ICS 27.180
P 61
Record Number: J2299-2017

NB

ENERGY SECTOR STANDARD
OF THE PEOPLE'S REPUBLIC OF CHINA

中华人民共和国能源行业标准

P NB/T 31105 -2016

Preparation Specification for Feasibility Study Report of Onshore Wind Power Projects

陆上风电场工程可行性研究报告编制规程

Issued on December 5, 2016 Implemented on May 1, 2017

Issued by National Energy Administration of the People's Republic of China

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Chief Development Department: China Renewable Energy Engineering Institute

Approval Department: National Energy Administration of the People's Republic of China

Implementation Date: May 1, 2017

China Water & Power Press

中国水利水电出版社

Beijing 201X

Introduction

This English version is one of China's energy sector standard series in English. Its translation was organized by China Renewable Energy Engineering Institute authorized by National Energy Administration of the People's Republic of China in compliance with relevant procedures and stipulations. This English version was issued by National Energy Administration of the People's Republic of China in Announcement [201x] No.xx dated xxxx, 201x.

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Many thanks go to the staff from the relevant standard development organizations and those who have provided generous assistance in the translation and review process.

For further improvement of the English version, all comments and suggestions are welcome and should be addressed to:

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国家能源局

Announcement of National Energy Administration of the People's Republic of China

[2016] No. 9

According to the requirements of Document GNJKJ [2009] No.52, "Notice on Releasing the Energy Sector Standardization Administration Regulations (tentative) and detailed implementation rules issued by National Energy Administration of the People's Republic of China", 373 sector standards such as *Code for Design of Coalbed Methane Gathering and Transportation Systems*, including 66 energy sector (NB) standards, 29 energy/petrochemical sector (NB/SH) standards, 111 electric power sector (DL) standards and 167 petroleum and natural gas sector (SY) standards, are issued by the National Energy Administration of the People's Republic of China after due review and approval.

In the above standards, coalbed, biological liquid fuel, electric power, and electrical appliance equipment standards are published by the China Electric Power Press, coal-based fuel standards are published by the Chemical Industry Press, coal standards are published by the Coal Industry Press, oil and gas standards are published by the Petroleum Industry Press, the petrochemical industry standards are published by China Petrochemical Press, the boiler and pressure vessel standards are published by Xinhua Publishing House.

Attachment: Directory of Sector Standards

National Energy Administration of the People's Republic of China

December 5, 2016

Attachment:

Directory of Sector Standards

Serial number	Standard No.	Title	Replaced standard No.	Adopted international standard No.	Approval date	Implementation date
…						
35	NB/T 31105-2016	Preparation Specification for Feasibility Study Report of Onshore Wind Power Projects			2016-12-05	2017-05-01
…						

Foreword

According to the requirements of Document GNJKJ [2012] No. 326 issued by National Energy Administration of the People's Republic of China, "Notice on Releasing the Development and Revision Plan of the Second Batch of Energy Sector Standards in 2012", and after extensive investigation and research, summarization of practical experiences, consultation of relevant national and sector standards and wide solicitation of opinions, the drafting group has developed this specification.

The main technical contents of this specification include: basic data, executive summary, wind energy resources, engineering geology and hydrology, project tasks and scale, type selection & layout of wind turbine generator systems (wind turbines) and estimate of energy output, electrical system, fire protection, civil works, construction planning, environmental protection and soil and water conservation, occupational safety and health, design cost estimate, financial evaluation and social impacts analysis, energy saving, and tendering.

National Energy Administration of the People's Republic of China is in charge of the administration of this specification. China Renewable Energy Engineering Institute has proposed this specification and is responsible for its routine management. Wind Farm Planning and Design Subcommittee of Energy Sector Standardization Technical Committee on Wind Power is responsible for the explanation of the specific technical contents. Comments and suggestions in the implementation of this specification should be addressed to:

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Contents

1 General Provisions

1.0.1 This specification is formulated with a view to standardizing the feasibility study report preparation for onshore wind power projects in terms of the contents, adequacy and technical requirements.

1.0.2 This specification is applicable to the feasibility study report preparation for onshore wind power projects.

1.0.3 In addition to this specification, the preparation of feasibility study report for onshore wind power projects shall also comply with the current relevant standards of China.

2 Basic Requirements

2.0.1 The report preparation shall observe the principle of safety, reliability, technical feasibility, practicality and efficiency.

2.0.2 Application of new materials, new processes, new structures, and new equipment in the feasibility study shall be subject to technical and economic appraisal.

2.0.3 In the feasibility study, different design schemes shall be compared and wisely selected in terms of wind turbines, wind turbine foundation pattern, step-up distribution equipment, collection line, roads, and step-up substation, so as to justify their technical feasibility.

2.0.4 Possible restrictive factors related to wind power project shall be analyzed to evaluate its implementation practicality.

2.0.5 The energy output capability, cost level, return rate and financial sensitivity of a wind power project shall be analyzed to evaluate its financial viability.

2.0.6 The contents of the feasibility study report should be consistent with the provisions in Appendix A.

3 Basic Data

The basic data to be collected for the feasibility study shall include:

3.0.1 The outcome in the planning stage and special studies related to power development, power accommodation, transmission planning, etc.

3.0.2 The pre-feasibility study and wind resource assessment results.

3.0.3 Basic conditions and data of meteorological stations in the vicinity of the project site, not shorter than 30 years in the time frame, including the monthly average statistical data of wind speed, wind direction, air temperature, air pressure, humidity, thunderstorm, sandstorm and extreme weather conditions, as well as the hour-by-hour wind speed and wind direction data of the referenced meteorological station concurrent with the monitoring time frame of the meteorological mast (s) established in the wind farm site; other long-term meteorological observation data or meteorological model reanalysis data may be collected as well.

3.0.4 Wind data within the project site, including measurement location, altitude, measurement period, meteorological mast installation report, surrounding topography and morphology, anemometry instrument setup and inspection report, of which at least one anemometer mast shall have the wind data of not less than one year.

3.0.5 The 1:50000 topographic map within the range of the wind farm boundary and 10 km extension, and 1:10000 or 1:5000 topographic map within the range of the wind farm and 1 km to 2 km extension. For a wind farm project in a mountainous area, a 1:2000 topographic map of the project area should be acquired.

3.0.6 Information about sensitive points and restrictive development zones within the wind farm site and its surrounding, including the distribution of nature reserves, construction ban areas, covered mineral areas, historic reservation areas, settlements, etc., as well as current land use and planning information.

3.0.7 Engineering geology and hydrological data.

3.0.8 Socio-economic condition and development plan, power sector current situation and development planning, geographic power grid network diagram of the wind power project area and the powered region.

3.0.9 Data and information about the wind farm to be connected into the power system.

3.0.10 Natural conditions and outbound transport conditions in the wind farm project area.

3.0.11 Prices of main construction materials in the region where the wind farm is located and related cost estimate rules or regulations.

3.0.12 Preferential policies that wind farm projects may enjoy, etc.

4 Executive Summary

4.0.1 The Executive Summary should cover an overview, wind energy resources, engineering geology and hydrology, project task and scale, wind turbine selection and layout, energy output estimate, electrical system, fire protection, civil works, construction planning, environmental protection and water and soil conservation, occupational safety and health, primary cost estimate, financial evaluation and social benefit analysis, energy saving, project tendering, conclusions, project characteristics table and other contents.

4.0.2 The Overview section should briefly describe the project location, topography and morphology, climatic features, project planning, main conclusions of previous studies, the higher authorities, the construction scale and installed capacity that may eventually reach at current stage, power transmission programs, feasibility studies work process and the agreement with the relevant government departments, and other constraints that may exist, a schematic drawing of wind farm location.

4.0.3 The Wind Energy Resources section should give an overview of wind resources in the project area, meteorological data such as air temperature, atmospheric pressure, humidity, thunderstorms, sandstorm, congelation, and others, describe their main characteristic values and analysis conclusions, and evaluate the wind energy resources of the wind farm.

4.0.4 The Engineering Geology and Hydrology section should brief the regional geology, physical and mechanical properties of rock and soil mass, the conclusion of major engineering geological problems, assessment of geological disasters, as well as hydrology at the project site area.

4.0.5 The Project Task and Scale section should brief the project planning background, relevant regional economic and social development, power system status and development plan as well as the project's role in the power system, and account for the project development task and scale.

4.0.6 The Wind Turbine Selection, Layout and Energy Output Estimate section should brief the selected wind turbine-generator type, single unit capacity, number of units and their arrangement, and estimate the annual on-grid energy of the wind farm.

4.0.7 The Electrical System should brief the scheme of connecting wind farm's step-up substations into the power system, the selection and arrangement of the main electrical equipment, wind turbine collection line wiring scheme; and should brief the control and protection of wind turbine and main electrical equipment, and wind farm's dispatching and communications program.

4.0.8 The Fire Protection section should brief the fire protection design and the fire control plan during the construction period.

4.0.9 The Civil Works section should brief the project scale, grade, standard, general layout plan, foundation design of wind turbine, foundation design of wind turbine step-up and power distribution equipment, as well as the dimensions, layout plan and structure pattern of major structures.

4.0.10 The Construction Planning section should brief the construction conditions, traffic conditions, installation method of wind turbine, construction method of major structures, general construction layout principles, construction schedule, main construction materials, main construction machinery and equipment, supply and consumption of water and power during construction, areas of permanent and temporary use lands for construction purposes.

4.0.11 The Environmental Protection and Soil-Water Conservation section should brief the main conclusions and countermeasures with respect to the environmental impact assessment and the soil erosion and water loss impact analysis.

