TÜV NORD Wind Energy
TÜV NORD风能

TÜV NORD Renewable Energy
TÜV NORD 可再生能源

TÜV NORD可再生能源部
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公司介绍

TÜV NORD GROUP is one of the world-leading technical provider with over 150 branches in more than 70 countries. Down its development path of more than 150 years, TÜV NORD has grown from a traditional steam boiler inspection organization to a technology service company officially authorized by German government. Expanding and improving its services unremittingly, TÜV NORD has now become one of the world' s top ten certification authorities.

The core services of TÜV NORD GROUP mainly include testing, inspection, certification, assessment, education and engineering, which covers a wide area of expertise in industry, energy, railway, mobility, environmental protection, IT, natural resources, aerospace, education & training and staff qualification training, etc.

作为全球领先技术服务专家，TÜV NORD集团在全球70多个国家设有超过150家分支机构。在超过150年的发展历程中，TÜV NORD从最初的“压力容器检验协会”，到成为德国官方授权的技术服务公司，持续拓展服务范畴，完善服务，迄今已发展成为全球十大认证机构之一。

TÜV NORD集团核心服务主要体现在测试、检验、认证、评估、教育及工程，涉及行业包含：工业、能源、铁路、车辆、环境保护、IT、自然资源、航空航天，以及变得越发重要的教育培训及员工资质培养等。

Wind Business Introduction
风能业务综述

TÜV NORD is an independent third party
authorized by German government, DAkkS, BSH, CNAS
and a registered body listed by Danish Energy Authority (DEA).

TÜV NORD是
由德国政府、DAkkS、BSH、CNAS授权的
独立第三方认证机构，
同时也是由丹麦能源管理局(DEA)
注册列名的认证机构。

TÜV NORD Group possesses rich resources of wind energy service both in China, Indian, Brazil, Turkey and Europe. Our labs with 100% certification and evaluation ability of Wind turbine generator system and components are accredited in compliance with the ISO / IEC 17065 / 17020 norm, equipped with top-class technical experts. The large capacity of certification, evaluatioan ensures your wind products could be certified immediately as soon as we receive them. Therefore, the whole period of certification and evaluation will be shortened and your products become more competitive at global market in short time.We dedicate to providing a comprehensive range of certification and services for manufacturers, installers, suppliers and investors from Wind. Products with 'TÜV NORD' mark, which symbolizes safety and guarantees and receives recognition from global purchasers and consumers widely, is in compliance with relevant European certification standards and requirements. Our international recognized certification marks increase the marketability of your products all over the world.

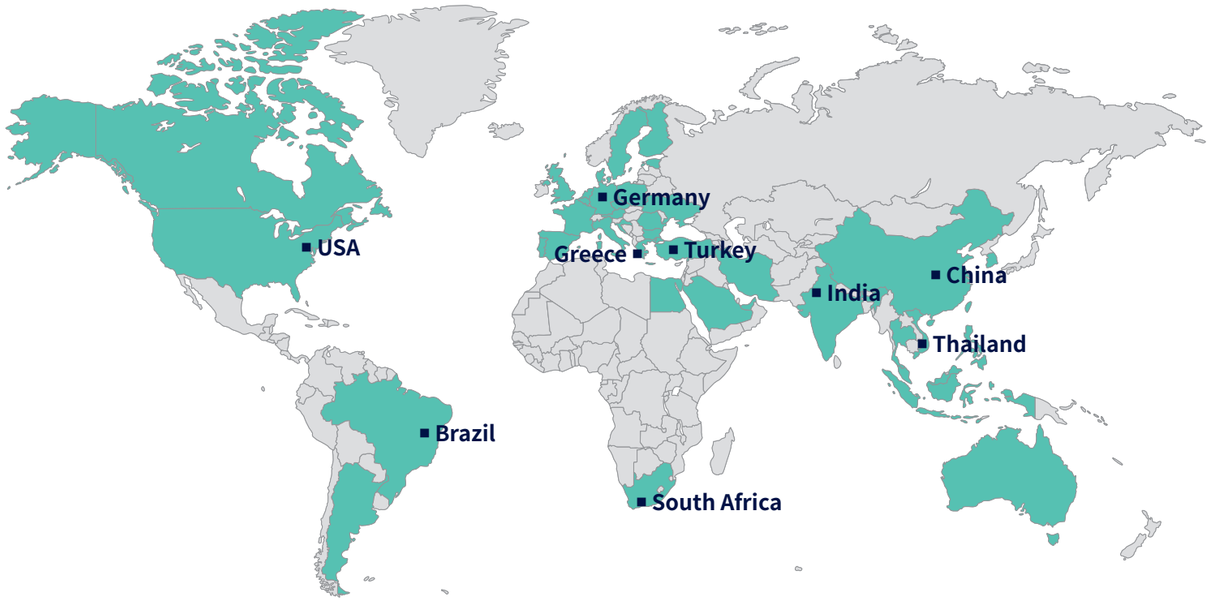
TÜV北德集团在中国大陆、印度、巴西、土耳其以及欧洲本土等分支机构都拥有丰富的风能认证、评估及检测实验室资源。这些分支机构已通过ISO / IEC 17065 / 17020认可，具有100%风电机组及零部件的认证及评估能力，并配备优秀的技术专家。让您的认证需求可以得到快速响应，缩短整个认证周期，助您在短时间提高全球市场竞争力。我们致力于为制造商、安装商、服务供应商及投资商提供风能发电系统整个产品供应链的全方位认证及评估服务。“TÜV北德”标志象征着安全与保障，携带该标志的产品符合相关欧洲认证标准及要求，得到全球采购商和消费者的广泛认可。我们的国际认证标志使您的产品在国际市场更具竞争优势。

In the field of wind energy, TÜV NORD can provide a 'one-stop technical evaluation solution' for the whole life cycle of wind power business, from the research and development of wind turbine, design, wind farm site selection, construction, Operation and wind turbine decommissioning. Our services include, but are not limited to, wind turbines and component type certification, raw material and component factory approval, CE certification of wind turbines, wind farm (project) certification, technical inspection and surveillance of wind farms, technical due diligence of wind farms, wind farm wind resource forecasting and complete guaranteed AEP assessment, site-specific suitability evaluation, environmental impact analysis, root cause analysis, grid connection, life extension assessment of wind farm design or in-service wind farms as well as financial and legal due diligence service，to help investors and wind farm owners control the quality problems in all links, so as to reduce investment risks and protect returns.

