CHAPTER 5

FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 GENERAL FINDINGS

1. The demand for power is greater than supply of power in the three states as well as at all India level from the 2005 to 2012 as shown in Table 12.

2. The state of Tamil Nadu had the least deficit in 2005 and Gujarat had the greatest deficit in power supply among the three states under study. The peak period deficit was also greatest in Gujarat in 2005. (Table 13)

3. The situation was completely reversed in 2012 when Gujarat had the least deficit and Tamil Nadu had the greatest deficit. The peak period deficit was also greatest in Tamil Nadu and least in Gujarat in this period.

4. The peak period deficit was greatest in 2007-08 at all India level as well as in the three states and declined by 2011-12.

5. The demand supply gap narrowed from 2005 to 2012 due to increase in installations during this period. The increase in installations was greatest in Gujarat and least in Tamil Nadu as shown in Table 14.

6. The total installed capacity of power is greatest in Maharashtra and least in Tamil Nadu.

7. The new installations have been made mostly in private sector. In 2005 the share of private installations was greatest in Maharashtra. However, in Gujarat the increase in private installations was the greatest during the period from 2005 to 2012. (Table 15)

8. The share of Central installations has decreased at all India level as well as in the state of Gujarat and Tamil Nadu but has increased in the state of Maharashtra.
9. The share of state installations has declined at all India level as well as in the three states.

10. Thermal power continues to be the major source of power at all India level as well as in the three states under study. (Table 16)

11. The share of Thermal power declined during the period 2008-09 at all India level as well as in Maharashtra and Gujarat and then increased by 2011-12. This decline in thermal power has also coincided with greatest demand supply deficit faced during the same period. (Table 12)

12. The share of renewable energy has steadily increased from 2005 to 2012 at all India Level as well as in three states under study. The share of wind energy is around eighty percent in renewable energy as per MNRE.

13. The share of renewable energy is greatest in Tamil Nadu. In 2011-12 the share of renewable energy was 38% in overall resource wise installed capacity. This share is greater than the share of renewable energy at all India level.

14. If the power consumption is analyzed consumer wise the greatest consumer of power are the industries in all the three states under study. (Fig 4)

15. Domestic consumption is second in Maharashtra and Tamil Nadu after industries while Agricultural consumption comes second in Gujarat.

16. Commercial consumption is more in Maharashtra and Tamil Nadu as compared to Gujarat.

17. The other categories of consumers are Railways, outside the state and others which form minority of consumers.

18. The average tariff for power is highest in Gujarat for domestic and commercial consumers. Twin rates are applicable for domestic consumers, one for rural and one for urban area.

19. The average rate of tariff for agriculture is highest in Maharashtra.
20. In Tamil Nadu agriculture gets free power and the overall tariff for domestic and commercial consumers is also less than other two states under study.

21. The wind power potential at 50m hub height at all India level is 49,130 MW. Only 35% of this potential has been tapped till 31st March 2012.

22. The potential in MW at 50 m hub height is greatest in Gujarat. The installed potential is only 27.95% so there is 72.05% untapped potential.

23. In Tamil Nadu the installed capacity has exceeded its potential while in Maharashtra 49% of existing potential has been tapped.

24. The actual wind speed is highest in Tamil Nadu averaging from 4.37 to 7.32 m/sec. Gujarat comes next with a wind speed ranging from 4.33 to 6.97 m/sec. Maharashtra has a wind speed of 4.31 to 6.58 m/sec.

25. The number of identified sites for wind power development are more in Tamil Nadu and the identified numbers of potential districts are more in Maharashtra as compared to other two states under study.

26. The number of wind monitoring station operating till 31st March 2012 were very few as compared to number of wind monitoring stations established till 31st March 2012 in all the three states under study.

27. The installed capacity of wind power was 17,354 MW as on 31st March 2012. The increase in installed capacity at all India level was 88% from 2005 to 2012. (Table 20). During the years 2007-08 to 2009-10 the percentage increase showed a declining trend and was revived in 2010-11.

28. Tamil Nadu had the highest installed capacity among the three states in 2005 as well as in 2012. However, the percentage increase in installed capacity has shown a decreasing trend and has been revived in 2011-12.

29. Gujarat which had the least wind power installed capacity in 2005 among the three states has shown the greatest percentage increase in installed capacity from 2005 to 2012 namely of 295% over base year 2005.
30. The percentage increase in Maharashtra was greatest in the year 2005-06 after which the increase showed a decreasing trend. It was revived again in the period 2011-12.

31. The generation of wind power from wind turbine power project installations has shown a 123% increase over the base year 2005 at all India level. (Table 22)

32. The greatest percentage increase in generation from 2005 to 2012 has been shown by Gujarat among the three states. The percentage increase has been 314% over 2005.

33. Tamil Nadu has the highest installed capacity and the highest generation in MW among the three states. However, the percentage increase in generation has been the least amongst the three states.

34. The tariff rates laid down by Central Electricity Regulatory Commission (CERC) are higher than adopted in any of the three states under study. (Table 23)

35. Maharashtra has adopted the tariff rates laid down by CERC from the year 2009-10. It has also divided the tariff according to wind zones. The tariff rates have also been bifurcated on the basis of those availing accelerated depreciation and those not availing the accelerated depreciation benefit.