4.0.12 The Occupational safety and health section should outline the main risk factors analysis and preventive measures.

4.0.13 The Primary Cost Estimate section should prescribe the principles and bases for the preparation of design estimates, static investment, total project investment and financing plan.

4.0.14 The Financial Evaluation and Social Benefit Analysis section should brief the major results and conclusions of financial and social benefits evaluation.

4.0.15 The Energy Saving section should brief the main conclusions of energy-saving analysis for the project.

4.0.16 The Project Tendering section should brief the tendering scope, tendering method and tendering organization form.

4.0.17 The Conclusion section should summarize the conclusions of the feasibility study report for the project.

4.0.18 The Project Characteristics Table should be tabulated in accordance with the provisions of Appendix B of this Regulation.

5 Wind Energy Resources

5.1 Regional Wind Energy Resources

5.1.1 An overview of macro-distribution of wind energy resources in the wind farm area should include parameters such as theoretical reserves and technically developable reserves.

5.1.2 The causes of wind energy resources in the wind farm area shall be accounted for in brief.

5.2 Referenced Meteorological Stations

5.2.1 Referenced meteorological stations or other weather stations with long-term meteorological data should be compared and selected for the wind farm.

5.2.2 Basic conditions of the referenced meteorological station (s), including coordinates, elevation, siting history, surrounding environment, anemometer installation height, and change, shall be briefed. Meteorological element features of weather stations or reanalysis data, annual and interannual wind speed change laws, and wind direction characteristics shall be produced in statistical forms.

5.2.3 Requirements for the wind farm design shall be proposed in respect to regional climatic features.

5.3 Checking and Processing of Measured Wind Data

5.3.1 Basic conditions of the available meteorological masts within the wind farm site range or in the peripheral area shall be described, including location, altitude, wind measurement period, surrounding topography and morphology, and anemometer setup. Based on topography and environmental conditions, meteorological mast erection report, and anemometer inspection report, it should be briefly appraised whether meteorological masts can meet the wind resource assessment requirements.

5.3.2 The measured wind data checking and processing shall be conducted in accordance with GB/T 18710, *Methodology of Wind Energy Resource Assessment for Wind Farm*. The monthly and annual average wind speed statistical data at different mast heights before and after processing shall be presented in tables; when the wind measurement period is more than one year, the statistical data shall be presented year by year.

5.3.3 Measured wind data utilization shall be based on meteorological mast's representativeness analysis.

5.3.4 Based on long-term wind data measured by meteorological stations or reanalysis data, the selected wind data shall be rectified and processed in accordance with GB/T 18710, *Methodology of Wind Energy Resource Assessment for Wind Farm*. Verified wind data at different heights of the meteorological masts shall be rectified into a series of representative wind data reflecting the long-term average level at the wind farm site.

5.4 Wind Energy Resources Assessment

5.4.1 The air density at the height at which the wind turbine hub is to be installed at the representative meteorological mast position shall be determined through calculation.

5.4.2 The wind shear index and the full-wind-speed-range turbulence intensity of the wind farm shall be determined through calculation. When there are two or more meteorological masts, their respective wind shear indexes and the turbulence intensity values shall be calculated separately, and comprehensively compared so as to determine the parameter values or value ranges.

5.4.3 The 50-year return period maximum wind speed and extreme wind speed at the height at which wind turbine hub is to be installed shall be calculated in accordance with GB/T 18710, *Methodology of Wind Energy Resource Assessment for Wind Farm*.

5.4.4 Based on the revised wind speed data in representative years, the average wind speed and wind power density, the wind speed frequency distribution and wind energy frequency distribution, wind direction frequency and wind energy density distribution, Weibull distribution fitting parameters at different heights of the meteorological masts shall be calculated, and the processed wind regime parameters shall be plotted. When there are two or more meteorological masts, various wind regime parameters shall be processed and plotted according to the determined wind data usage scheme.

5.4.5 When the wind frequency distribution of wind speed data measured by meteorological mast is inconsistent with the Weibull distribution, the cause should be analyzed briefly.

5.4.6 An overall evaluation of the wind regime characteristics and wind energy resources of wind farm sites shall be made, and the safety level of wind turbine shall be specified.

5.5 Charts

5.5.1 The following statistical tables of wind energy resources shall be presented in the report:

1 Statistical table of monthly average air temperature, atmospheric pressure, and humidity at meteorological stations over the years.

2 Statistical table of monthly average wind speed at each meteorological masts before and after processing.

3 Statistical table of revised wind speed and wind power density at the wind farm in representative years.

5.5.2 Following diagrams and graphs of wind energy resources shall be presented in the report:

1 Geographic location of meteorological stations and wind farm.

2 Interannual wind speed variation histograms of referenced meteorological stations in consecutive years.

3 Monthly average wind speed variation histograms of referenced meteorological stations over the years.

4 Geographic location of meteorological masts and wind farm.

5 Year-round diurnal variation curves of wind speed and wind power density at meteorological masts in wind farm.

6 Year-round annual variation curves of wind speed and wind power density at meteorological masts in wind farm.

7 Year-round wind speed and wind energy frequency distribution histograms at meteorological masts in wind farm.

8 Year-round wind direction rose at meteorological masts in wind farm.

9 Year-round wind energy rose at meteorological masts in wind farm.

10 Monthly wind direction rose at meteorological masts in wind farm.

11 Monthly wind energy rose at meteorological masts in wind farm.

12 Monthly diurnal variation curves of wind speed and wind power density at meteorological masts in wind farm.

6 Engineering Geology and Hydrology

6.1 Overview

The Overview shall cover the following contents:

6.1.1 A brief description of the natural and geographical conditions of the project area, site area coverage, total installed capacity of the wind farm, and layout of main buildings in the wind farm.

6.1.2 Basis, purpose and tasks of engineering investigation for the wind farm project.

6.1.3 Classifications of the wind farm engineering investigation grade and site.

6.1.4 Process and completion of the investigation.

6.2 Regional Geology and Ground Motion

The Regional Geology and Ground Motion Parameters shall cover the following contents:

6.2.1 A brief description of the regional geology of the wind farm project area.

6.2.2 An evaluation of regional structural stability of the wind farm project area.

6.2.3 Determining the site area's ground motion peak acceleration and corresponding basic earthquake intensity in accordance with the current national standard GB 18306, *Seismic Ground Motion Zonation Map of China*.

6.3 Geological Conditions and Evaluation of Site Area

This section shall cover the following contents:

6.3.1 Description of the basic geological conditions of the site, including the site topography and morphology, the thickness, genetic type, material composition, stratification structure and distribution law of the foundation soil, and the rock type, stratification occurrence, weathering features, and fault and fissure developmental characteristics of the foundation rock.

6.3.2 Description of adverse geological actions at the project site, including the development degree, genetic type, distribution range and size of the adverse geological actions.

6.3.3 Description of the site hydrogeologic conditions, including the groundwater type, burial conditions, water level, water quality, and recharge and discharge relationship.

6.3.4 Analysis of the physical and mechanical test results of rock/soil masses sampled from the site, and proposing recommended values of physical and mechanical parameters and soil resistivity of rock and soil.

6.3.5 Evaluation of engineering geology of the wind farm site, including the bearing capacity of the foundation rock/soil mass, burial depth of bearing stratum, foundation stability against sliding and deformation, possibility of seismic liquefaction of foundation, engineering geological characteristics of special soil mass, and the impact of groundwater on foundation and its corrosion to foundation and steel structures.

6.3.6 Evaluation of the site geological conditions of the step-up substation.

6.3.7 Account of seasonally frozen soil in the project site area, and provision of the standard frost line depth of the site soil.

6.3.8 Evaluation of the geological conditions along the site roads and the collection lines.

6.3.9 Preliminary analysis and evaluation of the quantity and quality of construction water and domestic water sources.

6.3.10 Preliminary evaluation of natural building materials quality, reserves and exploitation, and transport conditions.

6.3.11 Proposal for foundation treatment scheme based on the conclusions of geological condition evaluation.

6.4 Engineering Hydrology

6.4.1 The necessity of hydrologic design and survey shall be analyzed according to the wind farm area's topography and morphology.

6.4.2 The hydrological design and survey shall include the following contents:

1 Determine the scope and contents of the survey work.

2 Describe regional physical geography, catchment area and riverway features, calculation of storm, floods and other hydrological parameters in the wind farm area.

3 Calculate the design flood and tide in the wind farm area in accordance with the design flood and tide calculation specifications according to the flood control, moisture-proof standards for structures/buildings.

4 Investigate, measure and estimate the occurrence times of historical floods in the wind farm area.

6.5 Charts

The engineering geological findings charts shall include the wind farm area's tectonic outline maps, site engineering geology plans and longitudinal/cross-sectional profiles, borehole histograms, and typical shaft, pit/trench histograms.

7 Project Tasks and Scale

7.1 Overview

This section shall outline the wind power planning, development and utilization status in the project area, as well as the preliminary works of the project.

7.2 Development Tasks

7.2.1 Description of socio-economic status and development plan of the project area and the powered area.

7.2.2 Description of the status quo and development planning of the electrical power system in the project area and the powered area.

7.2.3 Demonstration of the project development tasks in combination with the region's energy resources, and its economic and social development needs of the requirements of this wind farm.

7.3 Development Necessity

7.3.1 The necessity of the project construction shall be analyzed and demonstrated in terms of the national energy policies, renewable energy development requirements, local electric power sector development, and environmental protection, as well as the promotion of local economic and social development.

7.3.2 The environmental, economic and social benefits of the wind farm shall be outlined for a demonstration of the project necessity.

7.4 Electric Power Accommodation Analysis

Electric energy accommodation of the wind farm shall be studied and analyzed according to the project scale and output characteristics, to put forward possible accommodation scope and its role playing.