在风能领域，TÜV北德可以提供从风力发电机组研发、设计到风场前期选址、建设、投入运营再到风机退役这整个风电业务的全生命周期过程中“一站式的技术评估解决方案”。我们的服务包含但不限于风机及零部件型式认证、原材料及零部件工厂许可、风机CE认证、风场（项目）认证、风电场的技术检验和监督、风电场的技术尽调、风电场风资源预测及完整的可担保的AEP评估、特定场址适应性评估、环境影响分析、根本原因分析、并网、风电场设计延寿或在役风电场的延寿评估、风电场相关的金融和法律尽调等服务，帮助投资者及风场业主把控各个环节的质量问题，从而降低投资风险保障收益。

A World Leading Wind Industrial Service Provider
世界领先的风能服务提供者

Global Access for One-stop Service
一站式服务遍布全球



Professional Technical Services Provided by TÜV NORD International Team
TÜV北德国际化团队的专业服务

With global presence and local offices in more than 70 countries worldwide, TÜV NORD serves the wind industry with state-of-the-art and customized product portfolios. With rich experience of certification and inspection for onshore and offshore wind turbines and wind farm, our international team provides you professional technical services. Our experts will always be your strong support and help you to reach business goals efficiently.

TÜV NORD在全球70多个国家设有办事处，为风电行业提供服务最先进和定制的产品组合。TÜV北德国际化的团队拥有丰富的陆上风场、风机及海上风场、风机的认证及评估的经验，向您提供专业化的技术服务。我们的专家一如既往的给予您强大的技术支持，助您快速、有效地达到业务目标。

Professional Technical Services Provided by TÜV NORD International Team
TÜV北德国际化团队的专业服务

As members of IECEE/IECRE, widely recognized report and certificate.From project evaluation, management systems building, to quality management and control, supplier management, products improvement and optimization, global market access analysis. What we do is to help company better growth.

作为IECEE和IECRE互认体系成员，广泛认可的报告证书。从前期的项目评估、管理体系的建设、到生产过程中工艺质量管控、供应商管理、产品技改分析优化、全球外市场准入分析等，所有的一切都是为了能够帮助企业更好地成长。

1.Certification: Type & Component Certification and Project Certification
认证类：型式及部件认证、项目认证

Accreditations
已授权的标准：

- TÜV NORD Standard P20
- IEC WT 01
- IEC 61400-22
- IECRE
- GL-Guideline 2003/04
- GL-Guideline 2010
- GL-Guideline Offshore 2005 and 2012
- DNV OS-J101
- Danish Energy Authority's Executive Order
- TAPS 2000
- DIBt Guideline 2004 and 2012
- GB/Z 25458、GB/T 35792

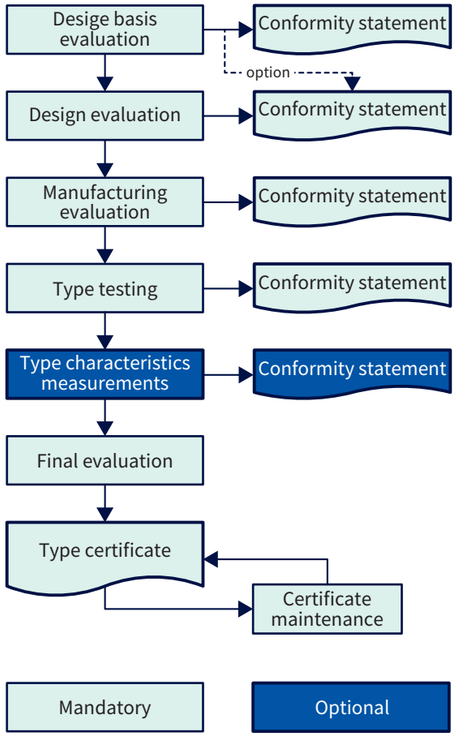
2.Based on specific project assessment or inspection
基于特定项目的评估或检验

- SSDE(Site Specific Design Evaluation)特定场址设计评估
- White Paper Approach白皮书方法评估
- Rotor Blade Material Type Approval叶片材料型式许可
- RCA Evaluation根因分析评估
- Remote Inspection远程审核
- Operation&Maintenance for Wind-farm风场运维认证
- Re-powering增效评估（基于部件更换）
- Site Assessment / Risk analysis / CFD
  场址评估/风险评估/CFD
- Wind Turbine Life-extension风机延寿
- Wind Turbine Technical Improvement Evaluation风机技改评估
- Availability evaluation of wind turbines and wind farms
  风机和风场的可利用率评估
- Conditioning Monitor System Evaluation and Certification
  监控系统评估及认证
- 2nd and 3rd Party Inspections第二、三方审核
- Compliance with Local Grid Codes / LVRT Measurements
  当地并网适应性评估
- Assessment of Grid Connection Concepts and Power Quality Measurement低电压穿越测试
- Global Marketing Access全球市场准入

Type Certification
型式认证

The scheme below presents the type certification process and its modules according to IECRE. Other certification schemes are similar or refer directly to IECRE. Each of the modules can be independently evaluated and concluded with TÜV NORD conformity statements. These can also be used as individual and reusable packages since mutual recognition agreements ensure acceptance of certificates bet- ween accredited bodies.

以下方案展示了依据IECRE型式认证的过程及其模块。其他认证方案则类似或者可以直接参考IECRE认证标准。每个模块都可以用TÜV NORD一致性声明进行独立评估和总结。互认协议可确保TÜV NORD证书在认证机构之间可被互相接受。



Type Certification Scheme(acc. to IECRE OD-501)

Design Basis Evaluation
设计基础评估

The design basis defines requirements, assumptions and methodologies, which are essential for the design and documentation of the wind turbine.

设计基础定义了要求、假设和方法，这些对风机的设计和文件记录来说是至关重要的。

Manufacturing Evaluation
制造能力评估

For quality assurance and compliance with the certified design, the implementation of design related requirements is verified by TÜV NORD manufacturing evaluation.

为了保证质量并符合认证设计，设计相关要求的实施由TÜV NORD通过制造能力评估来验证。

Design Evaluation
设计评估

Design evaluation is based on design code requirements and documentation provided by customers. Our evaluation comprises load assumptions, safety concept/system, electrical, mechanical and structural components, rotor blade, tower and tower internals, as well as turbine manuals.

设计评估是基于由客户提供的设计规范要求和文档记录。我们的评估包括载荷假设、安全概念/系统、电气、机械和结构部件、叶片、塔筒和塔筒内部构件以及风机手册。

Type Testing
型式认证

During type testing TÜV NORD accompanies you to verify that all relevant assumptions set during the turbine design process as well as the correct and safe functioning of the turbine in all operating conditions are ensured.