36. The tariff rates applicable in the three states from 2005 to 2012 show that Maharashtra has the highest rate of tariff as compared to other two states under study while Tamil Nadu has the lowest tariff rates.

37. The other two states namely Gujarat and Tamil Nadu have one single tariff rate for all wind zones in the state.

38. The tariff rates for wind turbine power project installations are calculated on cost plus basis. The various parameters for calculating the rate of tariff are laid down by CERC.

39. It can be seen from Table 24, 25 and 26 that the state do not necessarily follow the parameters laid down by CERC.
40. Some of the parameters like debt equity ratio, loan repayment period may be adopted by the states but for most of the other parameters like capital cost, return on equity the state lay down their own parameters. (Table 39 and 40)

41. The state of Maharashtra, from 2010 has adopted the parameters laid down by CERC. (Table 26)

42. The renewable purchase obligations (RPO) are specified by State Electricity Regulatory Commission (SERC). Only the state of Gujarat has RPO obligations especially for wind power (Table 27).

43. In Maharashtra the RPO obligations are for all non solar sources of renewable energy including wind.

44. In Tamil Nadu RPO obligations have been laid down for all sources of renewable energy and there is no separate quota for wind energy.

45. In the state of Gujarat and Maharashtra the RPO obligations have steadily increased from 2005 to 2012. However, in Tamil Nadu the RPO obligations have increased till 2010-11 and then decreased.

5.2 SPECIFIC FINDING

5.2.1 Findings From Cash Flow

1. The cost of installation or capital cost of wind turbine power project installations includes the cost of wind turbine, grid connection cost, foundation cost and consultancy costs. The cost of wind turbines constitute of about 70-80% of total installed cost. (Table 28 and Table 29)

2. The operation and maintenance cost is generally paid to developer as a part of service contract which the developer undertakes. It is fixed at a certain rate with an escalation clause. The operation and maintenance charges as per Central Electricity Regulatory Commission are Rs nine lakh per MW. This cost is escalated by 5.72% every year. Thus operation and maintenance cost only account for around 20-30% of total cost.
3. There is no fuel cost involved as wind is a free gift of nature. The generation of wind power depends upon the capacity utilization factor. Capacity utilization factor depends on the wind resource available in a particular area and turbine capacity. The capacity utilization factor varies from 20% to 32% as per CERC.

4. Financial Cost: The financial cost is cost of financing the project. The project is financed by Equity Component and Debt component. Equity component is provided by the wind turbine power project installation owner. The debt component is provided by financing institutions like Indian Renewable Energy Development Agency (IREDA) and commercial banks.

5. The majority of cost of wind turbine power project installation is fixed in nature. Apart from cost of installation the operation and maintenance cost is also fixed in nature as it is paid at a fixed rate to the developers for operation and maintenance. Similarly, insurance, depreciation and interest on loan is also fixed in nature.

6. The cost of generation calculated is 5.33 kwh. This is compared to tariff rates prevailing rates in three states under study shows that cost of generation is greater than applicable tariff rate. (Table 52).

7. The reason for feed in tariff is less than cost of generation in all three states because the capital cost assumptions for tariff calculations in three states are less than market price of wind turbine power project installations. (Table 38)

8. The method of tariff calculation adopted by the three states is cost plus method. The parameters which are same in all three states as well market norm are (Table 39)

9. The parameters which differ in all three states are as follows as per Table 40.

10. Only the state of Maharashtra has adopted the guidelines laid down by CERC and has determined tariff rates according to wind power zones. It has also laid down separate rates for those availing Accelerated Depreciation benefit and those who are not availing the accelerated depreciation benefit.
11. The states have laid down a certain expected return on equity for calculating tariff rates. The comparison between actual returns from cash flows calculated and expected return on equity for calculating tariff rates is given in the table below:

(Table 41 reproduced)

<table>
<thead>
<tr>
<th>Sr.</th>
<th>State</th>
<th>Return on Equity as per SERC</th>
<th>Return on Equity calculated from cash flows based</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gujarat</td>
<td>14%</td>
<td>6.95%</td>
</tr>
<tr>
<td>2.</td>
<td>Maharashtra</td>
<td>Average 21.55%</td>
<td>16.52%</td>
</tr>
<tr>
<td>3.</td>
<td>Tamil Nadu</td>
<td>19.85%</td>
<td>11.70%</td>
</tr>
</tbody>
</table>

12. Comparison of Return on Equity based on only tariff compared with Return on Equity under incentives. (Table 42 reproduced)

<table>
<thead>
<tr>
<th>Sr.</th>
<th>States</th>
<th>ROE under Tariff</th>
<th>ROI under AD benefit</th>
<th>ROE under AD benefit</th>
<th>ROI under GBI benefit</th>
<th>ROE under GBI benefit</th>
<th>ROI under REC benefit</th>
<th>ROI under REC benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gujarat</td>
<td>4.33%</td>
<td>3.70%</td>
<td>4.33%</td>
<td>3.70%</td>
<td>5.94%</td>
<td>4.18%</td>
<td>22.08%</td>
</tr>
<tr>
<td>2.</td>
<td>Maharashtra</td>
<td>11.68%</td>
<td>5.90%</td>
<td>5.87%</td>
<td>4.16%</td>
<td>13.07%</td>
<td>6.32%</td>
<td>12.07%</td>
</tr>
<tr>
<td>3.</td>
<td>Tamil Nadu</td>
<td>8.03%</td>
<td>4.81%</td>
<td>8.03%</td>
<td>4.81%</td>
<td>9.53%</td>
<td>5.26%</td>
<td>31.03%</td>
</tr>
</tbody>
</table>

a) The Return on investment and return on equity based on tariff is greatest in Maharashtra as the tariff rate is the highest. The returns are second highest in Tamil Nadu as it has a good resource but the tariff rate is the lowest as compared to other states.

