines that has important features to install and new ways to consider. The first thing is about

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<http://www.forbes.com/sites/kensilverstein/2015/02/18/can-wind-energy-be-counted-on-to-help-meet-obamas-carbon-goals/>

[23] Kumar, A., & Nair, K. (2012). Wind characteristics and energy potentials at Wainiyaku Taveuni, Fiji. *Management of Environmental Quality: An International Journal*, 23(3), 300 - 308.

computer modeling in system generation, and such modeling is better way recognizing the importance in the wind industry. The other standard is about the selection of local topography because it is more predictable as compared to others [24].

### 9.3 Entire Transmission Infrastructure

The first and foremost thing that contributes to transmission infrastructure is the tower that may be about 40 to 100 meter. This is the major element of infrastructure than there are rotor blades and rotor hub. These both mechanical parts are directly attached to the tower with the support of rotor bearing. This bearing gives strength and lubricants to resist the available resistant in it. Further, the main shaft that is responsible for shifting rotational force of rotor directly to the generator. The gearbox is supported device with the main shaft that can drive basic move from one level to another.

The generator is another major element that can convert mechanical energy received into electric energy ready to give. Yaw System is next stage that contributes to further proceedings in the electric generation through wind infrastructure. The Pitch system can use dynamic feature of wind accordingly. The power converter can convert electricity directly from generator to big grid network. The attached transformer in transmission network converts electricity in same voltage that requires for the grid. The brake system means to give pause to system up to some extent when to require [25].

### 9.4 Characteristics of Electricity by Wind Power

Wind potential that can create as much electricity and wind farm length have many characteristics in which less costly is one. Winds Farm that have wind of about 4 meters per second can satisfactory meet demands of the population to acquire less expensive energy power. The natural environment across wind farm matters a lot, and the entire environment can create as beneficial outcomes as perceive to obtain. The maintenance cost of the wind farm is almost

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[24] Antonio, J., C., O. A., Ange, O., & Costa, M. (2010). New procedure for wind farm maintenance. *Industrial Management & Data Systems*, 110(6), 861 - 882.

[25] Biberacher, M. (2008). GIS-based modeling approach for energy systems. *International Journal of Energy Sector Management*, 2(3), 368 - 384.

none as compared to other renewable energy resources. There is a consensus that wind is adequate energy resources at large scale as compared to other resources.

## 10. COST TRENDS

Wind energy costs are trending down, as more efficient and workable turbines exist in different wind energy factories. Wind energy is now cheaper than other alternatives of energy. The costs that are being consumed by Wind turbine is only a fixed and bog cost, and there is the least consideration about other maintenance costs. The cost that is being invested in energy is about to give benefit accordingly.

	Investment (€1000/MW)	Share (%)
Turbine (ex-works)	928	75.6
Foundations	80	6.5
Electric installation	18	1.5
Grid connection	109	8.9
Control systems	4	0.3
Consultancy	15	1.2
Land	48	3.9
Financial costs	15	1.2
Road	11	0.9
Total	1227	100

Note: Calculations by the author based on selected data for European wind turbine installations.  
Source: Riss DTU

The cost element of energy grid is now focusing towards the wind because it requires least business developmental expenses indeed as compared to other energy resources. Costs structure that is given below has investment spending in the first look, operation, and maintenance in second. The further cost of energy production and leveling cost of energy estimates are some of the key considered aspects before initializing a wind power project [26].

### 10.1 Investment costs

The major part of investment costs consume while selecting a geographical location to build a wind farm. The selection of location can be costly because business owners should

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[26] Lynch, M. (2015). *Renewable Energy Pricing: Been There, Done That, Learned Nothing*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/michaellynch/2015/09/11/renewable-energy-pricing-been-there-done-that-learned-nothing/>

take that location, have enormous wind resources. For example, it is a little bit costly exercise to find a location with 4 meters per second air. The ideal location in terms if wind power considered investment costs to lower or finishes gap between supply and demand of electricity. The government has agenda to get low carbon electricity, therefore; wind energy comes from that agenda. The agenda can compensate investment cost of the project in the best way [27].