7.5 Project Scale

7.5.1 The installed capacity of the wind farm shall be demonstrated and determined based on the regional energy resources, status quo and development planning of the electrical power system, project requirements for the power system, as well as project development and construction conditions, and taking into account the wind turbine manufacturing level.

7.5.2 The overall planning of the wind farm shall be described. For a phased development project, the scale, scope, and timing of each development phase of the project shall be indicated, and the project site shall be scoped in a schematic plot for each phase works.

8 Type Selection & Layout of Wind Turbine and Estimate of Energy Output

8.1 Selection of Wind Turbine

8.1.1 The functional requirements that wind turbine must meet shall be specified, and the single unit capacity range shall be determined, and a few different unit capacity schemes shall be proposed according to the manufacturing level, technical maturity and price of wind turbines, as well as the wind regime characteristics at the wind farm site, equipment installation and transportation conditions of wind turbine.

8.1.2 Comparison and selection shall be conducted on the recommended wind turbine types in the following aspects:

1 Analysis and description of the impact of wind farm site altitude, extremely low temperature, extremely high temperature, congelation, sandstorm, salt fog, typhoons and other factors on wind turbine type selection and specific requirements.

2 According to the single unit capacity range, a number of wind turbine type shall be selected to compare their characteristic parameters, structural features, tower types, and power curves.

3 Trial layout shall be conducted on the various compared wind turbine types and different hub heights, and energy output capability shall be performed.

4 The cost estimate of different wind turbine type schemes and associated support costs.

5 Determining the recommended wind turbine type and hub height based on the comprehensive technical and economic comparison, in consideration of the wind turbine technology and certification and other conditions.

8.2 Layout of Wind Turbine

8.2.1 The wind turbine Layout section shall specify the layout principles, safety assurance principles, and restrictive factors. wind turbine layout shall be combined with intensive use of land resource and efficient use of wind energy resources. The safety assurance principles shall include the safety requirements for wind turbine equipment and its ancillary facilities. The restrictive factors shall include environmental protection, heritage preservation, and construction-prohibited areas. For a wind farm surrounded by existing wind farms, the adverse impact on the existing wind farms shall be determined and the reasonable avoidance distance shall be determined in the layout of the wind turbine.

8.2.2 A wind energy resource map at the proposed hub height of the wind turbine shall be plotted according to the wind data of the meteorological mast in the representative years, and a number of wind turbine layout schemes shall be proposed and compared to select the final

layout plan and plot the recommended wind turbine layout drawing.

8.3 Estimate of Annual On-grid Energy

8.3.1 The software and its version, topographic map scale and the main parameters used to calculate the energy output shall be specified, the error analysis should be conducted between the data simulated by software and measured data, theoretical annual energy output of wind farms shall be calculated with the dynamic power curve of the recommended wind turbine adaptable to the wind farm air density.

8.3.2 The theoretical energy output shall be discounted by the wake effect, wind turbine availability factor, power curve guaranteed rate, wind turbine control, turbulence effect, blade dirt and erosion, weather effect, wind farm service power consumption, and other factors possibly causing energy output reduction. A comprehensive reduction factor shall be calculated by multiplying these reduction coefficients, so that the annual on-grid energy, the annual equivalent full load hours and the capacity factor may be worked out. Probability analysis may be used to estimate the annual on-grid energy under the specific guarantee rate.

8.3.3 For a wind farm project required to conduct a special study on the electric power accommodation, the wind power output characteristic shall be analyzed and calculated.

8.4 Charts

8.4.1 Following tables related to the wind turbine selection, layout, and energy output estimation shall be presented in the report:

1 Table of main technical parameters and indicators of alternative wind turbine types.

2 Table of technical and economical comparison for alternative wind turbine types.

3 Table of energy output estimation of a single unit in the recommended layout for recommended wind turbine types.

8.4.2 Following diagrams and graphs related to the wind turbine selection, layout, and energy output estimation shall be presented in the report:

1 Wind energy resource distribution map of the wind farm.

2 Extremely low temperature, extremely high temperature, congelation, and other adverse weather effects within-a-year distribution diagram, and each-month duration statistical graph.

3 Comparison charts of power curves and thrust coefficient curves of all alternative wind turbine types.

4 The layout of locations of all alternative wind turbine types.

5 The layout of locations of the recommended wind turbine type.

9 Electrical System

9.1 Overview

9.1.1 Construction scale and design scope of wind power project shall be specified, which shall include the following items:

1 Planning and general condition of power transmission related to the wind farm.

2 Overall planning and proposed installed capacity of the wind farm, and the type, circuit numbers, and length of collection lines of the wind farm.

3 Planning and engineering scale of the step-up substation, connection type and circuit numbers of outgoing lines of different voltage ratings, and reactive compensation capacity.

4 Design range of the wind farm project and the boundary between the design work and the external cooperation work. For rehabilitation and expansion projects, the status of the existing plant and the connection and integration of the existing project and the proposed project shall be specified.

9.1.2 The mode of access to the power system shall be specified to include the following items:

1 Current situation and planning of the power system of the region where the wind farm is to be located.

2 Power access system program, including transmission voltage rating, circuit numbers of outgoing lines, transmission capacity and associated transmission and transformation works, in line with the overall planning and the installed capacity of the proposed wind farm project as well as the current status and planning of the power grid.

9.2 Selection of Step-Up Substation Site

9.2.1 Site selection of a step-up substation shall consider comprehensively various factors such as land use planning, access system program, the location of a wind turbine, the layout of collection lines, topographical, geological and hydrogeological conditions of the project area, the condition of incoming and outgoing lines and transport conditions. The site shall be suitable for construction of a step-up substation and any subversive factors shall be avoided. The process of site selection shall be described, at least two options in principle shall be proposed for comparison; in addition, the power transformation capacity of the step-up substation, the circuit numbers and outlet directions of the outgoing lines of different voltage ratings shall be specified briefly.

9.2.2 For different site options, the following features of the sites shall be described:

1 Basic condition of the site.

2 Power transmission condition of the step-up substation; the outgoing mode and ordering of transmission lines shall be studied on the basis of short-term and long-term transmission capacities and with overall consideration of outgoing line corridors of different voltage classes, so as to reduce crossing and turning of the lines.

3 Layout of collection lines and outgoing lines as well as main work quantities of the step-up substation.

4 Hydrological and geological conditions of the substation site, especially the flood level, wind velocity, ice and snow and freezing conditions, etc.; engineering geological condition and its main impact based on geological exploration report.

5 Excavation and backfilling condition of the earth and rock and estimation of excavation and backfilling quantities.

6 Schemes of the access road to the site and transportation, including the programs of road connection and large part transportation.

7 Connection mode and work quantities of the substation power supply.

8 Construction condition of the substation site.

9.2.3 Technical and economical comparison shall be made to all the optional sites; the recommended site and the reason of recommendation shall be described on the basis of the construction condition and the result of the technical and economic comparison of each site.

9.3 Primary Electrical System

9.3.1 Main design basis of the primary electrical system shall be specified, which shall include the design codes and documents applied in the design.

9.3.2 Main electrical connection scheme involving the following items shall be developed in consideration of the project scale and the access system requirement:

1 Preliminary scheme of electrical wiring for the power boosting and distribution units of a wind turbine, which shall be made with consideration of the proposed voltage class of the collection lines and on the basis of scheme comparison and technical and economic analysis and study.

2 Preliminary scheme of the main electrical wiring of the step-up substation, including the allocation of the main transformer, electrical wiring at different outlets, grounding mode of neutral point and reactive compensation, which shall be determined on the basis of scheme comparison and technical and economic analysis and study.

3 Construction and transition scheme for the wind farm to be constructed by stages so as to meet the requirement of staged transition, in addition, feasible technical solution and measures shall be proposed.

9.3.3 Type selection for power distribution unit of the step-up substation shall include the following items:

1 Scheme comparison and conclusion for the general layout of the electrical system by considering the impact on the general layout of the electrical system by the access system program, wind farm planning, topographical condition, equipment layout, short-term and long-term allocation of bays as well as natural environment factors of the substation site.

2 Description of seismic fortification measures for electrical equipment in consideration of the seismic intensity in the region where the project is to be located.

9.3.4 Short-circuit current shall be calculated and the main electrical equipment shall be defined preliminarily, which shall include the following items:

1 Description of basis and conditions for short-circuit current calculation and the calculation result.

2 Description of grid-connection performance requirement including active and reactive power control of wind turbine, low voltage ride through, power quality and so on in accordance with the recommended type of wind turbine and the current national standard GB 19963, *Technical Rules for Connecting Wind Farm to Power System*, and description of model, specification, quantity, voltage class and other main electrical technical parameters of wind turbine.

3 Determination of basic type of power boosting and distribution unit for a wind turbine with consideration of environmental and topographical conditions of the wind farm and the layout scheme comparison and selection of collection lines.

4 Determination of type, specification, quantity and main technical parameters of major electrical equipment including main transformer and high voltage switchgear; calibration of existing equipment for the wind farm projects proposed to be rehabilitated or expanded, and formulation of corresponding reconstruction measures.

5 Calculation and selection of parameters for neutral point grounding of the medium-voltage power collection system and reactive compensation equipment according to the project condition and the power system requirement. For the reactive compensation equipment, the compensation capacity shall be estimated according to related specifications and rules, and the proposal of equipment configuration shall be put forward based on the technical and economic comparison.

6 Special study on particular issues such as transportation, site assembly, hoisting of large and heavy parts of electrical equipment; application of new-type equipment and important new technology if any must be subject to special study and demonstration.

7 Special study on equipment and conductor comparison and selection as well as application necessity when metal-enclosed gas-insulated switchgear or mixed insulated switchgear should be used.