b) The returns based on only tariff are less than returns based on different incentive schemes. The returns based on tariff and under Accelerated Depreciation scheme are same because Accelerated Depreciation leads to tax saving hence improve the project returns and not accounting returns. Only in the state of Maharashtra the
returns are different because the tariff rate is lower for those availing the accelerated depreciation benefit.

c) The greatest returns can be obtained from the APPC–REC route. However, the market for REC is yet to develop.

13. Comparison of Project and Equity IRR under various incentives schemes. (Table 43 reproduced).

(In Percentage)

<table>
<thead>
<tr>
<th>Sr.</th>
<th>States</th>
<th>Project IRR under Tariff</th>
<th>Equity IRR under Tariff</th>
<th>Project IRR under AD benefit</th>
<th>Equity IRR under AD benefit</th>
<th>Project IRR under GBI benefit</th>
<th>Equity IRR under GBI benefit</th>
<th>Project IRR under REC benefit</th>
<th>Equity IRR under REC benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gujarat</td>
<td>7.01</td>
<td>3.96</td>
<td>12.18</td>
<td>13.08</td>
<td>8.10</td>
<td>5.44</td>
<td>14.43</td>
<td>17.26</td>
</tr>
</tbody>
</table>

a) When project and equity IRR are compared based on only tariff the highest returns are generated in the state of Maharashtra followed by Tamil Nadu. This is because Maharashtra has the highest tariff rates among the three states.

b) The Equity IRR is less than project IRR signifying that cost of debt is greater than project IRR.

c) When Accelerated Depreciation benefit is taken into consideration the project IRR and Equity IRR is greatest in the state of Tamil Nadu followed by Maharashtra. This is because Maharashtra has a separate rate of tariff for accelerated depreciation benefit which is lower than tariff rate for those not availing the benefit.

d) The Equity IRR is greater than project IRR under Accelerated Depreciation benefit.
e) The project and Equity IRR are highest in Maharashtra based on Generation based incentive followed by Tamil Nadu. This is because though Tamil Nadu has the highest generation it has the lowest tariff rate among the three states.

f) In case of GBI, the Equity IRR is greater than Project IRR only in the state of Maharashtra.

g) In case of APPC-REC benefit, the highest returns are generated by Tamil Nadu followed by Gujarat. This is because Tamil Nadu has the highest Average power purchase price compared to the three states. There is not much difference between the APPC of Gujarat and Maharashtra but the capacity utilization factor has been taken to be higher for Gujarat for the purpose of this study. As a result there is difference in project returns.

h) The Equity IRR is greater than Project IRR for Tamil Nadu and Gujarat.

i) The highest returns are generated by the REC scheme followed by Accelerated Depreciation and then Generation based incentive.

14. The debt service coverage ratio which shows the ability of the project to pay off its debt obligations is greater than 1 only in case of APPC-REC route. In all other cases it is less than 1 signifying that the operating income is not sufficient to pay off its debt obligations.

15. The equity payback period is least in case of Accelerated depreciation benefit. The cumulative cash flows are highest in case of APPC-REC benefit.

16. The sensitivity analysis conducted for capacity utilization factor shows that one percent change in capacity utilization factor brings about a change of 0.61% in Project IRR and 0.93% change in Equity IRR. Hence, it can be concluded that equity IRR is more sensitive to change in capacity utilization factor.

17. The sensitivity analysis conducted for capital cost shows that Equity IRR is more sensitive to change in capital cost. Project and Equity IRR are more sensitive to decrease in cost than increase in cost.
5.2.1 Findings From Primary Data

1. Out of a 317 wind turbine installation owners 173 were private limited companies and 92 were partnership firms carrying out trading or other activities. The highest number which is 189 of wind turbine owners own one to five wind turbines. This indicates that investment in wind turbines power project installation was made only as an investment avenue to avail incentives.

2. During the year 2007-09, 143 wind turbine owners had purchased wind turbines. Ninety one percent of wind turbine owners had purchased wind turbines for the purpose of availing tax benefits and Accelerated Depreciation benefit and only 9% had purchased for generation.

3. 78 wind turbine installation owners had chosen a particular state due to availability of wind resource and policy of the state Government as the reason for investing in a particular state. 77 wind turbine owners had chosen a particular state as they were the residents of that particular state.

4. Ninety three percent of wind turbine installation owners had availed financial assistance in the form of loan. Commercial banks were preferred for taking loan by 215 wind turbine installation owners over Indian Renewable Energy Development Agency (IREDA). Only 71 wind turbine installation owners had availed loan from IREDA. The loan rates varied from 11% to 12.5% and the general tenure of loan varied from 7 to 10 years.

