Government of tamil nadu engineering essay

Engineering

Abstract

The aim of the thesis is to study about the frequent power shortages its causes, wind power potential , policy and efforts put by Government of Tamil Nadu in support of Wind power development. To idendify the potential Wind sites for new projects and repowering of outdated wind turbine generator in Tamil Nadu

Introduction

In light of the mounting concern over the continual use as an country, India continues to lag behind in actions and intent on use of Electricity and promoting Renewable Energy (RE). With the energy generating capacity has increased significantly still as a state and country it lags behind in demand and many rural areas are didnt have access to electricity. The state of Tamil Nadu is located on the southern most part of India surrounded by neigbouring states of Kerala on West, State of Karnataka on north-west and Andhra Pradesh on north-east of Tamil nadu. Tamil Nadu is the eleventh largest state in India with area od 130, 058 sq. km, one of the most populous state more than 60 million people. The state of Tamil Nadu had attracted most business enterprises through various schemes and promotionsIn 2003 separate minsitry for renewable industry has been allocated by Government of India to bring in specialsed focus into renewables energy. Under Minstry of New and Renwwable energy (MNRE) an atonoumous institute called Centre for Wind Energy Technology(CWET) for wind energy has been set up at Tamil Nadu. This has been set up to develop, implement cost-effective technology, wind resource assesment, preparing standards, testing, commisioning and consulting services dedicated for wind IndustryFig : 1 Map of Tamil Nadu

Source: WISE 2010

Background

The state govenment of Tamil Nadu and Tamil Nadu Electric Board(TNEB) had failed to make progress to reducing the power outages which prevailed from 2004, rather the govenment continued to focused on subsidised elcetricity to Industrial estates, giving away freebies households to attract voters . In 2012 many part of the state other than the capital city Chennai are affected by an average of 6 hours of power cuts(the worst case was even 16 hours a day). Small scale industries suffers from insufficient power, resulting in poor production, unable to make loan payments and resulting in loss of revenue . Basic household needs such as cooking, cooling, heating are affectedIt was hoped that wind energy might play a supplementary role to meet the growing power demand in the country in general and Tamil Nadu in particular. But the gap between demand and supply has been increased in recent years forcing to increcsed power outages all over Tamil Nadu. As of now the peak damand on a day is more than 4000MW. Uncertainity of Kudankulam Nuclear power plant (900MW) further added woes . The grid operators had no other option than to enforce power cuts. The private producers doesnot want to continue to supply power for non-payment dues

Wind Power Development

In recent times, we have seen many committed citizens coming together across the country and making significant progress on the journey of sustainable energy. For example, in Bihar, where almost 80% of the population resides in rural areas with limited or no access to electricity, Husk

Power Systems provides electricity to over 100, 000 people using rice husk, which was essentially a waste product in the villages. Similarly near Andhra Pradesh border in Karnataka, Agriculture Development and Training Society, has built 5, 500 biogas units across 339 villages providing clean cooking fuel and energy for heating water. In Delhi, Holy Family Hospital is saving up to 60% on its water heating bills due to solar systems set up on its roof, while Odanthurai panchayat in Tamil Nadu, has invested in wind turbines to provide better energy and public services for its citizens. In India the total gross inland consumption increased from about18, 800 PJ/a in 2000 to 29, 000 PJ/a in 2009. Renewable energy provided 7, 500 PJ/a or 25% of gross energy consumption in India in 2009. Despite the overall growth of renewable energy in India and worldwide and constant maturing of these technologies, there is an urgent need to implement renewable energy on a much larger scaleRenewable energy has the potential to transform energy markets across the state but more so in case of India. India’s wind turbine industry clearly shows that the country has developed into a global hub for manufacturing renewable energy equipment.