8 Requirements on the selection of main electrical system equipment for intelligent step-up substation, and special study of the equipment selection if necessary.

9.3.5 Program for over-voltage protection and insulation coordination shall be drafted, which shall include:

1 Description of insulation coordination and over-voltage protection measures for the electrical equipment of different voltage classes.

2 Description of natural condition, environmental condition, and pollution grade of the step-up substation; requirement on external insulation of electrical equipment, selection, and determination of type and number of insulator strings.

9.3.6 Layout of electrical equipment shall be provided, including:

1 Layout scheme of power boosting and distribution unit of the wind turbine.

2 Layout scheme of the step-up substation.

9.3.7 Lightning protection and grounding program shall be provided, including:

1 Respective description of lightning protection method for wind turbine and power boosting and distribution unit in accordance with the layout of the wind turbine and the power boosting and distribution unit.

2 Description of the method of protection for the step-up substation against the direct lightning strike.

3 Description of over-voltage protection principle for the wind farm equipment and the step-up substation in accordance with the wind farm equipment layout, the step-up substation access system report as well as the requirement of related design codes and specifications for over-voltage protection.

4 Description of the technical principles for the design of grounding device and selection of grounding materials and the design scheme of grounding, based on the collection and study of resistivity and corrosivity of the soils in the areas of the wind farm and the step-up substation.

5 Description of requirement on lightning protection and grounding by the control, protection, monitoring and measurement system.

6 Verification of the existing grounding grid and over-voltage protection measures for the projects proposed to be rehabilitated or expanded.

9.3.8 Service power supply system and lighting program for the substation shall be provided, including:

1 Sources of substation service power and plant service power as well as the electrical wiring scheme of substation service power.

2 Calculation of substation service power load and selection result of substation service transformer.

3 Layout of substation service power distribution unit and equipment type selection.

4 Mode of power supply for operating lighting, emergency lighting, maintenance and fire protection, and lighting and control modes for main areas.

9.3.9 The scheme power cable facilities shall be provided, including:

1 Layout and cross-sections of power cable tunnels and trenches within the substation site, and selection of the power cable laying method.

2 Type selection of power cable, fire protection, and flame retardant measures applied for the cable structures.

9.3.10 List of equipment and materials shall be provided.

9.3.11 For the primary electrical system, following design drawings shall be provided：

1 Main electrical connection diagram including the wiring diagram of the substation service power system.

2 General layout plan of the electrical system for the step-up substation.

3 Plan layout and profiles of the power distribution units of different voltage ratings.

4 Wiring diagram of power distribution unit for the step-up transformer of the wind turbine.

9.4 Control, Protection, Monitoring, and Measurement System

9.4.1 The basis and principle for the design of control, protection, monitoring, and measurement system shall be specified.

9.4.2 Dispatching relation between the power grid and the wind farm shall be specified.

9.4.3 Monitoring and protection program for the wind farm shall be provided in accordance with the type selection of wind turbine and the power boosting and distribution unit of a wind turbine, which shall include the following items:

1 Monitoring and protection program for a wind turbine, the structure, main function and main equipment configuration of the monitoring system for the wind farm, the configuration and main function of the protection system of the wind turbine.

2 Monitoring and protection program for power boosting and distribution unit of a wind turbine, the structure, main function and main equipment configuration for the monitoring system of power boosting and distribution unit of a wind turbine, the configuration and main function for the protection system of power boosting and distribution unit of the wind turbine.

9.4.4 Monitoring and protection program for the step-up substation shall be provided in accordance with the requirements of the main electrical connection and access system of the wind farm, which shall include the following items:

1 Monitoring system program for the step-up substation, and the structure, main function and main equipment configuration of the monitoring system.

2 Relay protection program and type selection for the main electrical equipment of the step-up substation.

3 Configuration program for the protection and automatic safety device of the power system.

4 Configuration program for the dispatching automation system of the power system.

9.4.5 Electrical wiring program for the control, protection, monitoring and measurement systems shall be provided, which shall include the following items:

1 Description of the design scheme of the electrical wiring of the control, protection, monitoring, and measurement system, including metering, measuring, signaling, and blocking, etc.

2 Description of configuration and main technical requirement of the current transformer and voltage transformer, covering:

1) Preliminary determination of reposition accuracy for the current transformer and voltage transformer at the metering point between the wind farm project and the power grid, and configuration requirement for energy metering gauge and inspection gauge, which shall be made on the basis of the access system data.

2) Rational selection of capacity, transformation ratio and characteristics of current transformer based on the system short circuit capacity, so as to meet the requirement for relay protection in terms of selectivity, sensibility, reliability, and speed.

3) Consistency of the current transformer transient characteristic and the corresponding saturation voltage at different outlets of differential protection shall be guaranteed.

9.4.6 The program for control power supply system (CPS) comprising the following elements shall be provided:

1 Description of DC system voltage ratings and DC power wiring modes for the wind farm and the step-up substation, technical and economical comparison for multiple options (if necessary). statistics of DC power load, the preliminary proposal of type, capacity, and number of storage batteries.

2 Description of supply range of UPS; statistics of power load needed for AC uninterrupted CPS, calculation of UPS capacity; proposal of UPS configuration and wiring program.

9.4.7 Design scheme of image monitoring and security guard system shall be provided in accordance with the layout program and the safety protection class of the wind farm and the step-up substation; in addition, type selection and allocation of main equipment shall be specified.

9.4.8 Design scheme of an automatic fire alarm system shall be put forward in accordance with the layout program and the safety protection class of the wind farm and the step-up substation; in addition, type selection and allocation of main equipment shall be specified.

9.4.9 Structure, function and main technical requirements of the wind power forecast system for the wind farm shall be defined.

9.4.10 Design scheme of the information management system for the wind farm and the allocation scheme of main equipment shall be provided.

9.4.11 Equipment layout of the control, protection, monitoring and measurement system shall be briefed.

9.4.12 Design scheme of equipotential ground screen shall be specified in accordance with the layout of the main electrical equipment and the equipment of the control, protection, monitoring and measurement system.

9.4.13 List of equipment and materials of the control, protection, monitoring and measurement systems of the wind farm and the step-up substation shall be provided.

9.4.14 For the control, protection, monitoring and measurement systems, following design drawings shall be provided:

1 Arrangement plan of relay protection for main electrical equipment and measurement.

2 Schematic diagram of computer supervision and control system.

3 Arrangement plan of the DC system.

9.5 Communication

9.5.1 Design scope, basis, and principles of the communication system shall be specified.

9.5.2 Networking mode, optical cable line route and optical cable type section for communication of the wind farm shall be defined in accordance with the requirement on the communication network by the monitoring systems of the wind turbine and the power boosting and distribution unit of wind turbine; in addition, the communication mode for on-site maintenance and patrol inspection of the wind farm shall be specified.

9.5.3 Mode of internal and external communication of the step-up substation shall be defined, and the function and allocation of main equipment shall be specified.

9.5.4 System communication mode of the step-up substation shall be defined preliminarily and the function and allocation of main equipment shall be specified in accordance with the communication design requirement of the access system of the wind farm.

9.5.5 Design scheme and main equipment allocation scheme for the monitoring system of the communication equipment of the step-up substation shall be put forward.

9.5.6 Communication power supply mode shall be defined, function and allocation scheme of the main equipment shall be specified.

9.5.7 Design scheme of the integrated communication line network of the step-up substation

shall be specified.

9.5.8 Layout and grounding of main communication equipment of the step-up substation shall be specified.

9.5.9 List of equipment and materials of the communication systems of the wind farm and the step-up substation shall be provided.

9.5.10 For the communication system, following design drawings shall be provided:

1 Communication system diagram.

2 Communication power system diagram.

9.6 Current Collection lines

9.6.1 Layout and basic condition of the wind farm shall be briefly described, including the connecting type between the power boosting and distribution unit of wind turbine and the collection lines, location of the step-up substation, location and direction of the incoming and outgoing lines, relationship between the existing lines and proposed lines, and short-term and long-term transition schemes; in addition, the hydrological, geological, topographical, geomorphological conditions and surface features, geological environmental assessment of the project area shall be described briefly.

9.6.2 Combination of meteorological conditions used for the design of collection lines shall be defined based on analysis of the meteorological data.

9.6.3 Scheme of collection line route including the following items shall be provided:

1 Description of basic principle and method for route selection.

2 Proposal of collection line schemes and comparison of the schemes in line with the selection principle of the line route and the site selection of the step-up substation.

3 Comparison of the scheme of double circuits on the same tower and the scheme of multiple circuits on the same tower, when multiple overhead collection lines along the same route are applied.

9.6.4 Scheme of cable route shall be briefed in accordance with GB 50217, *Design Code for Cables of Electric Power Projects*, when power cables are used as the collection lines, which shall include the following items:

1 Selection of power cable conductor material, insulation level, insulation type, sheath type, conductor cross-section area, and cable accessories according to the meteorological environmental condition, typographical and geological conditions, etc.

2 A brief description of the laying of cable lines in different laying areas and the matters needing attention;

3 A brief description of the modes of grounding and protection, including allocation of lightning arrester and surge suppressor, control of induced voltage, and the safety

precautions needed.

4 A brief description of fireproofing and flame inhibiting requirements for cables.

9.6.5 Selection of conducting wire, ground lead and fittings shall be conducted with the following requirements:

1 Cross section area of the conducting wire or the ground lead shall be selected and checked with calculation in accordance with the requirements on segment capacity, ice zone partition, atmospheric corrosion, operation and maintenance of the proposed collection lines; the mechanical and electrical characteristics of the recommended ground lead shall be provided; measures against wire vibration, windage and galloping shall be drafted in accordance with the wind speed or the wire galloping zone classification of the region where the wind farm is to be located.