5. The land for installing wind turbine power project installations had been purchased by 263 wind turbine installation owners from private source, while government land was purchased by 31 wind turbine installation owners and forest land was purchased by 23 wind turbine installation owners. The land for installing the wind turbines were purchased by the developers’ hence individual wind turbine owners did not face any problems in land purchase.
6. The wind turbine power project installation owners were not very satisfied with the policies of the state governments or Central Government. (Table 50 reproduced). The major reasons of dissatisfaction were:

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Policy</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Incentives</td>
<td>Removal of incentives like Accelerated Depreciation and Generation based incentive.</td>
</tr>
<tr>
<td>2.</td>
<td>Tariff Rates</td>
<td>Low rate of tariffs provided by state Governments.</td>
</tr>
<tr>
<td>3.</td>
<td>Grid infrastructure</td>
<td>Poor grid facilities for power evacuation.</td>
</tr>
<tr>
<td>4.</td>
<td>Evacuation Infrastructure</td>
<td>Total cost of evacuation infrastructure not covered under capital cost for tariff calculation.</td>
</tr>
<tr>
<td>5.</td>
<td>Timely payment by DISCOMS</td>
<td>The distribution companies not making timely payments as in case of Tamil Nadu.</td>
</tr>
<tr>
<td>6.</td>
<td>RPO and its compliance</td>
<td>The RPO limit set was not being strictly followed affecting the marketability of wind power.</td>
</tr>
<tr>
<td>7.</td>
<td>Land issues</td>
<td>Land Issues were major problem in Maharashtra due to poor local support.</td>
</tr>
<tr>
<td>8.</td>
<td>Finance issues</td>
<td>The rate of interest for wind installations was very high.</td>
</tr>
<tr>
<td>9.</td>
<td>Change in policies</td>
<td>Frequently changing policies by Government was not providing stability</td>
</tr>
<tr>
<td>10.</td>
<td>Marketability of wind power</td>
<td>Not enough support for marketing of wind power.</td>
</tr>
</tbody>
</table>
7. The wind turbine installations were purchased by the wind turbine power project owners from the manufacturers and developers. The wind turbine owners only made investment in such projects hence they did not face any problems relating to obtaining permissions and clearances, land purchase and development of infrastructure.

8. The wind turbine power project owners invested in wind turbine power project installations to avail the benefits of Accelerated Depreciation and Income tax benefits u/s 80IA. However, with the removal of benefits they were no longer interested in further investment.

5.3 Conclusion

1. **Demand for power is greater than supply of power.** As a result there is deficit in supply not only during peak period but also during normal times. The demand for power will be greater in the coming years with a rapidly growing economy, increasing population and increased standards of living. In all the three states, industry is the greatest consumer of power (fig 1). The domestic sector demand is greater than agricultural demand in two out of three states under study. This shows that domestic demand is slowly and steadily increasing.

2. **Increase in private sector participation.** The private sector participation has been allowed in the power sector by passing suitable legislations. As a result private sector participation has increased. This can be seen from the increase in private sector installations in the three states as well as at all India level. In wind power project installations also majority investment has been done by the private sector.

3. **Fossil fuel is a major source of power.** Sixty eight percent India’s power requirement was being met through fossil fuel power plants in 2011-12 as can be seen from Table 16. Fossil fuel plant or coal based plants though provide cheap continuous supply of power however the demand for fuel is met through imports. This has led to overdependence on foreign countries for requirement of essential commodity like coal. It has also led to drain
of foreign exchange. Besides, fossil fuel is not environment friendly and is responsible for emitting harmful green house gases. Thus the need of the hour is to explore alternative methods of power generation. The source of power should be cheap, readily available and should not cause environmental concerns. Renewable energy sources are such sources. Among renewable energy also wind is the most commercially viable source. The other sources of power in India are Hydro, nuclear and Renewable Energy. As can be seen from Table 16 the share of nuclear and Hydro has actually declined while the share of renewable energy has increased in all three states as well as at all India level.

4. **Steady but lopsided growth of wind power in India.** India has a good wind resource which can be tapped to solve its power problem. Only 35% of India’s wind power potential had been tapped till 2012 (Table 17). This potential is calculated at 50m hub height. At 80m hub height and with adoption of new and better technology this potential will be even greater. Out of the three states Tamil Nadu has already exhausted its estimated potential and yet more wind power projects are being planned in the state as it has a good wind resource as can be seen from Table 18. Gujarat has the greatest untapped wind power potential among the three states. There has been a continuous increase in installed capacity at all India level as well as in three states under study. Tamil Nadu has the greatest installed capacity but the increase in installed capacity is greatest in Gujarat (Table 19). The percentage increase in generation over base year 2005 has been greatest in the year 2007-08 in all three states as well as at All India level. (Table 22)

5. **Wind Policy adopted by few states:** The growth of India’s wind energy programme is restricted to a few states only as can be inferred from Table 4. Only ten Indian states had wind power programmes as per the Table 4 up to 2012. India has a good wind resource and remaining states can also use this resource to their advantage.