在型式测试期间，TÜV NORD将验证风机设计过程中设定的所有相关假设，以及风机在所有操作条件下的安全功能是否得到了保证。

Optional modules are scheme-specific and can be included on customer request.
可选认证模块是针对特定方案的且可以根据客户要求来提供。

For type and component certification, TÜV NORD is your accredited partner.
对于型式和部件认证，TÜV NORD将是您的合作伙伴。

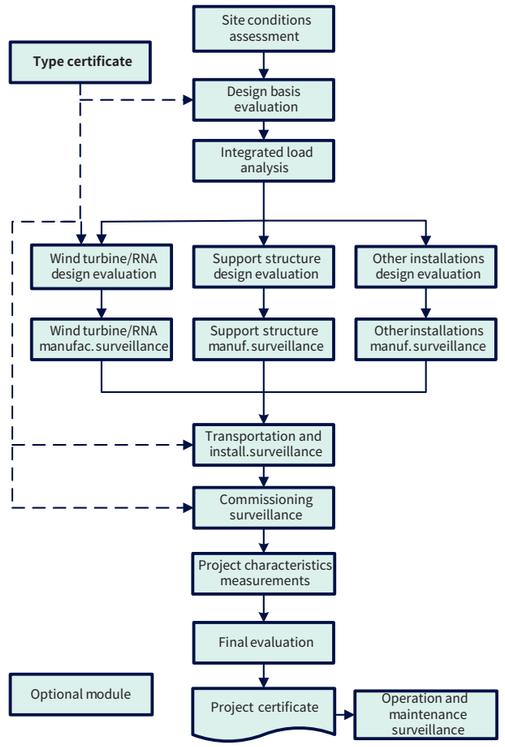
Project Certification
项目认证

Project certification increases the overall project confidence and value while reducing technical and financial risks for all stakeholders. In addition, project certification provides assurance that type certified wind turbines and foundation designs are in conformity with site-specific conditions, local codes and regulations at the project site.

项目认证提高了投资者对整个项目的信心和价值，同时降低了所有利益相关者的技术和财务风险。此外，项目认证还保证通过型式认证的风机和基础，设计符合项目现场的特定场址条件、当地规范与法规。

Project certification increases the overall project confidence and value while reducing technical and financial risks for all stakeholders. In addition, project certification provides assurance that type certified wind turbines and foundation designs are in conformity with site-specific conditions, local codes and regulations at the project site.

与型式认证类似，项目认证的每个模块都可以独立评估，并包含在被认可的 TÜV NORD 符合性声明中。这些可以作为单独服务项进行处理，由于认证机构之间的证书相互认可，项目认证机构可以地将其整合到对应的项目证书中。



Project Certification of Wind Farms (acc.to IECRE OD 502)

The implementation of design requirements in project specific manufacturing, transport and installation processes are ensured by TÜV NORD surveillance and on-site commissioning based on strategies agreed with and adapted to the customers ‘needs.

通过TÜV NORD的监督和现场调试，可以确保在特定项目制造、运输和安装过程中根据与客户商定的需求及适应的策略，来执行设计的要求。

With focus on shortest timeline and leanest processes, our certification services are tailored to project specific needs and can be extended to optional activities such as independent inspection for foundation designs, operation and maintenance surveillance as well as modification management.

我们的认证服务专注于用最短的时间和最精简的流程，根据项目具体需求来量身定制，并可扩展到可选认证项，如基础设计的独立检查、运维监督以及设计更新管理。

Onshore Wind Turbine Service
陆上风电服务

Type Certification for Wind Turbine
风机型式认证

CE Certification for Wind Turbine System
风机系统的CE认证

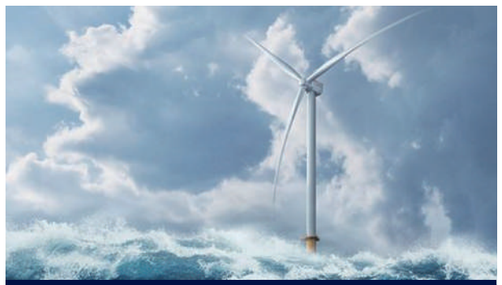
- Wind Turbines CE Certification
  风机的CE认证
- Wind Turbine Components CE Certification
  风机部件的CE认证

On Site Services for Wind Turbine
风机现场服务

- End of Warranty Inspection
  出质保检验
- In-service Inspection
  在役检验
- Site Assessment and Duty Diligence
  场址评估及尽职调查

Offshore Wind Turbine Service
海上风电服务

- Type and Project Certification
  型式及项目认证
- Support for BSH Releases
  (Federal Maritime and Hydrographic Agency)
  BSH的支持(联邦海事水文局)
- Manufacturing Inspections
  制造评估
- Quality Assurance
  (eg. Inspection for Support Structure,
  Sub-station, etc.)
  质量保证(如支撑结构检查,海上升压站检查等)
- Periodical or Condition Based Inspections
  周期性或条件性的检验
- Component Approval
  部件的认证评估
- Corrosion Protection
  防腐保护
- Risk Assessments
  风险评估
- HSE
  健康、安全及环境
- Assistance in Project Development
  海上项目开发支持
- Tailored Services on Request
  基于需求的定制化服务
- Commissioning WTG
  海上风机试运行



Siemens Gamesa SG 11.0-200 DD Offshore Wind Turbine

LM 107 P Rotor Blade

TÜV NORD White-paper Approach — Certification Process Simplification
TÜV NORD白皮书—简化认证流程

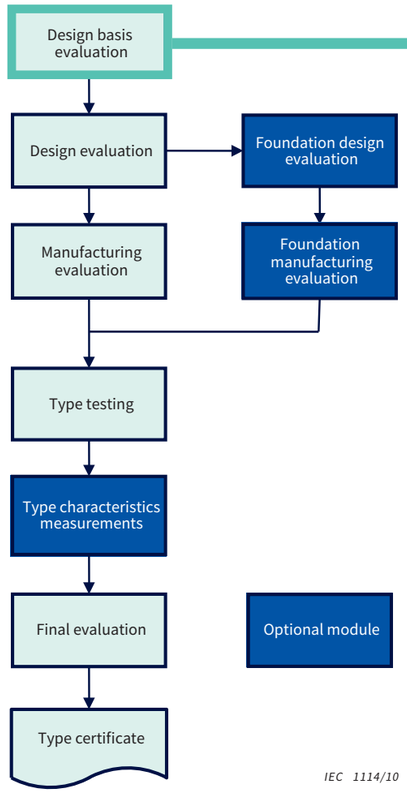


Figure 2 – Modules of type certification

Design basis evaluation - ensure the safe design of the wind turbine type.
设计基础评估--确保风力发电机组类型的安全设计

The design basis covers all requirements, assumptions and methodologies, including:
设计基础涵盖了所有的要求、假设和方法，包括：