### Cost of energy for coal and wind technologies

Levelised cost of energy for some coal and wind technologies, 2012

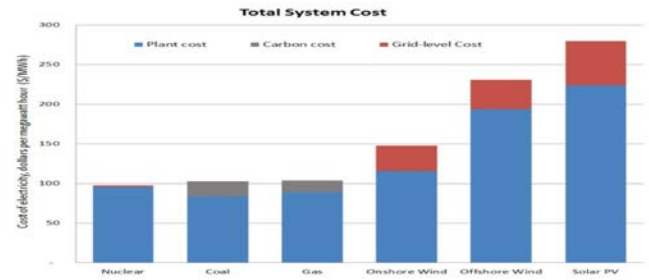
Technology	With CO2 price	Without CO2 price
Supercritical brown coal	\$162	\$95
Supercritical brown coal with CCS	\$205	\$192
Supercritical Black coal	\$135 - \$145	\$84 - \$94
Supercritical black coal with CCS	\$162 - \$205	\$153 - \$196
Wind	\$111 - \$122	\$111 - \$122

### 1.2 Operation and maintenance

To accomplish the task of government to provide, as many facilities as wind power want to exploit is the reflection of operation and management costs. The other thing that is satisfactory decreasing operational costs is about the need for wind energy at the society level. The operation also includes the human resource to monitor the whole wind farm and favoring policies of government has an enormous impact on it. The operation costs depend upon design and quality of turbine that is considerable before the project. Operation costs meant to give the exactly same thing in the best way because it is complete infrastructure in development form. The selection of new turbine model can decrease probability in costs as compared to older models [28].

[27] Eschenbach, T., & Cohen, R. (2006). Which Interest Rate for Evaluating Projects? *Engineering Management Journal*, 18(3).

[28] Lynch, M. (2015). *Renewable Energy Pricing: Been There, Done That, Learned Nothing*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/michaellynch/2015/09/11/renewable-energy-pricing-been-there-done-that-learned-nothing/>



### 10.3 Energy production

The site that has 4 meters per second wind is properly providing a way that can decrease as much cost as one can expect. Resources meant to give a potential for the sale price of electricity generated through these resources. The wind power is about to give the best approach towards thinking about green energy and low carbon content material. The performance of wind power means that site that specifically have proper wind resources can give more cheap electricity. Levels could be decreased as resources decrease if happens so. It is not possible that a site has constant positive wind resources in large scale because the wind is dynamic in nature and changes its direction in many ways [29].

### 10.4 Leveling cost of energy estimates

Different wind resources mean that different cost factors while exploiting those resources. There is a lot of difference between leveling costs of energy that is being produced by offshore wind energy project as well as onshore wind energy project. The cost is not only a difference between them because of wind resources and their different method to produces electricity indeed. Policies of pipeline companies matter a lot here because the wind has to change their way of costs as adopted earlier. Offshore wind, power is mostly costly as compared to inland wind energy and the main reason is complicated transmission system [30].

[29] Lynch, M. (2015). *Renewable Energy Pricing: Been There, Done That, Learned Nothing*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/michaellynch/2015/09/11/renewable-energy-pricing-been-there-done-that-learned-nothing/>

[30] Eschenbach, T., & Cohen, R. (2006). Which Interest Rate for Evaluating Projects? *Engineering Management Journal*, 18(3).

## 11. ENVIRONMENTAL AND SOCIAL IMPACT

Generation of electricity through the harnessing of the power of wind is the most appropriate way that provides a positive impact on the environmental aspects. By using wind power, it produces no toxic pollution in the environment. The wind is affordable, inexhaustible and abundant that makes viable for fossil fuels.

Wind Power is a cheap way to produce electricity as resources allow producing but only in limited areas. There are few areas in the United States that suitable to produce electricity. For example, few areas have the potential of about 4 meters per second speed of air. Even in Texas, that is proposed best location according to wind resources is not contain constant 4 meters per second speed. There are many variables speed measures historically. This is a major limitation to wind power because it is highly centralized in working but never respond positively.

The global warming emission is not a product by wind power execution. The concept of wind power is renewable and low carbon footprint energy. It provides environmental benefits and has positive social impact. Water free and emission free energy source that generates renewable energy goals. Wildlife and land recognized great effect due to the wind power generation. The uncontrolled nature of wind is considerable apprehension for investors and negates wind power projects in the presence of many subsidies by U.S. government [31].

### 11.1 Direct impact

Wind power has a direct impact on wildlife and land. An adverse environmental impact is recognized like potentially to reduce or degrade habitat for wildlife plants and fish. The turbine blades that are spinning vastly impose a threat for flying wildlife like bats and birds. Addressing permitting and sitting issues in the wind industry are priority challenge. The impact on fossil fuel power plant produces rotor blades and deaths of birds. Hence, production of wind energy has a direct effect on the wildlife environment.