6. **Suitable policy Measures.** The Government has encouraged the growth of wind power in India through suitable policy measures like feed in tariff and benefits like Accelerated Depreciation benefit, Generation based Incentive. To improve the marketability of wind
power it has laid down renewable purchase obligations (RPO) which have to be fulfilled by the utilities. It has also started the sale and purchase of renewable energy credits through power exchanges. This shows the Governments intention to encourage wind power but there is gap in the implementation of policy measures.

7. Lack of uniformity in implementation of tariff policy. Tariff rate is the rate at which utilities purchase power from wind turbine power project installations. The Central Government has prescribed suitable policy measures however while implementing these policies certain gaps can be identified which are as follows:

a) The government has prescribed a higher rate of tariff for wind power installations. This rate is laid down by Central Electricity Regulatory Commission (CERC) but it was observed that the state Governments do not implement the rates laid down by CERC. The state Governments have laid down tariff rates higher than at which power is purchased from conventional sources but they are much lower than the rates set by CERC. Only the state of Maharashtra has been adopting the rates prescribed by CERC from 2010 onwards. (Table 23).

b) The tariff rates have been calculated by adopting the cost plus method. However, the cost of installation or capital cost estimated by the states is much below the cost prescribed by CERC or the market value of the turbines. This has resulted in very low profitability for wind power installations based on feed in tariff. The return on equity is also much below the return on equity stated by the SERCs for computing the feed in tariff rates. (Table 41).

c) CERC has laid down different tariff rates according to different wind power zones based on the capacity utilization factor. A higher rate of tariff is prescribed for zones with lower capacity utilization factor and vice versa. This differential rate ensures the profitability for wind turbine power project installations even in areas of lower capacity utilization factor. (Table 23) The states of Gujarat and Tamil Nadu have not prescribed tariff rates according to wind zones. They have prescribed one blanket rates for all wind power zones. The disadvantage of having one rate is that the rate prescribed according to a
particular capacity utilization factor will not yield any profitability for capacity utilization below the prescribed limit. The advantage of this policy is that it discourages installations in areas where the prescribed limit is not met.

d) CERC has also given two separate tariff rates for installations availing the accelerated depreciation benefit and those which are not availing this benefit. A lower feed in tariff rate is given for installations availing the accelerated depreciation benefit. This Policy helps in removing any undue advantage to those installations which are availing this benefit and those which are not availing the benefit. This means that installations which are taking the GBI incentive as against the AD benefit are not at a disadvantage. This policy has been adopted in Maharashtra and it is reflected in the cash flows. (Table 42 and 43.)

e) The cash flows based on feed in tariff without any incentives reveal that the profits generated are too low to attract any investment. (Table 32)

8. The advantages and limitations of different Incentive schemes: The advantages and limitations of different implemented are as follows:

<table>
<thead>
<tr>
<th>Incentive</th>
<th>Profitability</th>
<th>Advantage</th>
<th>Limitations</th>
</tr>
</thead>
</table>
| Accelerated Depreciation(AD)       | Second in terms of profitability on the basis of cash flows. | 1. Gives tax benefit to the investor.  
2. Easily implemented as the benefit is availed through tax concessions and the cost of installation is recovered within few years of installation. | 1. Encourages investment for availing tax incentive and not for generation.  
2. Is not beneficial for those investors |

Table 65: Advantages and limitations of different Incentive schemes
<table>
<thead>
<tr>
<th>Incentive Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation based incentive (GBI)</strong></td>
<td>3. Most popular benefit till date for attracting investment. who do not have a core business to gain from AD benefit.</td>
</tr>
<tr>
<td></td>
<td>2. Can be availed by that class of investors who cannot avail AD benefit.</td>
</tr>
<tr>
<td><strong>Renewable Energy Credits (REC)</strong></td>
<td>1. Provides incentive based on actual generation.</td>
</tr>
<tr>
<td></td>
<td>2. Can be availed by that class of investors who cannot avail AD benefit.</td>
</tr>
<tr>
<td></td>
<td>1. Minimum installed capacity requirement is 5MW.</td>
</tr>
<tr>
<td></td>
<td>2. There is a cap of Rs 62 lakh per MW.</td>
</tr>
<tr>
<td></td>
<td>3. The incentive is not available to those installations which generate electricity for captive consumption or third party sale.</td>
</tr>
<tr>
<td><strong>Renewable Energy Credits (REC)</strong></td>
<td>1. Beneficial to the investor as well as utility.</td>
</tr>
<tr>
<td></td>
<td>2. REC is price is market based.</td>
</tr>
<tr>
<td><strong>Generation based incentive (GBI)</strong></td>
<td>1. Minimum installed capacity requirement is 5MW.</td>
</tr>
<tr>
<td></td>
<td>2. There is a cap of Rs 62 lakh per MW.</td>
</tr>
<tr>
<td><strong>Renewable Energy Credits (REC)</strong></td>
<td>1. Depends on the RPO laid down by the states and their strict enforceability.</td>
</tr>
<tr>
<td></td>
<td>2. The market for REC is yet to develop.</td>
</tr>
</tbody>
</table>
3. REC issued has validity of only one year.
4. REC is issued for 1MWh of electricity injected into the grid.
5. No secondary market for REC.