- Codes and standards;
  准则和标准。
- Parameters, assumptions, methodologies and principles
  参数、假设、方法论和原则
- Other requirements, e.g. for manufacture, transportation, installation and commissioning, Operation and maintenance.
  其他要求，如制造、运输、安装和调试、运维。

There are rooms for demonstrating and evaluating unique design approaches e.g. for:
设计基础具备评估独特设计方法的的灵活性，例如：

- External design parameters;
  外部设计参数。
- Design load cases selection (e.g. based on MTBF)
  设计载荷情况的选择(例如,基于MTBF)。
- Load factors and load reduction factors; (e.g. through test, FEM modeling)
  载荷系数和载荷降低系数;(例如,通过测试、FEM建模)。
- Partial safety factors applied on loads and materials;
  应用于载荷和材料的部分安全系数。
- Duration of simulation as well as number of simulations;
  仿真的时间以及仿真的数量。
- Methods for extreme and fatigue design loads/response analysis;
  极限和疲劳设计载荷/响应分析的方法。
- Environmental conditions relevant for installation;
  与安装有关的环境条件。
- Inspection scope and frequency;
  检查范围和频率。
- Target lifetime of components, systems and structures, and
  部件、系统和结构的目标寿命
- Requirements for condition monitoring systems.
  对状态监测系统的要求。

TÜV NORD White-paper Approach
TÜV NORD白皮书的优势

- Flexible and customized
  灵活性与定制化服务
- Document the special design basis evaluation result
  可以记录特殊设计基础评估结果
- Widely accepted through mutual recognition scheme
  通过互认体系使得认证结论被广泛接受
- One time certification for common portion and reduce cost/cycle for future
  对同类型的设计部分的进行一次性认证,降低未来项目的成本/周期

Site-Specific Design Evaluation
特定场址设计评估

For sustainable and profitable wind energy projects, it is important that the selected wind turbines match with the local wind, climate, electrical and terrain conditions. During the first stages of the wind farm project, site-specific design evaluation (SSDE) assures that the site conditions, which affect loading, durability and operation of the turbines, are in compliance with the turbine design.

对于可持续的和有盈利性的风能项目，至关重要的是所选择的风机要与当地的风力、气候、电力和地形条件相匹配。特定场址设计评估（SSDE）可以确保载荷、耐久性和运行的现场条件符合风机设计。

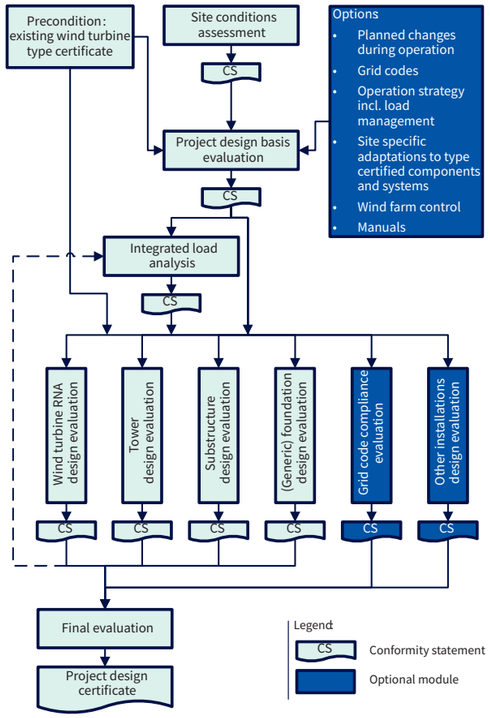
Site-specific design evaluation is performed for wind turbines which have got the type certificates or the design evaluation conformity statements. Site-specific design evaluation is part of the project design certification module and project certification module, as well as can be performed according to customer request.

特定场址设计评估是针对已经获得型式证书或设计评估符合性声明的风机。特定场址评估是项目设计认证模块和项目认证模块的一部分，也可以根据客户要求定制。

With experiences more than 250 site-specific evaluations with global customer players, TÜV NORD is the leading service provider. Our references include SSDE in countries like China, Germany, Japan, Italy, Thailand, Australia, UK, Kenya, Argentina, Poland, Pakistan, Egypt and USA. The scopes of these site-specific projects were various from project to project, for example:

TÜV NORD与全球客户合作进行了250多次现场评估，是行业领先的服务提供商。我们的案例包括中国、德国、日本、意大利、泰国、澳大利亚、英国、肯尼亚、阿根廷、波兰、巴基斯坦、埃及和美国等国家的项目。这些特定场址项目的工作范围因项目而异，例如：

- Plausibility check of the site-specific loads
  特定场址载荷的合理性检查
- Integrated load analysis based assumed site conditions
  基于假设场址条件的载荷分析
- Site conditions+ integrated load analysis + all components.
  场址条件+载荷分析+所有零部件分析



Project Design Certification Scheme (acc. to IECRE OD-502)

Remote Inspection
远程检验

By using remote inspection techniques, TÜV NORD has applied the most advanced digital solutions from the very beginning.

通过使用远程检测技术，TÜV NORD应用了最先进的数字解决方案。

Compared to traditional on-site activities, remote techniques do not require the physical presence of the inspector on site.

与传统的现场活动相比，远程技术不需要检查员亲自到现场。

Benefits for our customers
为客户带来的益处：

Remote techniques will increase flexibility of inspections while saving costs.

远程技术将提高检查的灵活性，同时节约成本。

Especially for organizations with a large number of manufacturing sites, remote techniques are beneficial –regardless of the countries where the sites are located. Remote techniques remove the necessity of travelling to the site, which saves both time and travel costs.

特别是对于拥有大量生产现场的企业来说，无论在哪个国家，远程技术都是非常有益的。远程技术消除了前往现场的必要性，从而节省了时间和旅行成本。

If experts in special fields are required within one inspection, as many as needed can be involved by means of remote techniques – without unnecessary additional travel costs.

如果在一次检查中需要特殊领域的专家，可以通过远程技术让所需的专家参与进来，而不需要额外的差旅费。

Acceptance
验收

There are no requirements within the ISO standards, taken as basis for accreditation of certification bodies and inspection bodies. The IAF (a forum for worldwide accreditation bodies to ensure comparable rules) published the document MD4. This document provides basic rules and acceptance of remote techniques for auditing.

ISO标准中没有相关要求可以用于认证机构和检验机构授权的基准。IAF（是一个由有关国家认可机构参加的多边合作组织，其主要目标是协调各国认证制度）发布了MD4文件。本文件提供了基本准则和对远程审计技术的验收。

The certification guidelines and standards relevant for certification of wind turbines do not prohibit the use of remote techniques.