2 Assembly type and characteristics of suspension string and tension string for conducting wire and ground lead shall be specified; insulator string and its safety factor in different cases shall be provided; type and model of major fittings for core wire joining and antivibration shall be specified.

3 In case a new material is proposed for use, the applicability of the material shall be specified in respect of raw material, manufacture, test, trial operation, and procurement, etc.

9.6.6 Pollution class of collection lines shall be defined in accordance with the factors such as the condition of local polluted area and the meteorological environmental condition, and the creepage distance shall be defined accordingly; type of insulator shall be defined based on comparison, numbers and creepage distanced of suspension insulators and tension insulators shall be defined, altitude correction shall be conducted for the insulator in high altitude area.

9.6.7 Scheme of lightning protection for collection lines shall be put forward according to the condition of lightning activities in the area with the collection lines; scheme and requirement of line grounding shall be put forward according to the geological investigation data of the area along the collection lines.

9.6.8 Type of mainline tower and the tower foundation shall be provided.

9.6.9 List of equipment and materials shall be provided.

9.6.10 Diagram of the collection line route shall be provided.

10 Fire Protection

10.1 Overall Fire Projection Design

10.1.1 Laws and regulations, as well as technical standards followed in the fire protection design, shall be specified.

10.1.2 General layout of the project shall be briefed, structures and facilities requiring fire protection design shall be described in details.

10.1.3 Whether the current condition of existing or neighboring fire-fighting facilities is capable of satisfying the fire protection requirement for the wind farm project shall be described in brief; location and equipment allocation of the local fire departments and fire-fighting forces in the project area, and the joint prevention system and other social supports shall be sketched.

10.1.4 Principles for structure layout, equipment type selection and design of channels (passages) shall be briefed; principle for fire protection design of electrical and mechanical system shall be specified.

10.1.5 Overall fire protection design for the wind farm project shall be provided.

10.2 Fire Control Design for Project

10.2.1 Fire risk classification, fire resistance rating and fire-fighting measures for structures shall be specified.

10.2.2 Fire protection design scheme of main structures (buildings), equipment and power cable shall be specified.

10.2.3 Layout of evacuation exit and fire fighting access inside each structure shall be specified.

10.2.4 Design scheme of fire water supply, supply objects, and supply system shall be specified.

10.2.5 Design scheme of power distribution, power supply, communication, emergency lighting, emergency evacuation signals and lamps and lanterns for fire protection shall be specified.

10.2.6 Design scheme of fire protection for ventilation and air conditioning system shall be specified.

10.2.7 Design scheme of fire monitoring and control system for the wind farm project shall be specified.

10.2.8 Design scheme of fire protection for architectural decoration and finishing shall be provided.

10.2.9 List of main equipment for fire protection works shall be specified.

10.3 Fire Control Design for Construction

10.3.1 Planning layout of the construction site and the objects requiring fire protection shall be specified.

10.3.2 Planning of fire protection for construction shall be specified.

10.3.3 Scheme of fire protection for warehouses that are flammable and explosive during construction of the wind farm project shall be specified.

11 Civil Works

11.1 Design Safety Standards

11.1.1 Project class and the grade of the main structures (buildings) shall be defined, to include the following aspects:

1 A brief description of the planned overall installed capacity of the wind farm, installed capacity of the wind farm project of a certain stage, and voltage class of the step-up substation. A brief description of the construction scheme of the wind farm project of certain stage and layout of main structures (buildings), and specification of the project class.

2 Description of tower foundation, design grade of structures of the substation, and safety class of structures (buildings) of the wind farm project.

11.1.2 Design standard of flood control shall be defined, to include the following items:

1 Flood design standard (return period) for wind turbine tower foundation.

2 Flood design standard (return period) for structures of the step-up substation.

3 Flood design standard (return period) for access roads inside and outside the project site.

11.1.3 Seismic fortification criterion of the wind farm project shall be defined.

11.2 Layout of Wind Farm

11.2.1 Overall layout scheme of a wind turbine, collection lines, and access roads shall be specified.

11.2.2 Layout scheme of step-up substation shall be specified.

11.3 Wind Turbine Foundation

11.3.1 Design basis for wind turbine foundation including the following aspects shall be specified:

1 Codes and specifications applied in the foundation design of wind turbine.

2 Loads and relevant parameters of wind turbine, wind turbine type, loads on top surface of foundation ring, and main parameters of wind turbine; in this part, loads under normal operating condition, extreme condition, fatigue condition, etc. shall be considered, and the main parameters of wind turbine involve type and category, hub height, tower weight, nacelle weight, impeller blade diameter, and weight, etc.

3 Main indicators influencing the foundation design, including bearing capacity, deformation, stability, etc.

4 Operating cases influencing the foundation design, including normal operating condition, extreme condition, fatigue condition, etc.

11.3.2 Recommendations of foundation type shall be put forward by technical and

economical comparison in line with the engineering geological condition of the wind farm and the load data of wind turbine.

11.3.3 The result of check calculation of foundation bearing capacity, settlement deformation, tilting deformation, overturning stability of subsoil and the stability against sliding of the foundation shall be provided.

11.3.4 Subsoil treatment and corrosion protection design of subsoil shall be provided, which shall include the corrosive effect of the subsoil on foundation concrete structure and reinforcing bars and appropriate protective measures to be taken accordingly.

11.3.5 Design scheme of flood control for wind turbine foundation shall be provided in accordance with the topographical and hydrological conditions of the project site.

11.3.6 Design scheme of horizontal displacement and settlement observation should be provided in accordance with the topographical and hydrological conditions of the project site.

11.3.7 Work quantities of wind turbine foundation work shall be provided.

11.4 Step-up Power Distribution Device Foundation of wind turbine

11.4.1 Type, size and work quantities of foundation for power boosting and distribution unit of wind turbine shall be defined in accordance with the engineering geological condition, as well as the capacity, dimension and weight of the power boosting and distribution unit of the wind turbine.

11.4.2 Design scheme of flood prevention and drainage for power boosting and distribution unit of wind turbine shall be prescribed in consideration of the topographical and geological conditions of the wind farm site.

11.5 Road

11.5.1 Primary basis and data applied in the design of roads shall be provided.

11.5.2 In accordance with the scheme of on-site and out-site traffic and transportation routes defined by option comparison and selection with consideration of the requirements of vehicles entering into and leaving from the project site as well as equipment transportation, technical indexes and parameters for design of the roads leading to the wind farm (plant and substation) site and the roads for construction and maintenance within the site shall be put forward, which shall include the road width, pavement structure, minimum radius of horizontal curve, minimum radius of vertical curve, maximum longitudinal grade, classification of road widening, maximum superelevation, flood control standard, slope gradient, etc.

11.5.3 Planning and layout scheme of the roads leading to the site and plant (substation) and the roads for construction and maintenance within the site shall be provided, and the quantities of road works shall be put forward in consideration of the requirements of road slope protection, water retaining and drainage, and subgrade flood control.

11.6 Step-up Substation

11.6.1 General layout design defining the arrangement of each functional zone and the on-site and out-site traffic and transportation of the step-up substation shall be specified, and the general layout plan shall be provided.

11.6.2 Design scheme of the structures (buildings) of the step-up substation shall be provided, which shall include:

1 Design basis.

2 Main characteristics including floor area, number of stories, height, main structural form and function of the structures (building).

3 Main construction and decoration materials, including a selection of the materials of interior and exterior walls, floor, ceiling, roof and thermal insulation material of the exterior wall.

4 Design scheme of the building structure, including the structural type and foundation type of individual structure (building), primary components of the step-up substation and the anti-corrosion to be taken for those components.

5 Flood control design and vertical arrangement design of the step-up substation.

11.6.3 Design basis and design scheme of water supply and drainage of the step-up substation shall be specified and the list of main equipment and materials shall be provided.

11.6.4 Design basis and design scheme of heating, ventilation and air conditioning system shall be specified, and the list of main equipment shall be provided.

11.7 Charts

Following design drawings in respect of civil works shall be provided:

1 General layout plan of the wind farm.

2 Structural drawing of wind turbine foundation.

3 Drawing of the foundation of power boosting and distribution unit of the wind turbine.

4 General layout plan of the step-up substation.

5 Plan layout and vertical layout of the main structures of the step-up substation.

12 Construction Planning

12.1 Construction Conditions

12.1.1 Natural conditions including topographical, geological and meteorological conditions of the wind farm shall be described.

12.1.2 Construction condition shall be briefed, which shall include mainly the following items:

1 Geographical location of the project, project task and scale, and an engineering scheme.

2 Out-site traffic and transport condition.

3 Source and supply condition of main natural construction materials and outsourced materials needed for project construction.

4 Local water supply, power supply, and communication conditions.

5 Possible capacity for repairing and processing and supply condition of living goods and materials in the locality.

6 Requirements for environmental protection, water and soil conservation, labor safety and other special issues during project construction.

12.1.3 Major construction characteristics and important technical concerns in construction shall be specified.

12.1.4 Requirements of project legal entity and other interested parties on construction preparation, the time limit of critical works, and overall construction schedule shall be specified.

12.2 Overall Construction Layout

12.2.1 Principles for overall construction layout and planning layout scheme of different construction zones shall be provided.

12.2.2 Layout schemes of major construction facilities and warehouses shall be provided, which shall include:

1 Description of quality and quantity requirements for concrete aggregates and rock materials including boulders, stones and pebbles, material sources selection, proposed material stockpiling program and covering area.

2 Description of overall concrete quantity, concrete placement capacity of different stages, and demands of concrete of various classes and types; determination of concrete production and supply scheme based on option comparison and selection; for concrete production system built by the contractor on site, the production capacity, main equipment configuration, overall layout, covering area and work quantities shall be specified.