9. **Policies have not been implemented on long term basis.** One of the biggest factors which increases the risk perception of investors in wind turbine power project installations is the inability of the Government to implement policies on long term basis. For example, Accelerated Depreciation was being provided at 100% of capital cost till 2005. It was reduced to 80% after 2005 and then withdrawn in 2012. Similarly, Generation based incentive was implemented from 2010 but was withdrawn in 2012. The frequent change in policies discourages investors.

10. **No uniformity in Renewable purchase obligations:** The renewable purchase obligations are determined by State Electricity Regulatory commission (SERC). They help in improving the marketability of the wind power. The RPO obligations prescribed by each state are different. In the state of Gujarat, the RPO obligations have been prescribed only for wind power while in Maharashtra, the RPO obligations are for all non-solar sources. In Tamil Nadu, the obligations have been prescribed for all renewable sources. If the obligations are prescribed for one particular source, the utilities have to complete their quota of RPO obligation from that particular source but if a common quota is provided for all sources of renewable energy then the utilities generally buy from a source depending upon the cost economics and availability.
11. **High cost of installation.** The cost of installation or capital cost of wind turbine power project installation is very high. The cost of wind turbine accounts for about 70% to 80% of total cost of installation. The operation and maintenance cost is very low in comparison and fuel cost is negligible. The cost of wind power project installations is mostly fixed in nature. Apart from cost of installation, the operation and maintenance, depreciation, insurance premium are all fixed as they do not depend on output. The only variable component is reactive energy charges and other such minor charges which may be considered variable.

12. **The cost of generation is greater than tariff rate applicable in all the states.** As a result the wind turbine power project installations cannot become a profitable venture on the basis of tariff alone. This has been proved with the help of ratio analysis and capital budgeting techniques.

13. **Investment made to avail tax benefits.** The investors who invested in the wind turbine power project installations for the period from 2005 to 2010 mostly were private limited companies, partnership firms and individuals. The number of installations owned by them varied from one to five. The reason for investment by these investors was to avail the tax benefits in the form of accelerated depreciation and Income tax benefit u/s sec80IA.

14. **The wind turbine power project installation owners were not very satisfied with the policies of the State or Central Government** nor were they very satisfied with the working of state nodal agencies and state electricity boards. They wanted restoration of accelerated depreciation benefit, better infrastructural facilities and improving the marketability of wind power through proper enforcement of RPO obligations.
15. **The wind turbine power project owners borrowed mostly from commercial banks.** The rate of interest varied between 11% to 12.5% and loan tenure varying from seven years to ten years. The banks provided loans on the credibility of the investors i.e. on the basis of their balance sheets. This proves the following facts:

a) That commercial banks are preferred for borrowings over IREDA and PFC.

b) The banks are not ready to finance on project financing basis as they perceive the risks to be high.

c) The project is financed on the creditworthiness of the borrower and not as a wind turbine power project.

16. **Projects developed by turbine manufactures and developers.** The wind power projects during the period from 2005-12 were mostly developed by turbine manufacturers who would purchase land, take licenses and permissions, develop the infrastructure and install the wind turbine power project installations. They would also look after the operations and management also thus providing end to end solutions. The wind turbine power project investors had to purchase the wind turbine power project installation and sign the power purchase agreement with the utilities and avail the benefits.

17. **The cost was hyped to increase profitability** of wind turbine manufacturers. The above arrangement was beneficial to both the manufacturer cum developer as the manufacturer could get good profits by increasing the cost of installation. The investor also benefitted from the tax benefits. Hence, it was a win-win situation for both the parties. This can be seen from table 65 and fig 21. The cost of installation of wind turbine power project installation did increase on account of increase in cost of wind turbines around the world due to increase in raw materials and increased demand for wind turbines over its supply. However, the cost increase was much more as has been proved by proving the third hypothesis.
18. **No incentive to invest due to withdrawal of incentives.** With the withdrawal of Accelerated depreciation and generation based benefit the wind turbine power project installation owners has no reason for investing in wind turbine power project installations. There was no profitability on the basis of tariff and the benefit of REC market depended on strict enforcement of RPO.

19. **Decrease in cost of installation.** The cost of installation has come down from the year 2010 an account of increased competition among wind turbine manufacturers, decrease in demand from retail investors due to withdrawal of benefits.

**FINAL CONCLUSION**

The present study has assessed the overall power situation in India and the role of wind energy in the overall power situation and derived conclusions based on it as above. It was observed that there has been increase in wind turbine installations in the three states under study as well as at all India level. The Government has encouraged wind power by providing incentives. The Accelerated Depreciation benefit and Income tax benefit under sec 80 IA were the main drivers for investment in the wind turbine installations as observed from this study. However, the reason for investment by wind turbine installation owners was to avail tax benefits and not generation as has been proved by the study.