与风机认证相关的认证指南及标准并不禁止使用远程技术。

Services for application of remote techniques. Following services can be provided by TÜV NORD with remote techniques:

远程技术应用服务，TÜV NORD可以使用远程技术提供以下服务：

- Manufacturing Inspection as part of Manufacturing Evaluation within Type Certification of Wind Turbines
  制造检验: 风机型式认证中制造评估部分
- Manufacturing Inspection as part of Manufacturing Surveillance within Project Certification
  制造检验: 项目认证中制造监督部分
- Test Witnessing as part of Type Testing within Type Certification of Wind Turbines
  测试见证:风机型式认证中型式测试部分

Site Assessment Services
场址评估服务

Extensive expertise and many years of experience in the national and international field of site assessments distinguish the team of TÜV NORD Site Assessment.We accompany you with your wind farm project from planning and approval, through the operation to life time extension beyond the design life time. As your competent partner, we are at your side quickly and reliable with comprehensive services from one source.

TÜV NORD场址评估团队在国内和国际场址评估领域拥有广泛的专业知识并累积了多年经验。我们自始至终陪伴您的风电场项目，从规划和审批，到运营，再到超过设计寿命以外的延寿。作为您有能力的合作伙伴，我们将快速可靠的为您提供一站式的全面服务。

As a technical service provider, we assist you with all questions regarding the site assessment for your photovoltaic projects and support you in the grid connection certification. We are of course DAkkS accredited according to DIN EN ISO/IEC 17025 and other standards.

作为一家专业技术服务提供商，我们协助您解决项目现场评估的所有问题，并为您提供并网认证技术支持。我们也具备由DIN EN ISO/IEC 17025和其他标准认证授权的DAkkS资质。

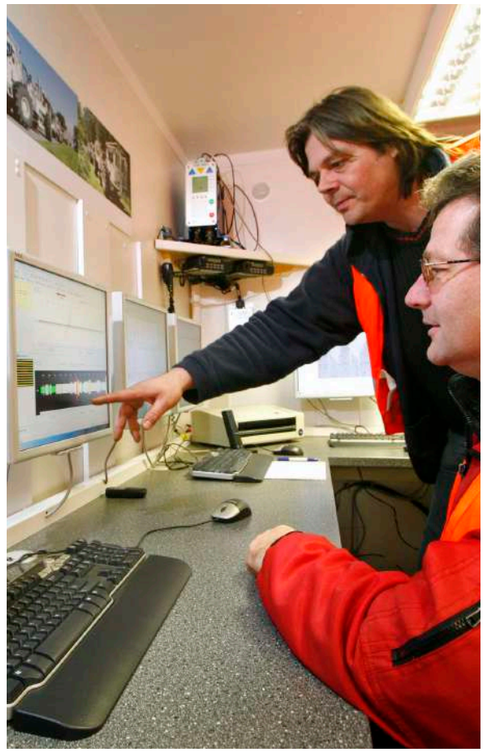
We are happy to support you, for example, with questions on the following topics:
我们可以为您提供关于以下技术评估：

- Determination of the site-specific wind potential and energy yield prognosis
  特定场址风能及发电量预测
- Wind measurements with LiDAR
  利用LiDAR测量风速
- Site quality assessment according to EEG 2017
  根据EEG 2017进行场地质量评估
- Site suitability (turbulence report, generic load comparisons)
  场址适应性（湍流报告，通用载荷对比）
- Minimum distance and analysis of the wake flow in relation to overhead lines
  与架空线有关的尾流分析和最小距离
- Noise immission prognosis
  噪声预测
- Shadow flicker prognosis
  塔影闪变预估
- Risk Assessment (ice fall, ice throw, tower failure, blade fracture, fire)
  风险评估（落冰、甩冰、塔筒失效、叶片断裂、火灾）。
- Geotechnical site investigation and foundation consulting
  岩土工程现场调查和地基咨询
- Life time extension of wind turbines beyond 20 years
  超过20年以上风机延寿
- Technical Due Diligence
  技术尽职调查
- Visualization of wind turbines
  风机的可视化
- Optimization of wind farm layout
  风电场布局的优化
- Root Cause Analysis
  失效根因分析

Due Diligence
尽职调查

Possible Aspects of a Due Diligence
尽职调查相关方面

01. Assessment of Plausibility of the Energy Yields (AEP) and Wind Potential Prognosis or Study
    年产能及风况预报或研究的可行性评估
02. Plausibility Check of Calculated Annual Energy Production (AEP)
    计算年产能的可行性检查
03. Assessment of Plausibility of the Certification Documents of the Chosen Wind Turbine Type
    被选风机类型认证文档的可行性评估
04. Evaluation of Technical Risks of the Turbine Concept and Technology
    风机概念及工艺的的技术性风险评价
05. Evaluation of Technical Risks of the Foundation Construction
    基础建设的技术性风险评价
06. Assessment of Plausibility of the Maintenance and Service Concept
    维护和服务概念的可行性评估
07. Review of the Interface Management
    接口管理审核
08. Assessment of Plausibility of the Soil Assessment Reports
    土壤评估报告的可行性评估
09. Contract Assessment on Extend and Completeness
    延展性及完整性相关的合同评估
10. Contract Assessment on Legal Content
    法务相关内容的合同评估
11. Assessment Report with Findings and Recommendations
    问题发现及推荐的评估报告
12. Profitability Analyses on the Base of the Profit and Loss Account and the Investment Sum Review of the Risks of the Insurance Concept
    基于利润及亏损账户及投资总和的盈利性分析



Economy Efficiency
经济效益

Investments 投资

- Costs per Turbine 风机成本
- Costs for Installation 安装成本
- Costs for Foundation 基础成本
- Grid Connection 并网
- Access Roads, Crane Site 道路吊装条件
- Costs for Transformer and Cabeling 变压器及线缆成本
- Project Development, Site Management 项目开发，现场管理

Financing 金融

- Dept 部门
- Equity 公正
- Num. of Dept Investors 投资部门数量
- Dept Conditions 部门条件

Operational Costs 运营成本

- Insurance 保险
- Operation Management 运行管理
- Maintenance Service 维护服务
- Land Lease 土地租赁
- Repairs 维修
- Fees for Technical Inspections 技术检查费用

Earnings 盈利

- Energy Yield Brutto acc. to Prognosis 产能与预估的对比
- Feed-in Tariff 补贴政策
- Availability 可利用率
- Safety Margin 安全裕量
- Annual Energy Production Netto 最低年产能

Technical Inspections And Related Evaluation For Wind Farms
与风场相关的技术检验和评估

Surveillance and Inspection Service
监造及检验服务

- Driver Train Vibration 传动链振动检测和分析
- Inspection / Surveillance for Substation and MV / HV Electrical Equipment 升压站中高压电气设备的检验及监造
- Oil Inspection and Analysis 油品检测和分析
- Blade Inspection 叶片外观检测和分析
- Endoscopic Inspection for Gearbox 齿轮箱内窥镜检测和分析
- Wind Turbine Inspection 整机检测和分析