3 Description of planning layout, floor area and work quantities of warehouses and equipment storage sites shall be provided.

12.2.3 Scheme of planning layout, covering the area and work quantities of construction management zone and living zone shall be provided.

12.2.4 Water and power supply planning for construction use shall be put forward, which shall include:

1 Determination of peak water demand and water supply planning, selection of water source and transmission mode.

2 Determination of peak power demand, selection of power source and voltage class.

12.2.5 Principle requirements for size, covering area and leveling of the land for wind turbine hoisting shall be put forward.

12.2.6 Earth-rock materials balance planning for the project shall be analyzed and put forward, planning and coverage area of spoil areas shall be defined as needed.

12.3 Construction Transport

12.3.1 Traffic situation inside and outside the project site, including route condition, transport capacity, and restrictive factors shall be briefed.

12.3.2 Out-site transport scheme and the transport route shall be drafted by synthesizing various factors such as the requirements on transport of heavy and large parts, the proposed source for material procurement, the capacity of optional transportation facilities, and the traffic situation outside the project site, etc.; measures of rehabilitation and extension for local existing facilities or of temporary traffic measures shall be analyzed and put forward based on the proposed out-site transport scheme.

12.3.3 On-site transport scheme and planning layout scheme of access roads leading to the site, construction roads inside the site, and roads for maintenance inside the site shall be defined by considering various factors such as the requirements and characteristics of transport of heavy and large parts, the capacity of optional transportation facilities, the traffic situation inside the project site and the difficulties in rehabilitation and extension, and the site construction condition; temporary traffic scheme and measures shall be studied and put forward based on the proposed on-site transport scheme.

12.4 Construction Land Acquisition

12.4.1 Land policy of the region where the project is to be located shall be briefed, which shall include the expense standard for permanent land acquisition and temporary land use, and the compensation standard, etc.

12.4.2 Scheme of land acquisition for project construction shall be drafted, which should include:

1 Basis, standard and method for determination of land acquisition scope for the wind

farm.

2 Scheme of land use and land area of wind turbine and power boosting and distribution unit, power cables or overhead lines inside the wind farm, step-up substation and other structures, on-site roads, and temporary construction facilities, shall be drafted in combination of the general layout scheme and general construction layout scheme of the wind farm.

3 Land usage of the different structures, facilities, and roads shall be specified in line with the land policy of the region where the wind farm project is to be located.

12.5 Main Works Construction

12.5.1 Construction sequences, main construction technical specifications and construction methods, equipment allocation and quality control measures of different project items and sub-items shall be specified or drafted in line with the construction characteristics and main technical issues of the project; for critical construction links and control points as well as new techniques and methods proposed to be applied in the project construction, specific explanation or analysis and description shall be provided.

12.5.2 Construction scheme for wind turbine foundations shall mainly include the following items:

1 Description of construction sequence, construction method and construction equipment allocation for earth-rock excavation and backfilling, and foundation treatment of wind turbine foundation and erection platform, storage and transport scheme for excavated materials and backfill materials, and main technical requirements and quality control measures for the construction based on analysis; control standard and protective measures for blasting safety during excavation where control blasting is required.

2 Description of construction sequence and construction method for foundation concrete placement, main technical requirements and quality control measures for each construction step or item, concrete transport scheme and transport equipment allocation.

3 Determination of main construction method and construction equipment allocation for foundation pile construction based on a comparison of different options, and proposal of main technical requirements and quality control measures for the construction based on the analysis.

12.5.3 Construction method for foundation excavation and concrete placement of the power boosting and distribution unit of the wind turbine as well as the requirements and measures for connection and coordination with electrical equipment installation shall be specified.

12.5.4 Construction sequence and construction method for main construction items,

including excavation, foundation treatment, and concrete placement, of civil works of the step-up substation, shall be specified, and the requirements and measures for connection and coordination with electrical equipment installation shall be specified.

12.5.5 Wind turbine installation scheme shall include the following:

1 Describe the construction preparation items and safety measures for the wind turbine installation.

2 Propose the **s**torage and transport scheme for the main equipment of wind turbine, and requirements for the coordination between the equipment storage/transport and civil engineering.

3 Determine the hoisting scheme for main equipment of wind turbine through comparative study; describe the hoisting equipment, procedure, method, construction condition and relevant supporting measures of the proposed scheme; put forward the requirements for the coordination between the equipment hoisting and the civil engineering.

12.5.6 Measures for storage, installation, and transportation of main electrical equipment and requirements for the coordination between the electrical equipment storage, installation and transportation, and the civil engineering shall be specified; construction sequence, construction method and installation progress for main electrical equipment and embedded parts shall be provided; transportation method, construction technical requirement and method of materials for collection lines within the project site shall be drafted.

12.5.7 Scheme of storage and transportation of main electrical equipment and materials shall be specified; technical requirement for installation of main electrical equipment, embedded parts and collection lines shall be specified; primary technical requirements and construction method for laying construction of collection lines shall be drafted, and the requirements for coordination between the aforesaid installation and construction works and the civil engineering.

12.6 Overall Construction Schedule

12.6.1 Principles and basis for planning of overall construction schedule shall be specified; factors controlling the project progress, such as the main works, out-site traffic, on-site traffic, temporary construction works, and construction facilities shall be described.

12.6.2 Critical paths controlling the overall construction schedule and construction intensity of major individual work items shall be analyzed and proposed, and the planning of the overall construction schedule shall be put forward.

12.7 Construction Resources Supply

12.7.1 Allocation of the labor force for main works shall be specified.

12.7.2 Total quantities of main construction materials including rolled steel, cement and

sand-gravel aggregates needed for the construction shall be listed.

12.7.3 Main machinery and equipment needed for the construction shall be specified, and the summary of the machinery and equipment shall be provided in terms of designation, specification, and quantity of the machinery and equipment.

12.7.4 For a sub-project of a large-scale wind power base to be developed in a centralized pattern, the overall supply condition of the construction resources shall be specified.

12.8 Charts

12.8.1 The following tables in respect of construction planning shall be provided:

1 Bill of quantities of temporary construction works.

2 Statistics of land acquisition for construction use.

3 A summary sheet of main construction machinery and equipment.

12.8.2 The following design drawings and tables in respect of construction planning shall be provided:

1 General construction layout plan.

2 Sketch map of out-site traffic.

3 Overall construction schedule.

13 Environmental Protection and Soil and Water Conservation

13.1 Overview

13.1.1 The working process of environmental impact assessment, environmental protection design and soil and water-soil conservation design for the project shall be briefed.

13.1.2 Main conclusions of the environmental impact assessment report (table) and the soil and water conservation scheme report of the project, as well as the authorities' review and approval comments on the reports, shall be briefed.

13.2 Environmental Impact Assessment and Soil and Water Loss Impact Analysis

13.2.1 The environmental status, environmental sensitive objects and major environmental concerns of the area where the project is to be located shall be briefed.

13.2.2 Main conclusions of the environmental impact assessment report and the impact analysis of water loss and soil erosion because of the project shall be briefed.

13.2.3 Countermeasures proposed in the environmental impact assessment report (table) and the soil and water conservation scheme report shall be briefed.

13.3 Environmental Protection Design

13.3.1 Laws and regulations, policies and technical documents in respect of environmental protection, which are adopted as the design basis of the project, shall be specified and the overall design principle shall be provided.

13.3.2 The tasks of environmental protection design shall be defined in accordance with the protection scheme and the requirement proposed in the submitted environmental impact assessment report (table) and the corresponding review comments on the report; design modification or alteration, if any, shall be described.

13.3.3 The environmental protection targets of the project shall be specified.

13.3.4 Design scheme of environmental protection measures to be implemented during the project construction and operation periods shall be put forward, which mainly involves the following:

1 Design of water pollution control measures, including general condition of wastewater (sewage), treatment target, scheme selection, and process design, the design of main structures, equipment type selection and allocation, operation, and maintenance management scheme, etc.

2 Design of atmospheric pollution control measures, including reduction and control of dust caused by excavation and blasting, dust produced by gravel aggregate and

concrete processing systems, road dust and waste gas generated by oil firing, etc.

3 Design of noise control measures, including control of noise generated by construction machinery and construction auxiliary systems, control of traffic noise, control of blasting noise, etc.

4 Design of human health protection measures, including protection against electromagnetic radiation, hygiene and epidemic prevention measures, etc.

5 Design of solid waste disposal measures.

6 Design of ecological protection measures, including measures for ecological protection and protection of rare and endangered species, etc.

13.4 Soil and Water Conservation Design

13.4.1 Laws and regulations, policies and technical documents in respect of soil and water conservation, which are adopted as the design basis, shall be specified and the overall design principle shall be provided.

13.4.2 The task of soil and water conservation design shall be defined in accordance with the soil and water conservation scheme and the requirement proposed in the submitted soil and water conservation report and the corresponding review comments on the report; design modification or alteration, if any, shall be described.

13.4.3 The scope of responsibility for the prevention and treatment of water loss and soil erosion shall be specified.

13.4.4 Controlling standard and overall aims of prevention and treatment of water loss and soil erosion shall be specified.

13.4.5 Zoning for the prevention and treatment of water loss and soil erosion shall be defined, and the overall arrangement of soil and water conservation measures shall be put forward.

13.4.6 Design of soil and water conservation measures for each protective zone shall be provided. For key protective zones such as spoil areas, the engineering grade and the flood control standard of the protective works shall be defined, and the design scheme of major structures shall be put forward.

13.5 Environmental Monitoring and Soil and Water Conservation Monitoring Plan

13.5.1 Aims of environmental monitoring and soil and water conservation monitoring and the planning principle of the monitoring works shall be specified.