The reason for the same, on the basis of this study can be enlisted as follows:

1) The Tariff rates provided by state governments are not enough to attract investment.
2) The Tariff rates are not uniform throughout India and vary from state to state.
3) The states do not strictly adhere to the guidelines laid down by Central Electricity Regulatory Commission (CERC) for Tariff determination.
   As a result, incentives have to be provided to attract investments in wind turbine installations.
This fact has been proved by the primary data in the study that 98% of wind turbine installation owners were not interested in reinvestment in wind turbine installations due to withdrawal of Accelerated Depreciation benefit and Generation based Incentive. Hence, it can be concluded that wind turbine installations still require the incentive provided by the Government as they cannot become commercially viable without these incentives. With the growing demand for power, there is an urgent need to encourage wind energy by increasing and bringing uniformity in tariff rate. Besides, suitable incentives like reinstating Accelerated Depreciation benefit, Tax exemption, linking tax to generation, and increase in Generation based incentive. Besides this the REC market should also develop by increasing the RPO limit and strict enforceability of RPO by states. It should become mandatory for common consumers to source some part of their power requirement through a renewable energy source, either by installing a source or by purchase of REC.

Thus wind power can be a solution to India’s growing power requirement and should be suitably encouraged through suitable incentives.
5.4 RECOMMENDATIONS

5.4. 1 General

1. Availability of affordable & un-interrupted power to the citizens. The aim of the Government should be to provide un-interrupted and affordable power to its citizens. The availability of power should not be an issue for the people. The goal of the government,” availability of power for all by 2050” should be modified as availability of “affordable power for all by 2050”.

2. This can only be possible if different resources of producing electricity are tapped. By opening the power sector for private investment the Government has increased competition and increased availability of power. However, the power generation is still dominated by fossil fuel. The need is to reduce the dependence on fossil fuel for this the different sources of energy like renewable energy should be tapped.

3. The production of power through various technologies like small wind turbine, bio gas etc should be encouraged. The Government has taken suitable steps but these technologies have not become popular due to lack of technology, awareness and availability. There is need to increase the awareness as well as availability for the same. The need to produce power in every home is an urgent need because as per finding demand from domestic sector is growing very fast.

4. To increase the popularity and usage of wind energy, stand alone wind turbines can be installed to meet the need of a group of houses, or a housing society. This method can also be adopted for solving the problem of rural electrification. A small cluster of wind turbines can be installed and with the help of local grid can also meet the requirements of residential as well as industrial area.
5.4.2 Specific

1. Tariff:

The following conclusions have been drawn on the basis of the study.

   a) There is no uniformity in tariff rates across India.

   b) The tariff rates are not being determined according to CERC guidelines.

   c) Tariff rates are not sufficient to attract investments.

   a) Uniformity in tariff rates: The study has shown that the tariff rates are not uniform. They vary from state to state. A uniform rate of tariff should be adopted by the SERC on the basis of guidelines from CERC. CERC lays down the guidelines for determining the tariff rates as well sets down standard tariff rates.

   b) It has been observed that the tariffs rates prescribed by CERC are not being strictly followed. For example CERC has laid down separate tariff rates according to wind zones as well as different rates for investors availing the Accelerated Depreciation benefit and those who are not availing this benefit. This policy has been adopted only by Maharashtra but the other two states have not followed these guidelines. Hence, it is recommended that the tariff rates laid down by CERC should be implemented throughout India.

   c) The tariff rates are not sufficient to attract investors. According to the study, the tariff rates are not able to cover the cost of generation also even though they are calculated by the cost plus method. The main reason is that the parameters adopted for calculating the cost is much below the market norms. Hence, the tariff rates calculated on the basis of these parameters are also low. CERC* has suggested an indexation method to calculate the cost of installation which is as follows:

\[
CC (n) = P&M (n) \times [1+F1+F2+F3]
\]

\[
d (n) = (a \times (S1(n)-S1(0))-1) + b \times (E1(n)-E1(0))-1)/(a+b)
\]

\[
P&M (n) = P&M b (0) \times (1+d (n))
\]
Where,

\[ a = \text{weight age of steel index}, \]
\[ b = \text{weight age of electrical machinery index} \]
\[ F_1 = \text{Factor for land and civil works} \]
\[ F_2 = \text{Factor for Erection and commissioning} \]
\[ F_3 = \text{Factor for IDC and Financing} \]

The formula has factored in the rise in cost of steel and electrical machinery, land and civil works, erection and commissioning and infrastructural development and financing.

As per the current study there are two factors responsible for price increase namely:

Endogenous: Those drivers which are within the control of the industry.

Exogenous factors: Those drivers which are beyond the control of the industry.

The endogenous factors cannot be included for the purpose of indexation as they are in control of the industry however; exogenous factors have to be factored in for purpose of indexation. Out of the three exogenous factors studied only one namely increase in raw material prices has been factored in for calculating the capital cost. *The other two factors which are increase in energy prices and foreign exchange should also be factored in for calculating the capital cost.*

2) **Tax Benefits:**

Tax benefits increase the returns of any project or proposal. Hence, they play an important role in attracting investment. The following benefits are recommended.

a) Tax benefit under sec 80IA should be extended for 20 years: The tax benefit under sec 80IA is applicable to all power generating and distribution companies and not specific to wind turbine power project installations only. In order to promote wind energy this benefit should be extended for a period of at least 20 years.
b) Withdrawal of Minimum Alternate Tax (MAT) :Currently, minimum alternate tax at the rate of 20.08% is payable on the book profits. The wind power project installations get a ten year tax holiday as per Sec 80IA. During this period also MAT is applicable. On the basis of current study it can be observed that the pre tax returns are very low. After tax these returns are reduced further giving no incentive for investment. Hence, it is recommended that MAT should be withdrawn on wind power project installations.

c) Accelerated Depreciation Benefit: The Accelerated Depreciation benefit has been the greatest driver for investment in wind energy in India. The Government’s decision to discontinue the benefit in 2012 seriously impacted the investment decision as has been brought out by this study also. The Accelerated Depreciation should continue so that it gives the incentive to small investors to invest in wind energy. The incentive should be adopted till REC market have developed and it becomes profitable to invest in wind installations without accelerated depreciation benefit.

d) Production Tax Credit: In USA, tax credit is given on the basis of production known as Production tax credit. A tax credit on similar lines should be adopted in India. This will help in providing incentive on the basis of generation.