Performance evaluation based on the relevant SCADA system data analysis
基于SCADA系统相关数据分析的风场性能评估

Smart Wind Farm
智慧风场

- Wind Farm Smart Operation
  风场的智能化运行
- Efficiency Analyze
  效率分析
- TBA / PBA Analyze
  可利用率的分析
- CMS Service
  CMS服务

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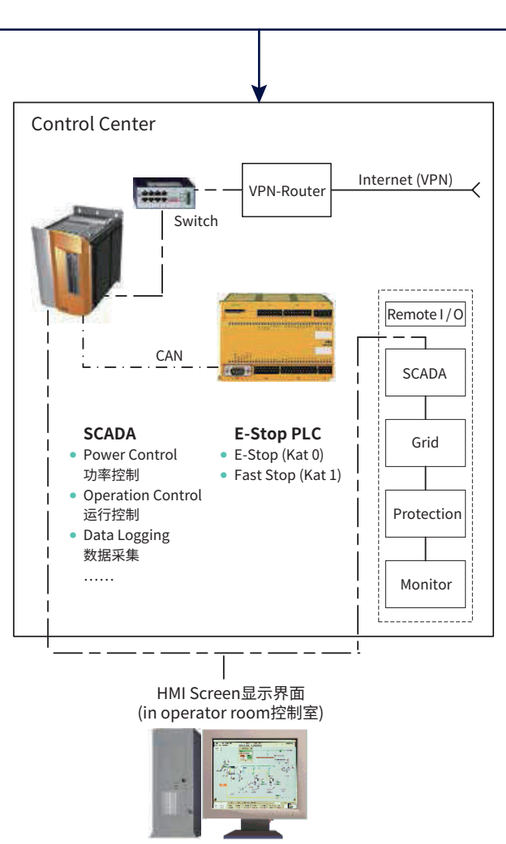

Smart Grid
智能电网

- Smart Dispatch
  智能调度
- Smart Protection
  智能保护
- Energy Storage System
  储能系统

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Damage and Repair Evaluation for Rotor Blades
叶片损坏及维修评估

Rotor Blades are one of the most sensitive components of wind turbines. Design, manufacturing and handling are challenging and require high competence and mindfulness from all involved parties.However, damages do occur despite all efforts.

叶片是风机最重要的部件之一。设计、制造和运输都具有挑战性并且需要所有参与方有很强的能力和意识。尽管做了种种努力，还是有发生损坏的情况。

Damage is often subject of discussions between turbine manufacturers and their customers. Furthermore, investors and insurance companies want to be sure that the turbines are available and produce the predicted amount of energy within the assumed lifetime. An independent evaluation report from a competent third party can provide clarity here and give valuable information on how to deal best with damaged blades.

损坏往往是风机制造商和他们的客户之间讨论的热点。此外，投资者和保险公司希望确保风机可以投入使用并在预期的使用寿命内产生预期的发电量。一份来自有实力的第三方独立评估报告可以提供关于如何最优处理受损叶片的宝贵信息。

TÜV NORD Competences
TÜV NORD的能力

With more than 30 years of experience in wind energy, TÜV NORD stands for a high degree of quality and customer satisfaction. We are a leading international testing, inspection and certification service provider and have extensive in-house expertise in the evaluation of blade damages and corresponding measures.

TÜV NORD在风能领域拥有超过30年的经验，代表着高水准的质量与客户满意度。我们是国际领先的检测、检验和认证技术服务商，在评估叶片损坏和相应措施方面拥有广泛的内部专业知识。

TÜV NORD Services
TÜV NORD的服务

TÜV NORD offers an independent evaluation of recognized damages and corresponding measures.
TÜV NORD对识别损害和相应的措施可进行独立评估。

This service includes:
这些服务包括：

- Evaluation of root cause analysis
  根本原因分析评估
- Understanding the root cause for recognized damages
  识别损害的根本原因的释义
- Concluding on further possible effected areas
  界定可能进一步损坏的区域
- Evaluation of inspection methods
  检查方法的评估
- Ensure that all damages are detected
  确保所有的损坏都被检测
- Evaluation of repair methods
  评估维修方法
- Evaluation of repair documentation
  评估维修文件
- If requested, witnessing of inspections and repair
  如有要求，支持检验和修复的现场见证

Floating Offshore Wind Turbines
漂浮式海上风机

Floating offshore wind turbines have a floating foundation instead of a fixed foundation, which allows installation independent from shallow waters. Prototypes are installed around the world and the market is accelerating for maturity.
漂浮式海上风力发电机有一个浮动的基础，而不是用于浅水安装的固定基础。样机已在世界各地安装，市场正在加速成熟。

TÜV NORD provides reassurance for stakeholders in all aspects of Floating wind. For new concepts, we offer Conceptual Design Evaluation and Technology Readiness Evaluation.
TÜV NORD在漂浮式风力发电领域的各个方面为利益相关者提供保证。对于新的设计概念，我们提供概念设计评估和技术储备评估。

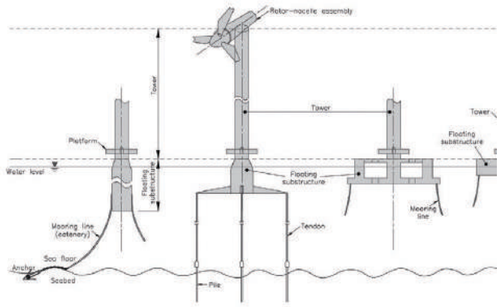
Conceptual Design Evaluation and Technology Readiness Evaluation
概念设计评估和技术储备评估

Independent verification and certification increases confidence. The customer' s specific concept/ technology is evaluated against accepted standards and state of the art engineering practice in order to reduce remaining risks.
独立验证和认证增加了信心。客户的独有的设计概念/技术，可根据公认的标准和最先进的工程实践来评估的，以减少风险。

Certification Services
认证服务

TÜV NORD covers all relevant certification services for floating offshore wind turbines.
TÜV NORD涵盖了漂浮式海上风机的所有相关认证服务。

- Design basis evaluation设计基础评估
- Integrated load analysis综合载荷分析
- Wind turbine RNA, tower and floating substructure design evaluation
  风机RNA、塔筒和浮式下部结构设计评估
- Cable and mooring line evaluation线缆和系泊线评估
- Manufacturing制造
- Transportation and installation surveillance运输和安装监控
- Commissioning surveillance调试监控
- Operation and maintenance surveillance运行和维护监控