13.5.2 General design scheme of the environmental monitoring and soil and water conservation monitoring system of the project shall be drafted.

13.5.3 Technical requirements for monitoring sites, content, method, frequency, time and data compilation for different critical items shall be put forward explicitly.

13.6 Environmental Management Plan

13.6.1 Responsibility and content of environmental management and environment supervision plan in project construction period shall be drafted.

13.6.2 Requirements for environmental management in project operation period shall be drafted.

13.7 Protective Measures Execution Plan

Measures of environmental protection and soil and water conservation for the project, and the conditions, methods, and schedule for implementing those measures shall be drafted.

13.8 Cost Estimate

Preparation instructions of investment estimate, investment budget and annual investment plan for the environmental protection and soil and water conservation works of the project shall be drafted.

13.9 Charts

13.9.1 The following tables in respect of environmental protection and soil and water conservation design shall be provided:

1 Bill of quantities of environmental protection and soil and water conservation measures.

2 Cost estimate of environmental protection and soil and water conservation works.

13.9.2 The following drawings in respect of environmental protection and soil and water conservation design shall be provided:

1 Distribution sketch of environmental sensitive objects.

2 Layout sketch of environmental monitoring points and soil and water conservation monitoring points.

14 Occupational Safety and Health

14.1 Basis of Compilation

14.1.1 Purpose, basic principles, main contents, design scope, etc. of compilation shall be specified.

14.1.2 Main laws and regulations and technical standards on which the project is based, safety pre-evaluation report and review comments of the construction item, and other relevant information shall be enumerated.

14.2 Project Profile

14.2.1 Basic information of the project should be briefed, the scope of project management in operation period should be proposed.

14.2.2 Main conclusions and recommendations of safety pre-evaluation report on the construction item shall be briefed.

14.3 Analysis of Major Hazards, Harmful Factors, and Surrounding Environment Safety

14.3.1 Major hazards and harmful factors caused by project site selection and general layout of the wind farm, in terms of meteorology, hydrology, geology and other natural conditions of the project area and the surrounding environmental conditions, shall be analyzed.

14.3.2 Major hazards and harmful factors of the main structures (buildings), equipment and facilities shall be analyzed.

14.3.3 Type and nature of occupational safety hazards and harmful factors that exist or might occur during production, and the way of occurrence, as well as consequences of those hazards and harmful factors, shall be analyzed.

14.3.4 Type, source, physical and chemical properties, toxicological characteristics, concentration, intensity, distribution of occupational hazard factors that occur or might occur at workplaces, number of people exposed to the hazard factors and level of exposure, potential harmfulness, degree of risk of occupational diseases, and the possible harmful impact on staff's physical and psychological health shall be analyzed.

14.3.5 Major hazards and harmful factors that may occur in the construction period shall be analyzed, and the identification and analysis of major hazard sources in the construction period shall be conducted.

14.4 Design for Occupational Safety and Health

14.4.1 Design measures for occupational safety and health shall be set forth, including the following:

1 For the safety and health risks caused by site selection and general layout of the wind farm in terms of meteorology, hydrology, geology and other natural conditions

in site area and surrounding social environment conditions, protective measures to be taken for occupational safety and health shall be specified.

2 Structures and site layout, and safety design and precautionary measures for production buildings, facilities and equipment shall be put forward.

3 Safety design and precautionary measures shall be put forward with due consideration of the analysis, inspection and monitoring results of major hazard sources in the production process, analysis results of main hazards and harmful factors, and the engineering characteristics of the project.

4 Protective measures shall be put forward with due consideration of the analysis results of hazards and harmful factors in main workplaces and the engineering characteristics of the project.

5 Main protective measures for occupational safety and health in construction period should be put forward according to the analysis results of major hazards and harmful factors during construction and the engineering characteristics of the project.

14.4.2 Public safety precautions shall be set forth, unsafe factors that might be attributable to the public's contact with wind farm facilities shall be described, and relevant precautions shall be put forward.

14.4.3 Advanced nature and reliability of the process and technology, equipment and facilities applied in the project shall be analyzed.

14.4.4 Setup of production safety administrative organization and emergency management measures shall be specified.

14.4.5 Design proposal for health hazard prevention shall be analyzed and put forward.

14.4.6 Measures meeting other special occupational safety and health design requirements shall be put forward.

14.4.7 Design of occupational safety and health marks and signs shall be performed.

14.4.8 Design proposal for prevention measures of a potential accident and emergency rescue facilities shall be specified.

14.5 Administration Setup, Facilities Design, and Safety Management

14.5.1 Administrative organization and related staffing for occupational safety and health shall be specified.

14.5.2 Occupational safety and health management system shall be specified.

14.5.3 Design of safety education facilities for occupational safety and health shall be conducted.

14.5.4 Preparation requirements of emergency response plan shall be set forth.

14.6 Acceptance of Recommendations in Pre-Evaluation Report

14.6.1 Adoption of recommendations and measures put forward in the pre-evaluation report shall be described by items.

14.6.2 The reasons why the measures were not adopted or partially adopted shall be explained.

14.7 Expected Effects and Existing Problems

14.7.1 Expected effects of the precautionary measures for occupational safety and health shall be specified.

14.7.2 Existing problems after the implementation of precautionary measures for occupational safety and health shall be described.

14.8 Accident Prevention and Emergency Rescue Measures

Accident prevention and emergency rescue measures shall be put forward for accidents that may occur.

14.9 Cost Estimate

14.9.1 Basis and price level year of special investment budget preparation for occupational safety and health works shall be specified.

14.9.2 Specific bill of quantities for occupational safety and health works shall be prepared, including the following items:

1 Safety signs, safety fences, safety shield facilities.

2 Labor protection supplies and protective equipment.

3 Electrical insulation tools (appliances).

4 Climbing tools (appliances).

5 Lifting tools (appliances).

6 Power tools (pneumatic tools) (appliances).

7 Emergency supplies, equipment.

8 Equipment and facilities for safety education and training.

9 Testing apparatus, equipment, and installation works for safety and health.

10 Building works.

14.9.3 The special investment in occupational safety and health shall include the following items:

1 Costs of special safety protection facility for the main production process.

2 Costs of safety monitoring devices, equipment, apparatus, and instrument configuration.

3 Costs of production safety and occupational health management system, education, training, physical examination of employees, and labor protection supplies and so on.

4 Costs of materials and equipment related to accident emergency and rescue works.

5 Costs of safety evaluation, emergency plan, and studies.

6 Costs of special consultation, review, safety facilities inspection, and acceptance.

7 Cost of anti-terrorism.

14.10 Main Conclusions and Recommendations

14.10.1 Occupational safety and health measures adopted in the project design shall be summarized; whether the design meets the requirements of the nation's laws, regulations, standards, and specifications shall be confirmed, and the execution status of the measures put forward in the pre-evaluation report shall be described.

14.10.2 Other works and recommendations for improving occupational safety and health shall be set forth.

15 Design Cost Estimate

15.1 Overview

15.1.1 General situation of the project shall be briefed, sources of funding for project construction and capital fund proportion, etc. shall be specified.

15.1.2 Main indicators of investment, including total investment and static investment of the project as well as a corresponding investment per kilowatt, investment per kWh, etc., shall be specified.

15.1.3 Main project scheme shall be illustrated.

15.2 Preparation Instructions

15.2.1 Principles for selection of quotas and expense standard and the price level year for project design estimate shall be specified.

15.2.2 Basic price shall be specified, including:

1 Principles and basis for the determination of labor wage rate and source of main materials, and calculation of budgetary price.

2 Principles and basis for determination of basic price calculation of construction water supply, power supply, aggregate, etc.

15.2.3 Unit price of construction and installation works shall be specified, including:

1 Composition, methods of preparation and standard of charging for unit price.

2 Adoption and adjustment of quotas and indexes. As for the items requiring the preparation of supplementary quotas, the preparation principles and method, as well as quota levels, etc. shall be specified.

15.2.4 Preparation method for a budget estimate of equipment and installation works shall be specified, including:

1 Principles and basis for determination of original cost, source and transportation mode of main equipment.

2 Principles for determination of another equipment price.

3 Preparation method of equipment and installation costs.

15.2.5 Preparation method for budget estimate of construction ancillary works and building works, including:

1 Principles and basis for determination of cost index.

2 Cost estimate preparation method.

15.2.6 Standards for preparation of other cost estimates shall be specified, including the calculation method, basis of calculation and indexes adopted for project construction land fees, project management fees, production preparation fees, investigation and design fees, and other taxes and dues.

15.2.7 Calculation principles and methods of the basic budget reserve, spread contingencies, interest incurred during construction shall be specified.

15.2.8 Investment plan by year shall be specified.

15.2.9 Other issues that need to be specified shall be briefed.

15.3 Schedules of Cost Estimate Making

15.3.1 Preparation of design budget estimate table and appendix shall comply with the current sector standard NB/T 31011, *Regulations for Design Budget Estimate Making and Expense Standard of Onshore Wind Farm Project*.

15.3.2 Main technical-economic indicator sheet shall be prepared; the format of the main technical-economic indicator sheet shall comply with the provisions of Appendix C.

16 Financial Evaluation and Social Impact Analysis

16.1 Overview

16.1.1 Scale, construction duration and financial evaluation calculation period of the wind farm project shall be specified.

16.1.2 Basis of financial evaluation shall be specified.

16.2 Financial Evaluation

16.2.1 Constitution of project construction fund, including fixed asset investment, interest incurred during construction, liquidity, etc., shall be specified.

16.2.2 Sources of project construction fund, financing options, debt capital composition, and annual interest rate and repayment requirements shall be specified.