### 11.2 Indirect impacts

Reduced reproductive and survival output due to Wind power. Habitat loss is incurred by the indirect effect. Many of the studies conducted on the collision of the turbine. The disturbance in turbines is due to ecological footprints. The success of nest is also negative effect with the proximity to wind turbines. The reduction in breeding bird density is also recognized within 180 meters of the turbine. Collision mortality and local bird population have an indirect impact, especially in the plain critical environment.

### 11.3 Environmental benefits

A wide range of environmental benefits is identified towards the implication of wind power generation. Clean fuel source as well as not polluted air and provide greenhouse gasses in the environment. There is not any toxic pollution is produced by wind power technology and leads to less global warming emissions.

The sustainability of biomass is used that produce low emission of footprints. On the other hand, the unsustainable source of biomass produces a harmful effect on the global warming emission. The supply of renewable energy is altering carbon-intensive energy sources. The emissions of global warming are associated with wind turbine life cycle, maintenance and operation, material transportation & production, dismantlement, and on-site construction assemblies. These emissions produce less effect of global warming [32].

## 12. IMPACTS UPON HUMAN ACTIVITIES

The activity of a human is overloading in the atmosphere with carbon dioxide and emissions of global warming. This creates the particular effect of trap heat, increase earth temperature and harmful impact on human health as well as climate. The production of electricity provides about one-third of US global warming emission. Installations of wind power are not moveable in any way. The resistance from the population cannot be able to move it instantly unless investing the heavy amount to move entire infrastructure. Sometimes, visual impacts did not cover the whole system as the only useful system for further assumptions as set up by investors.

The wind turbines produce sounds that are detected by humans. Wind energy, urbanization, gas & oil production,

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[31] Wang, Z., & Li, J. (2009). China's renewable energy development. *International Journal of Energy Sector Management*, 3(1), 50 - 61.

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[32] Lehtovaara, M., Karvonen, M., Kapoor, R., Sakari, T., & Pyrhönen, K. J. (2014). Major factors contributing to wind power diffusion. *Foresight*, 16(3), 250 - 269.

and tall structures are the types of human activities. Shrub-steppe birds and grassland relationship is addressed in the human activity by the generation of wind energy. The noise of rotor is another way that disrupts human activity and can create the disturbance at the society level. A voice of rotor comes under the head of a noise pollution in which wind power is also contribution now.

The human activity without electricity is not possible now a day and wind power have positives impacts on human activities from business to personal. The fossil fuel is also contributing towards air pollution and unable to produce low carbon energy in any way. Oppositely, wind power resources have positives impacts while producing as green electricity as much as it could. It depends upon wind resources, and there is no other factor involved in it while exploiting already available resources. The little construction and minimum installation are another factor in wind power that can prepare a venture to give maximum output to unemployment sector [33].

### 12.1 Land usage

Usage is dependent on site. The wind turbines located in those areas those are horizontal for using more winds. Space that is covered by the wind turbine is not less than 5 to 10 diameters of rotors. The turbines revolve around infrastructures that contain transmission lines, and roads occupy a small portion of wind facility of the total area. Land usage and exploration of suitable land before usage provide a way to think about dual strategy. There are two purposes of building a wind farm; one is to install the wind turbine. Wind turbine installations give as many benefits to land owners as it could. The following advantages that land is still can be used for agricultural purposes.

A survey is conducted by national renewable energy laboratory about the wind sites in the US. The research indicates about the 30 and 141 acres per megawatt power is generated. This means that less than 1 acre per megawatt is allocated on a permanent basis. In addition to this, 3.5 acres per megawatt are assigned on a temporary basis during the construction period. The next approach is about the cost of land that has suitable wind resources to build farm. Even landowners are being given subsidies by the government so

that they cannot hesitate to give their land to wind investors.

The remaining land is used for other purposes like hiking trails, livestock grazing, highways and agriculture purposes. The facility of wind power is sited on brownfields. The brownfield means underused industrial land. This helps in concern about the space of land use in the industrial and commercial locations. Those land owners that are using their land as well after having a bulk of amount against it sees it profitable. The wind farm further has the attraction for tourists as well, and worth of used land will be increased in a satisfactory way [34].