TÜV NORD Competences
TÜV NORD的能力

TÜV NORD is the leading certification service provider for more than thirty years. In recent years, TÜV NORD has placed particular emphasis on the certification of offshore wind turbines.TÜV NORD is accredited by DAkkS for floating offshore wind turbines acc. to IEC (TS) 61400-3-2 and acc. to IECRE OD 501 and OD 502.
TÜV NORD是一家领先的认证服务提供商。近年来，TÜV NORD特别重视海上风机的认证。TÜV NORD获得了DAkkS对漂浮式海上风机的认证，符合IEC（TS）61400-3-2和IECRE OD 501和OD 502的要求。

Being part of the relevant committees for floating wind, TÜV NORD develops guidelines that define design and certification requirements for floating wind:
作为漂浮式风能相关委员会的一员，TÜV NORD制定了定义浮动风能设计和认证要求的准则。

- International standard on design requirements for floating wind: IEC 61400-3-2 in IEC TC88 MT3-2 and DKE/AK383.0.3
  作为IECRE TC88 MT3-2和DKE/AK383.0.3委员会参与的关于漂浮式风力设计要求的国际标准。
- IECRE Project Certification Scheme: IECRE OD 502 incl. sub documents
  IECRE项目认证方案：IECRE OD 502以及其子文件

Beyond developing guidelines, TÜV NORD is taking a leading role in research project FLOATECH as part of H2020 introduced by the EU-Commission: Optimization of floating wind turbines using innovative control techniques and fully coupled open source engineering tools.
除了制定指导方针，TÜV NORD还在研究项目FLOATECH中发挥了主导作用，该项目是欧盟委员会推出的H2020的一部分。使用创新的控制技术和完全耦合的开源工程工具可以优化漂浮式风机。

Information on IEC 61400-5
关于IEC 61400-5

IEC 61400-5 is the new technical IEC standard for rotor blades. It is indispensable for certifications acc. IECRE OD-501-1.
IEC 61400-5是关于叶片的最新IEC技术标准。它是根据IECRE OD-501-1标准来进行认证。

Similar to DNVGL-ST-0376, the guideline is based on a new strategy for safety factors. Uncertainties in effects of manufacturing tolerances, accuracy of analysis method or effects from aging or temperature are considered with corresponding safety factors.
与DNVGL-ST-0376标准类似，该指南规定了基于安全系数的新策略。制造公差的影响、分析方法的准确性、老化或温度的影响等不确定因素都会用采用各自相对应的安全系数.

Current Situation
目前现状

The valid version of IEC 61400-5 Ed.1 was published 31.05.2020.
IEC 61400-5 Ed.1的正式生效版本于2020年5月31日发布。

Based on current requirements from OD-501-1, IEC 61400-5 became mandatory for certifications according to IECRE OD-501 by the day of publishing.Clarification sheet CSH 028 specifies that the transition period starts when IEC 61400-5 Ed.2 is published.
基于OD-501-1的当前要求，IEC 61400-5在发布之日成为根据IECRE OD-501进行认证的强制性标准。澄清表CSH 028规定，过渡期从IEC 61400-5 Ed.2出版时开始。

What did not change:
没有变化的是：

- Existing IECRE-Component Certificates can be used for IECRE-Type Certifications until end of validity of Component Certificates
  现有的IECRE-组件证书可用于IECRE型式认证直到部件证书的有效期结束。
- Within a transition period of 12 months, Evaluation Reports and Conformity Statements in Revision 0 can be issued based on previous recognized standards
  在12个月的过渡期内，可以根据以前的认可标准发布第0版的评估报告和符合性声明。
- Within a transition period of 24 months, Evaluation Reports and Conformity Statements can be updated based on previous recognized standards.
  在24个月的过渡期内，评估报告和符合性声明可以根据以前的认可标准进行更新。
- After expiration of the above transition periods, modifications resulting in a revision of reports/conformity statements/certificates must be verified and evaluated according to IEC 61400-5 Ed.2
  在上述过渡期结束后，导致报告/符合性声明/证书修订的修改必须根据IEC 61400-5 Ed.2进行验证和评估。
- After expiration of the transitions periods, for re-certification IEC 61400-5
  在过渡期结束后，对于重新认证需要根据IEC 61400-5 Ed.2执行。

What does that mean for our customers?
这对我们的客户意味着什么？

The publishing date of IEC 61400-5 Ed.2 is not yet scheduled. Hence, the start date of the transition period and mandatory use of IEC 61400-5 Ed.2 is not yet determined. For certification acc. to IECRE OD-501 and IEC 61400-22, before and during the transition period of 24 months, IEC 61400-5 Ed.1 may be used as recognized technical standard, but is not mandatory. The validity of already existing Component Certificates or Design Evaluation Conformity Statements based on IEC 61400-5 Ed. 1 is not impaired.
IEC 61400-5 Ed.2的发布日期尚未确定。因此，过渡期和强制使用IEC 61400-5 Ed.2的开始日期还没有确定。对于根据IECRE OD-501和IEC 61400-22的认证，在24个月的过渡期之前和期间，IEC 61400-5 Ed.1可以作为公认的技术标准，但不是强制性的。基于IEC 61400-5 Ed.1的现有部件证书或设计评估符合性声明的有效性不受影响。

TÜV NORD Service
北德服务

Usage of IEC 61400-5 Ed. 1 may still have advantages against other recognized standards. TÜV NORD is accredited for IEC 61400-5 by DAkkS and is your partner for certification.
使用IEC 61400-5 Ed.1仍然具有与其他公认标准相比的优势。TÜV NORD已获得DAkkS对IEC 61400-5的认可，是您在认证服务中可以信赖的合作伙伴。

Evaluation of generic strategy paper for quantification
对通用战略文件进行量化评估

If requested we can provide an offer for the evaluation of a generic strategy paper for quantifications.
如果有要求，我们可以提供一份评估通用战略文件的报价，以便进行量化。