16.2.3 Calculation method and parameters of the original value of fixed assets and total cost of the project shall be specified. The total cost shall include depreciation cost, maintenance cost, wages and benefits, materials cost, amortization charge, other expenses, insurance, and financial expenses, etc. Cost per kWh shall be specified.

16.2.4 Main contents and results of the financial evaluation shall comply with the current sector standard NB/T 31085, *Specifications for Economic Evaluation of Wind Farm Project*.

16.3 Risk Analysis

16.3.1 Overall investigation and comprehensive analysis of the project may be conducted from the viewpoint of system theory; major risk factors affecting the project shall be identified in terms of natural conditions, safety, technology, market, capital, policy and so on.

16.3.2 Probability distribution of major risk factors or aggregate risks may be identified based on subjective or objective probability.

16.3.3 Key risk factors affecting the project's feasibility may be evaluated according to the results of risk identification and forecast analysis.

16.3.4 Measures to evade, control and prevent risks may be studied and proposed on the basis of the results of risk evaluation.

16.4 Social Effects Analysis

Social effects, including the economic development, urban construction, labor employment, ecology environment, energy-saving, and emission benefits, etc. that might be brought by the project construction and operation in the place where the project is located, shall be analyzed and evaluated.

17 Energy Saving

17.1 Overview

17.1.1 Information about project scale, general layout, technological process, and main energy-consuming equipment shall be provided.

17.1.2 Significance of energy saving for the project shall be described.

17.2 Energy-saving Design Basis and Principles

17.2.1 National, local or industrial laws, rules, and regulations, as well as technical standards, regulations and specifications on which energy-saving design is based, shall be specified.

17.2.2 Principles of an energy-saving design shall be specified.

17.3 Type, Quantity and Index of Energy Consumption in Operation Period

17.3.1 Status of power-consuming facilities and equipment in the operation period of the project shall be specified, and the electric energy loss in the production process and power consumption of electrical equipment shall be calculated.

17.3.2 Design criterion of water supply and water consumption in the operation period of the project shall be specified.

17.3.3 Oil-consuming equipment and their oil consumption in the operation period of the project shall be specified.

17.3.4 Energy consumption in lighting, heating, cooling, ventilation, water supply, etc. of project structures shall be specified.

17.3.5 Condition of local energy service shall be described, energy consumption in the operation period of the project shall be summarized by type; the comprehensive energy consumption index per 10 000-yuan output value, comprehensive energy consumption index per 10 000-yuan industrial added value and integrated power consumption rate and standard coal consumption for power supply, etc. in operation period of the wind farm shall be calculated according to financial indicators such as energy output, on-grid energy, feed-in tariff, etc., and the influence of energy consumption index on local energy service shall be analyzed.

17.4 Main Energy-Saving Measures

17.4.1 Energy-saving measures considered in wind turbine type selection, general layout and road planning shall be specified.

17.4.2 Energy-saving measures considered in access system engineering design, power transformation engineering design, collection line, and transmission line design and other electrical design shall be specified, including the energy-saving measures considered in the design such as equipment and material selection, equipment layout, and route selection, etc.

17.4.3 Energy-saving measures considered in building design shall be specified.

17.4.4 Energy-saving measures considered in production management and other aspects shall be specified.

17.4.5 Energy consumption characteristics of the project shall be described, and energy saving suggestions shall be proposed.

17.5 Energy-Saving Benefit Analysis and Conclusion

17.5.1 Energy-saving benefit and effects shall be analyzed.

17.5.2 Energy consumption indexes of the project shall be summarized, and the effect of an energy-saving design shall be concluded.

18 Tendering

18.0.1 Project scale, total investment, and financing mode of the project shall be described, and stipulations to be followed in the project tendering shall be specified.

18.0.2 Project tendering scope shall be described, concrete contents of tendering shall be listed. The tendering contents shall be sorted by service, construction and installation, equipment and so on, and subcontract plan shall be put forward.

18.0.3 Tendering manner and organization form adopted in the project tendering shall be specified.

18.0.4 Basic information for project tendering shall comply with the provisions of Table 18.0.4.

Table 18.0.4 Basic information for project tendering

Project:

Category	Scope of tendering		Organization form of tendering		Tendering manner		No tendering	Estimated amount (10 000 yuan)	Remarks
	Tendering for whole works	Tendering for partial works	Tendering on one's own	Tendering by agent	Open tendering	Invitational tendering			
Investigation									
Design									
Construction works									
Installation works									
Supervision									
Equipment									
Other									
Note:									

Appendix A Contents of Feasibility Study Reports for Onshore Wind Power Projects

Appendix B Features of Wind Power Projects

Table B Engineering Characteristics of XXXX Wind Farm Project

Description				Unit	Parameter /value	Remarks
Project site	Elevation			m		
	Longitude			° ' "		
	Latitude			° ' "		
	Annual average wind speed			m/s		At hub height
	Wind power density			W/m^2		At hub height
	Prevailing wind direction					
Main equipment	Main electromechanical equipment	Wind turbine	Number	set		
			Rated power	kW		
			Number of blades	Nos.		
			Rotor diameter	m		
			Swept area	m^2		
			Cut-in wind speed	m/s		
			Rated wind speed	m/s		
			Cut-out wind speed	m/s		
			Survival wind speed	m/s		
			Safety grade			
			Hub height	m		
			Output voltage	V		
			Rated power of generator	kW		
			Power Factor of generator			
		Step-up transformer of wind turbine	Number	set		
			Model			
		Collection line	Voltage class	kV		
			Number of circuits	Circuit		
			Length	km		
	Step-up substations	Main transformer	Model			
			Number	set		
			Capacity	MVA		
			Rated voltage	kV		
		Number of outgoing circuits and voltage class	Voltage class	kV		
			Number of outgoing circuits	Circuit		
Civil works	Foundation of wind turbine		Number			
			Model			
	Foundation of step-up transformer of wind turbine		Number			
			Type			

Table B *(continued)*

Description				Unit	Parameter /value	Remarks
Construction	Quantities	Earth-rock excavation		m^3		
		Earth-rock backfill		m^3		
		Concrete		m^3		
		Reinforcing bar		t		
		Access road		km		
		Internal road		km		
		Construction duration	Total duration (construction period)	Month		
			Operation of the first batch of wind turbine	Month		
Budget estimate factor	Static investment (preparation year)			10^4 yuan		
	Total investment			10^4 yuan		
	Static investment per kW			yuan/kW		
	Dynamic investment per kW			yuan/kW		
	Construction ancillary works			10^4 yuan		
	Equipment and installation works			10^4 yuan		
	Building works			10^4 yuan		
	Other expense			10^4 yuan		
	Basic reserve fund			10^4 yuan		
	Spread reserve fund			10^4 yuan		
	Interest incurred during construction			10^4 yuan		
Economic indicators	Installed capacity			MW		
	Annual on-grid energy			10^4 kW·h		
	Annual equivalent full load hours			h		
	Average feed-in tariff (Tax included)			yuan /kW·h		
	Profitability index	Financial internal rate of return of investment (before tax)		%		
		Financial internal rate of return of investment (after tax)		%		
		Financial internal rate of return of capital fund		%		
		Total investment yield		%		
		Profit and tax investment ratio		%		
		Net profit margin of capital fund		%		
		Payback period (after tax)		year		
		Loan repayment period		year		
	Solvency	Assets-liabilities ratio		%		

Appendix C The Schedules of Technical and Economic Index

Table C Main Technical and Economic Indexes

Name of wind farm			**Wind Turbine equipment price**		**yuan/kW**	
Project site			Tower (pylon) equipment price		yuan/t	
Designer			Wind turbine foundation cost		10^4 yuan /Nos.	
Contractor			Step-up substation of wind farm		10^4 yuan /Nos.	
Installed capacity	MW		Main quantities	Earth-rock excavation	m^3	
Unit capacity	kW			Backfill	m^3	
Annual energy output	10^4 kW·h			Reinforcing rebar	t	
Annual utilization hours	h			Concrete	m^3	
Static investment	10^4 yuan			Tower	t	
Total investment	10^4 yuan		Construction land area	Permanent land	*mu*	
Total investment per kW	yuan/kW			Temporary (Rented) land	*mu*	
Total investment per kWh	yuan/(kW·h)		Planned construction duration	Construction duration for power generation of first batch of wind turbine	Month	
Interest incurred in construction period	10^4 yuan			Total construction duration	Month	
Investment in power transmission works	10^4 yuan		Personnel quota		Person	

Explanation of Wording in This Specification

1 Words used for different degrees of strictness are explained as follows in order to mark the differences in executing the requirements in this specification.

1) Words denoting a very strict or mandatory requirement:
"Must" is used for affirmation; "must not" for negation.

2) Words denoting a strict requirement under normal conditions:
"Shall" is used for affirmation; "shall not" for negation.

3) Words denoting a permission of a slight choice or an indication of the most suitable choice when conditions permit:
"Should" is used for affirmation; "should not" for negation.

4) "May" is used to express the option available, sometimes with the conditional permit.

2 "Shall meet the requirements of…" or "Shall comply with…" is used in this specification to indicate that it is necessary to comply with the requirements stipulated in other relative standards and codes.

List of Quoted Standards

GB 50217, *Code for design of cables of electric engineering*

GB 18306, *Seismic Ground Motion Parameter Zonation Map of China*

GB/T 18710, *Assessment Method for Wind Energy Resources of Wind Farms*

GB 19963, *Technical rule for connecting wind farm to power system*

NB/T 31011, *Specifications and calculation basis for cost estimate of onshore wind power projects*

NB/T 31085, *Specifications for Economic Evaluation of Wind Farm Projects*