### 12.2 Property value

The offshoring of wind facilities is currently not operated in the US. The wind facility requires a large amount of space due to bigger blades and turbines. Depending on their location, installation of offshoring compete with the activities of an ocean, oil and gas extraction, recreational activities, navigation, fishing, and sand & gravel extraction. The local government collects payments in the form of property tax and income from owners of renewable projects of energy. The government has had collected \$11.5 billion tax in the head of property tax from local communities.

There is the difference between land that is a label under commercial land and agricultural land. After establishing wind farm of land, one can observe easily that property value of the same land would be boosted. The property value means that landowner can use the same land as agriculture, as the wind farm and after installing the wind turbine, the land has still its worth. Now a day modern agriculture requires much electricity to move heavy equipment at land. These types of equipment are now free to move because transmission lines are already established over there. Finally yet importantly aspect is about it is a legal process with energy policies [35].

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[34] Mirzatury, M. (2015). *Wind Energy: It's What Texas Does Best, If State Leaders Will Let Us*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/edfenergyexchange/2015/04/29/wind-energy-its-what-texas-does-best-if-state-leaders-will-let-us/>

[35] Silverstein, K. (2015). *Can Wind Energy Be Counted On To Help Meet Obama's Carbon Goals?* Retrieved September 19, 2015, from <http://www.forbes.com/sites/kensilverstein/2015/02/18/can->

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[33] Lehtovaara, M., Karvonen, M., Kapoor, R., Sakari, T., & Pyrhönen, K. J. (2014). Major factors contributing to wind power diffusion. *Foresight*, 16(3), 250 - 269.

### 12.3 Noise, health or safety impacts

Visual and sound impacts are two significant public health and community consideration. The wind turbines generated an enormous sound of aerodynamic that is caused by moving turbine blades in the air. The mechanical sound is also generated by itself turbine. The design and wind speed determines the levels of a good wind turbine. Many of the people close lived with the facility of wind and affected by vibration and noise issues. Wind power technologies are smartest was as compared to previous wind energy equipment. Those early types of equipment were diminished now because no one likes to get affected by the noise.

The government sponsored studies in Australia and Canada identifies that these issues do not harmfully affected the human health. The best practices of wind turbines are initiated with an open community to resolves their problems in a good manner. Efficient utilization of technology like sound absorbent materials as well as the reduction in a surface of bald imperfections minimizes wind turbine noise. The blade and shaft noise after having an appropriate way of proceedings can produce sound as much that can disturb human activity. Further, after receiving the mechanical force from the wind turbine, generator of significant size can create noise as well [36].

### 13. DEPLOYMENT PHASE

In deployment phase, particular issues are faced during its operations. Decarbonization of electricity, as well as renewable of wind energy and offshore wind power, is considered in the deployment phase. Planning and preparation are 1st phases that give a broad outline of the deployment process. In planning stage establishment of steering committee and then determine scope and boundaries off wind power energy. During the deployment face, there are many aspects necessary to develop the best-deployed method to accomplish a task as soon as possible.

wind-energy-be-counted-on-to-help-meet-obamas-carbon-goals/

[36] Mirzatury, M. (2015). *Wind Energy: It's What Texas Does Best, If State Leaders Will Let Us*. Retrieved September 19, 2015, from <http://www.forbes.com/sites/edfenergyexchange/2015/04/29/wind-energy-its-what-texas-does-best-if-state-leaders-will-let-us/>

After evaluating wind project through cause and effect basis, the central theme of deployment can understand.

For example, dynamic nature of the project that is the wind, in this case, considered various causes and effect element while deploying electricity through using transmission system. The deployment system of wind finds an economic system of the country in large scale and region in small. This is the first approach, and economic condition may vary with area. After satisfactory and positives trends in the economic system, another step is to evaluate growing energy demand for which possible units of energy are being considered. Renewable resources and electricity acquire through these resources require a sensitive system in consideration.

After evaluating energy demand across societies, another approach considers an ideal reduction in fossil reserves. Another variable id directly attached with growing energy demand is growing population without the same level increase in resources. The growing energy demand initiates two level approaches as well. One approach to initiates wind energy project and other is to enhance energy cost. There is no surprise that energy in demands transforms whole mindset and mechanism endorse value for energy related articles as compared to other necessities. After evaluation, this effect that cause through growing energy needs there is one consensus in society.