3) Generation based incentive:

Among the incentives provided by the Government, GBI gives the least benefit. Generation based incentive is an incentive of INR 0.50 per unit generated subject to a cap of 62 lakhs per MW. It has been proved from the cash flows that GBI gives the least profitability among the incentives given by the Government. This incentive is availed by those who cannot avail the accelerated depreciation benefit. Hence, in order to attract greater investment it is necessary to increase the rate and limit of this benefit. The rate of GBI should be Rs 1.00 per unit and the maximum limit should be Rs 124 lakh per unit. This benefit should give greater profitability than Accelerated Depreciation benefit so that even those who are eligible for Accelerated Depreciation should opt for this benefit. As this benefit is based on generation it is better option for the growth of wind turbine installations.
4) Renewable Purchase Obligations:

a) The renewable purchase obligations (RPO) are laid down by State Electricity Regulatory Commission. As can be seen from the study RPO obligations are different in different states. Some states have not stated the RPO on long term basis. Some states have also reduced their RPO limits. The states which have implemented the RPO obligations have not been able to enforce these obligations. This has directly impacted the REC market. It is necessary to enforce the same rate of RPO in all states. The RPO Obligations should also be strictly enforced.

5) Renewable Energy Credits:

The current study shows that the investors can get maximum profitability through the REC –APPC route. This will only be possible if the REC market is fully developed and demand is generated for the REC. The renewable energy certificates have been trading at the power exchanges namely Indian Energy Exchange (IEX) and Power exchange of India (PXIL) from March 2011. However, the demand for REC has not been generated. This is because the RPO targets are not being strictly enforced. The suggestions to increase REC market are as follows:

a) Increase the scope for RPO obligations: The RPO obligations should be made mandatory for not only power utilities but also for consumers of electricity. The consumers should be divided into two categories.
Fig 22: Consumers of Electricity

Consumers of Electricity

Wholesale consumers  Retail Consumers

1. Large scale industries  1. Small scale industries
2. Medium scale industries  2. Domestic consumers
3. Railways  3. Commercial consumers

A certain portion of electricity consumption by the above category of consumers should come from renewable energy sources. This can be done in two ways;

a. Wholesale consumers:

Either obtains electricity directly through a renewable energy source for example by installing wind turbines for captive consumption or purchasing electricity from renewable energy source for wholesale consumers. These consumers should get the benefit of Accelerated Depreciation benefit.

Or

Purchase a certain portion of their electricity requirement from power utilities a higher rate than prescribed rate.

Or
Purchase REC from the power exchanges. The second two categories should get a tax benefit at a certain percentage. The REC should have a minimum duration of two years.

b. Retail consumers:

The retail consumers should also either install a renewable energy source like a small wind turbine for fulfilling their requirements for which either they should get a subsidy or a tax benefit.

Or

Purchase REC from power exchanges. The REC for retail consumers should be of a smaller denomination and of fixed value. These REC should expire within a year.

6) Financial Requirements:

The wind turbine power project installations finance seventy percent of project cost through debt financing. Institutions like IREDA and PFC provide debt to wind turbine power project installations. However, majority of the wind turbine power project owners prefer to borrow from commercial banks as has been observed in the current study. In order to make the debt available at reasonable rates the following suggestions were made:

a) Priority sector lending: The Government should declare renewable energy as a priority sector. A certain percentage of banks loan should be provided for renewable energy installations. The banks should have a fixed target for financing this sector.

b) The banks should have separate cell for renewable energy. This cell will help in identifying the needs, problem and will design suitable financial products for this sector.

c) The Government undertakes the guarantee for particular loan raised by an organization for example loan to co-operative sugar factories are provided guaranteed by the State Government in the interest of the society. On the same
lines if the Government can provide some credit guarantee scheme for wind power installations it will help the financing of wind power.

7) **Land:**

Land should be made available by the government. One of the observations made by the researcher in the course of interviews with the developers was that land was becoming a major issue, both in terms of availability and pricing. Some of the wind turbine power project owners interviewed also expressed that though they had faced no difficulty in obtaining land as it was provided by the developer however in the course of time they were facing hostility from the local population.

The solution lies in Government creating a land bank and transferring the land to wind turbine power project owners on lease. Initially a total area of land was being purchased for setting a wind farm but now only the land for foot print area for erecting the tower and unit substation and approach road is acquired. Hence, the remaining area can be utilized for some other purpose including agriculture.

Wind is an important resource of the country which can be suitably tapped to produce electricity at affordable rates as well as address environmental concerns. This resource should be promoted through various incentives by the Central and State Governments.