Company

State

Suzlon energy LtdPuducherry/ GujaratGamesa Wind Turbine Pvt LtdTamil NaduGE India Industrial Pvt LtdKarnatakaKenersys India LtdMaharastraEnercon India LtdMaharastraElecon engineeringGujaratGlobal Wind Power LtdMaharastraGaruda Vaayu Shakthi LimitedTamil NaduLeitner Shriram Manufacturing LtdTamil NaduPoineer Wincon Pvt LtdTamil NaduR K Wind LtdNew DelhiRegen Powertech Pvt LtdTamil NaduRRB Energy LtdTamil

NaduChiranjjevi Wind Energy LtdTamil NaduInox Wind LtdUtter PradeshSiva wind Turbine India Pvt LtdTamil NaduSouthern Wind Farms Pvt LtdTamil NaduVestas Wind Technology India Pvt LtdTamil NaduWinWind Power Energy Pvt LtdTamil NaduShriram epcTamil NaduSRC Green PowerTamil NaduGhodawat Energy Pvt LtdMaharastraWelspun EnergyNew DelhiIndia Wind PowerTamil NaduNEPCTamil NaduNordic (India) solutions pvt ltdTamil NaduAzure PowerNew DelhiMoser baer projectsNew DelhiKarma energyMaharastraTorrent PowerGujaratGreen InfraNew DelhiWeizmann LimitedMaharastraOrient greenpowerTamil Nadu

Other source of input to grid

Fig: Installed Generation Capacity in Tamil Nadu 2009Source: TNEB policy note 2009From the above fig and table, its evident that wind power is major contributorFig : Wind Power Density MapSource : Centre for Wind Energy Technology (2010)

State

Installed Capacity (MW)

Andhra Pradesh212Gujarat2641Karnataka1852Kerala35Madhya Pradesh330Maharastra2560Rajasthan1830Tamil Nadu6613Others4Table: State-wise Wind Power Installed capacity in MW (up to Dec 2011)5% of energy in case of consumption at HV/EHV and 7. 5% in case of LVBanking : 5% (12 months)Rate : Rs. 3. 39/kWhMajority of WTG Manufacturers (Joint ventures, subsidiaries of foreign companies and Indian companies)have set up their different component manufaruting units in several part of Tamil Nadu due to attractive fiscal and finacial incentives such as excise duty exemption, sales tax exemption, income tax excemptio for 10 years, generation based incentives for wind power projects

Factors led to decline in Windfarm development

Unplanned addition of windfarm (Muppandal, Kayathar, Poolavadi etc,.) inadequate capacity at dedicated substations resulted in shutting down of wind turbines even during peak wind speed period with loss of generation and hence revenue loss to windfarm owners. Improper maintenance of turbines by owners and suppliers . connecting WTGs to weak and rural feeder lines in the absence of dedicated substations at some windfarm sites, poor grid--poor generation --loss of revenueinadequate facilities by some manufacturers of WTGs at sites for repairs as well as at their works. This led to long delays, breakdown periods and loss of generation rotor blade failures in some cases due to manufacturing defects as well as lightning strike disregard for earthing regulations and lightning protection leading to unduly large breakdown of control systems which resulted in very expensive repairs and long breakdown periods reduction in tax concessions enacted by the Union Government led to correspondingreduction in tax benefits to investors to put in windfarms. slump in textile and cement business activities. withdrawal of third party sale. difficulties in availing loans from banks especially for newly floated companiesapplying wind speed data from limited number of anemometers (two for 300 MW in Muppandal) resulted in wide variation from predicted wind turbine generation and actual generation, thus creating doubts about the viability of wind projects . the earlier irrational import policy led to substantial numbers of unworthy and uncertified machines, which resulted in failures of some models and cast aspersions in investors about the technology itself. As a result, the market for wind turbines dramatically shrunk, leaving even the genuinely good machines in troubleIncrease in power tariffs from 0. 12 INR to 2. 51INR an unitVery low tariffs compared to other state. Introduction of transmission charges for capitive investors(companies which generate and consume themselves) had also taken away the interst towards wind power. TNEB has not been able to pay power suppliers for years and don't have definite plan to settle the remaining dues, which intern affects the bank loans and TNEB the only constumer to buy electricity power suppliers had been forced to shut down prodution even during peak production hoursTweaking the policies and make promising plan could benifit the exsiting suppliers, repowering some of the best sites could benifit the people from power deficit in future and tamil nadu will continued to be attractive destination for wind industry