There is now strong need to develop a mechanism that can decrease energy costs while keeping all other factors constant. Now the need is to control energy costs means that United States show its concerns through investing for those investors that have business development potential. The innovative design that is highly a marketing related issue is core purpose. The business development field means that company that are in collision with the government have concerns about wind power projects. Wind power is another name of innovation because it is developing a technology.

The local manufacturing and government policies are highly relevant to these phases can be significant in deploying wind energy from a transmission site to all over the country. Selection of stakeholders and conduct detailed baseline research on wind power. Visioning is the 2nd phase that gives the development of wind technology. Roadmap development is the 3rd phase that identifies specific barriers to the hastening of wind energy. Local manufacturing of types of equipment means that local manufacturer will take care of all small necessities according to dynamic environment required by states like

Texas. Local production can decrease costs of wind turbines [37].

### 13.1 Issues during deployment

There are particular issues facing the wind power project. Huge initial investment is required to purchase the equipment to start operations. Large space of land is required which creates difficulties in acquiring land for wind purposes. A commercial and regulatory issue is also considered in this regard. Environmental issues are also faced with the deployment of wind energy. Legal and administrative matters are also faced with implementation. Grid issues including Grid Access, Pricing, and Balancing, is considered.

### 13.2 Issues after deployment

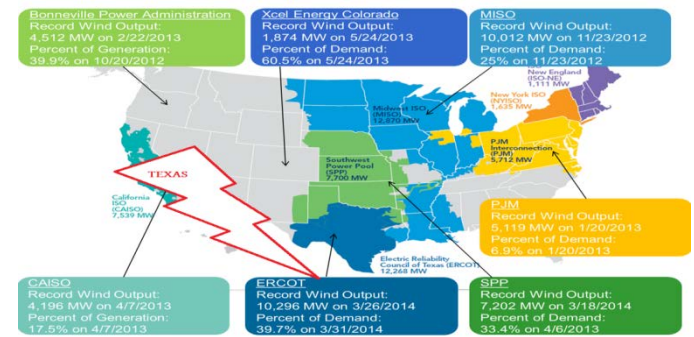
The enormous amounts of subsidies are wasteful in tax dollars. There is a minimum reduction in fossil fuels. The factories of industrial wind are destructive towards local and community environments. Many of the birds and bats are harmfully destroyed by the deployment of wind power. Vibrations and noise cause problems are affected the human health issues. The volatility of fossil fuel prices is not quantified with renewable energy. The allocation of cost rules is combined with the power plants, heat and grid connections [38].

Success Story of Electric Reliability Council of Texas (ERCOT)

Success Story of Electric Reliability Council of Texas (ERCOT)

The recent success story of ERCOT is in front of us that made clear that how Texas state is contributing towards wind energy development. ERCOT is dealing with about

24 million customers in Texas and representing about 85 per cent load of the whole state [39].



## 14. CONCLUSION

There are three kinds of thinking block when wind power is coming to debate. The first and foremost is about environmental effects, and it has proved that wind energy is lower carbon energy as United States dream to. The next approach is about societal impacts. The properly managed wind farm will never resist activity of human in any way. Further, the wind farm that has many wind turbines cannot resist population to do other activities on that wind farm. The transmission lines are underground and never halted daily base activity.

Many examples have shown that wind farm is being utilized for dual activities; one for electricity and other for traditional agriculture. The third level approach is to use economies of scales and exploit maximum government resources. The economic way means that government wants to develop such energy infrastructure that is never costly in any way and can give cheap electricity as wind farm designated to provide. The wind farm is the most economical solution of government's apprehension incomplete way. The population has shown that there is a possibility that wind farm is future of electricity. Texas as selection for Wind Farm is another aspect that can provide wind resources as much as the project requires. Historically, Texas is success story according to Wind energy and have 4 to 5 meter per second speed of the wind.

[37] Amer, M., Jetter, A., & Daim, T. (2011). Development of fuzzy cognitive map (FCM)-based scenarios for wind energy. *International Journal of Energy Sector Management*, 5(4), 564 - 584.

[38] Amer, M., Jetter, A., & Daim, T. (2011). Development of fuzzy cognitive map (FCM)-based scenarios for wind energy. *International Journal of Energy Sector Management*, 5(4), 564 - 584.

[39] Awea.org. (2015). *Wind Generation Records & Turbine Productivity*. Retrieved November 27, 2015, from <http://www.awea.org/generationrecords>