Energy Policy and Developments

Renewable energy resources and technologies are facing some critical barriers towards its development & deployment which are market-oriented, perception related, technology-biased and political in nature. To overcome these barriers, appropriate policy reforms at regulatory and market level must be ensured. The most important step is setting up an aggregate and stipulated generation based national renewable energy target of at least 20% by year 2020. This would help in consolidating the multiple targets for renewable energy. Furthermore, mandatory escalating Renewable energy Purchase Obligations (RPOs) target for each state was set up based on logical and rational criteria and have strong compliance and monitoring regime. Further, decentralised renewable energy infrastructures was prioritised as preferred option for rural/household electrification and therefore, half of financial allocations under national flag-ship rural electrification programme Rajiv Gandhi Gramin Vidhyutikaran Yojana (RGGVY) was be allocated for off-grid or grid-interactive renewable energy projectsThe challenge required to complete transformation of power to be produced, consumed and distribute energy, while maintaining economic growth. The five key principles behind this Energy Revolution was :•Implement renewable solutions, especially through decentralised energy systems•Respect the natural limits of the environment•Phase out dirty, unsustainable energy sources•Create greater equity in the use of resources•Decouple economic growth from the consumption of fossil fuels

Central govenment Incentives

80% accelerated depreciation on Wind farm equipementsGeneration based incentive (GBI) for grid interactive wind power projectsConcession on import duty on specified wind turbine componenets10 years tax holiday for wind power generation projects90% subsidy for rural electrification through renewable Energy (RGGVY Rajiv Gandhi Grameen Vidyutikaran Yojana)Custom and Excise duty exemptionReduced wheeling charges as compared to conventional energy100% Foreign direct Investment were allowed n renewable power projects

State level Incentive

3. 39 INR/kWh fixed price for 20 years without any escalation for wind mills commisiioned on or after april 2009Third party sale and self-use were allowedNo electricitiyConstruction of approach roads were funded50% cost for Evacuation arrangemnets like layingdown cables, feeders, sub-station

etc.. were subsidiced nad remaining weregiven as interest-free loanTo avoid dangerous climatic changes Greenpeace, GWEC and EREC suggest that the following policies and actions should be implemented in the energy sector: 1. India should have an aggregate target of at least 20% renewable energy in the national grid by 2020. 2. Each state should have an ambitious but mandatory Renewable energy obligation (RPO) target based on Renewable energy potential, consumer profile and economic status of the state. The RPO should have stringent compliance mechanism for effective implementation. 3. Enabling bottom up energy/electricity infrastructure and top-down financing as key principle for household / rural electrification. 4. Recognizing Decentralized Renewable Energy- both grid-interactive and off-grid, as preferred option in all government policies and scheme for energy access. 5. A transparent public consultation process should be held to arrive at the criteria for determining which forests should be permanently closed to mining. 6. Increase public investment in innovation through support for research and development. 7. The existing environment clearances for coal based power plants must be re-examined on the basis of a cumulative water impact. 8. Create a dedicated Renewable Energy Collateral fund for significant deployment of renewable energy. 9. Declare Renewable energy sector as priority lending sector and ensure nationalized banks and government financial institutions should provide easy soft loans to decentralized renewable energy projects. 10. Ensure better monitoring and management, first through smart meters at consumer’s level and then by integrating more advanced ICTs technologies like energy internet.

Grid Code for Wind Industry

A set of grid code has been proposed by CWET in order to establish starndard operating practice for wind turbines to minimize the impacts from frequency, voltage fluctuations, flicker, reactive power absorption and maximize the quality output. Indian wind grid code had been set up following the wind power leaders like USA, Germany, Canada, Spain and DenmarkWind generating facilities often require siginificant reactive power(VAR) support to maintain voltage and power factor withing the operating limits prescribed by transmission grid. Induction generators need VAR(Volt-Amphere Reactive) support from capacitor banks or drawn from the grid, which affects the voltage at the interconnection region. While, syncronous generators had to deal with harmonics. Hence, grid codes are set up for different type of generators for optimal production

Harmonics:

According to IEC 61400-21, harmonics measurement are required only for varialbe speed WTG with power electronic convertors. Harmonic content of the supply voltage is indicated by : Total harmonic distortion of voltaage = Vthd (%)Where Vn = nth harmonic of voltage; V1 = fundamental frequency Voltage(50Hz)System Voltage (kV)Total Harmonic Distotion (%)Individual Harmonic of any particular frequency (%)7651. 51. 04002. 01. 52202. 52. 01323. 002. 0Table : Voltage harmonic limitsWhere In = nth harmonic of current; I1 = fundamental frequency current(50Hz)

Active Power Control:

It is defined as the ability of wind turbine generator to regulate the active power output. To ensure a stable frequency in the system, to prevent overloading, to avoid large voltage steps and rush-in currents during start up and shut down ot WTG

Voltage imbalance :

Its defined as highest and lowest line voltage divided by the avaerage line voltage of three phases. Connecting a WTG to an unbalanced system will cause negative phase sequece current to flow into the rotor of WTGVoltage limitsVoltage level (kV)Imbalance (%)4001. 52202 <2203

Frequency Requirements:

System frequency is a major indicator in the system. Decrease or increase in generation causes frequnecy to drop or raise above nominal value. This imbalace cam be mitigated by primary and secondary control of conventional synchronous generators. Wind farms should be capable of operating continoiusly at system frequency range of 47. 5 to 51. 5Hz. Wind farms ccan br remain connected to grid when rate of change of frequency is within 0. 5Hz/sec.

Voltage and Reactive Power Issues:

Induction generators need reactive power support from grid. To reduce the impact on grid capacitor banks are used. Doubly fed induction and synchronous generators doesnot have this issues. Wind farms should have provision for VAR compesation such that they donate draw reactive power from grid. VAR exchanges with grid are priced as follows: Wind farm owner pays for VAR drawn from grid, when voltage at grid connection point is below 97% and VAR given to grid, when voltage is below 103%Wind farm owner gets paid for VAR supplied to grid, when voltage at grid connection point is below 97% and VAR drawn, when voltage is above 103%0. 25INR/kVArh upto 10% and 0. 50/kVArh above 10%

Fault/ low voltage ride through :

It is defines as ability of the WTG to remain connected to the grid without tripping grom grid for a specified period of time during a voltage drop at the point of connection. This depends on the magnitude of voltage drop at point of common coupling during fault and time taken by grid system to recover to the normal state. During a fault that causes a voltage drop at the wind turbine terminals, the reactive power demand of induction generators increases. Unless a reactive power support is available at the generator terminals, the reactive power will be drawn from the grid and further instability

Wind Farm Protection:

Operating voltage limits for Wind farmsVoltage (kV)Nominal voltage% Limit of VariationMaximumMinimum400+5to -10420360220+11to -9245200132+10 to -9145120110+10 to -12. 512196. 2566+10 to -972. 56033+5 to -1034. 6529. 7The wind farms should be equipped with voltage and frequency relays to disconnect it from the grid, when wind farm is operating outside the operating points of voltage and frequency of systemMinimum protection schemes that should be installed for wind farm protection areOver/under voltage protectionOver/under frequency protectionOver current and earth fault protectionLoad unbalace protectionDifferential protection for grid connecting transformensCapacitor banksTele-protection channels between grid connection point and user connection point circiut breakerBack-up protection shall be provided for required isolation/prevention in the event of failure of primary protection systems to meet fault clearance timeData communication chanel to monitor continously by system operator at substation level (Wind speed , wind direction, active/reactive power output, ON/OFF instruction, voltage regulation set point)Lightinng and Earthing protection equipmentsThe peneration of wind can be variable during the seasonal changes and with time, its is recommended to carry out reasonable forecasting method for proper scheduling and dispatching into the electrical system. Any changes vast difference amount of power fed into the grid can affect the system operator performance and difficult to meet the deamnd. Hence, it is recommended to adapt forecasting system. It can be hourly forecast / day ahead forecasting. Day ahead forecasting is to determin the probable energy derivation from wind energy and hourly forecasxt to mininmise the forecasting error