- safety factors intended to be applied
  拟采用的安全系数
- tolerances attended to be specified
  需要规定的公差
- scope of analysis intended to be provided and details for analysis methods
  准备提供的分析范围和分析方法的细节

and/or
和/或

- tests intended to be provided and test specifications
  拟提供的测试和测试规范

Introduction of Grid Code Compliant
"符合电网规范"概况

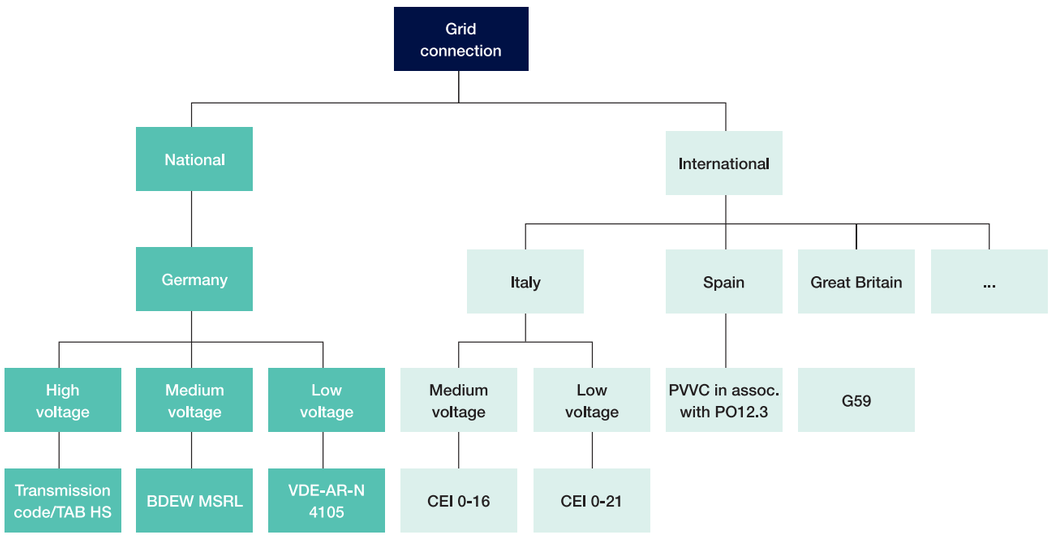
Tested grid code compliance for the national grid connection regulations (e.g. BDEW, VDE and CEI)
符合国家电网连接法规（例如:德国能源与水工业协会（BDEW）、德国电气工程师协会（VDE）和意大利电工技术委员会（CEI）的规定）的电网合规性测试

Target groups
目标群体

When connecting renewable-energy generation systems to a low-, medium- or high-voltage grid, evidence of electrical characteristics has to be provided. The evidence can or must be provided by means of certification, depending on the voltage level. In the first step, this certification covers the generation unit (a photovoltaic inverter, a thermal power station or an internal combustion engine),and the following step covers the generation plant itself (a photo- voltaic park or wind farm). This means that “Grid Code Compliant” certification is directed towards generation unit manufacturers and their sales operations (unit certification) and also to investors, planners, erectors and installers of generation plants (system certification).

当可再生能源发电系统连接到低压、中压或高压电网时，必须提供电气特性的证明。根据电压等级，可以或必须通过认证提供证据。第一步，该认证涵盖发电设备（光伏逆变器、热电厂或内燃机），下一步则涵盖发电站本身（光伏园区或风电场）。这意味着“符合电网规范”认证面向发电设备制造商及其销售业务（设备认证），同时也面向发电站的投资者、规划者、建造者和安装者（系统认证）。

Certification – national and/or international?
认证——国家性的还是国际性的?



When is which certification required?
什么时候需要哪种认证?

(Example: Connection to the medium-voltage grid in Germany)
（例如：连接至德国中压电网）

Which requirements are examined?
哪些要求会被检验?

The requirements for generation units and plants are based on grid behaviour during normal operation, cases of grid disturbance and also on system services. The requirements are as follows:
发电设备和发电站的要求基于正常运行期间的电网行为、电网干扰情况以及系统服务。要求如下：

- Behaviour during normal grid operation
  正常电网运行期间的行为表现
  - maximum active power
    最大有功功率
  - active power increase
    有功功率增长
  - maximum active and reactive power diagram
    最大有功和无功功率图
  - network interactions (harmonics, flicker)
    网络相互作用（谐波、闪变）
- Behaviour in cases of grid disturbance
  电网干扰情况下的行为
  - reduction of active power through frequency increase
    通过增加频率来减少有功功率
  - monitoring of grid voltage, frequency and reactive power consumption
    监测电网电压、频率和无功功率消耗
  - voltage dips in the grid (low voltage ride through; LVRT)
    电网中的电压暂降（低电压穿越；LVRT）
- System services for safe system operation
  为安全系统运行提供的系统服务
  - set values for active and reactive power
    有功功率和无功功率的设定值
  - voltage or active power dependent on reactive power
    取决于无功功率的电压或有功功率

In the case of plants, the requirements regarding the concept have been extended. These additional requirements are, for example:
对于发电站而言，有关概念的要求已得到扩展。这些额外要求有如下：

- Dimensioning of the operating equipment within the plant (switch gear, transformers – possibly including tap changer, cables)
  发电站内运行设备的尺寸确定（开关设备、变压器——可能包括有载分接开关、电缆）
- Protection concept in cases of faults in the grid or in the plant
  在电网或发电站发生故障时的保护概念
- Parametering of generation units, including of the certified software versions
  发电设备参数化，包含已认证的软件版本参数化
- Fulfilment of the conditions from the unit certification
  设备认证中条件的履行
- Plant regulation and control concept (park control)
  发电站调控概念（园区控制）

Introduction of Grid Code Compliant
"符合电网规范"概况

Certification procedure
认证程序

Power generation units

Offer phase

Creation of a product family
- structure and construction (hardware)
- control engineering (software)
- power range of product family
- selection of the device under test and target country

Order phase

Measurement
- procurement of an accredited laboratory
- initial discussion of the measurement
- performance of the measurement
- issuing of a measuring report

Conformity assessment of the hardware
- evaluation of the measuring results
- review of manufacturers' declarations
- issuing of a test report

Model validation
- simulation of relevant functions
- comparison of measurement and simulation
- examination of plausibility and usability
- issuing of a validation report

Certification of the product family
- monitoring of production
- listing on the Internet
- 5 years' validity

Power generation systems

Offer phase

Data of the generation plant
- location and date of entry into operation
- schematic structure of the plant
- grid operators and grid data

Order phase

Calculation
- dimensioning of the plant
- examination of concept (park control)

Simulation
- reproduction of the plant (e.g. with DIgSILENT)
- power flow calculation
- short circuit current calculation
- static and dynamic behaviour

Conformity assessment
- evaluation of behaviour when connected to the grid
- evaluation of the calculation and simulation results
- issuing of a test report

Certification of the plant
- planning certificate
- valid for six months

Declaration of Conformity
- inspection of the plant
- review of the commissioning protocols

At what time must the certificates be submitted to the grid operator?
证书在什么时候必须交给电网运营商?

In case of connection to the medium-voltage grid, the time from which the generation plants have to obey the requirements according to the amendment to the BDEW Medium Voltage Guideline depends on the primary source of energy. On this basis, there is already an obligation on all generation plants to fulfill the requirements. However, proof of fulfillment can be provided in arrears by means of a plant certificate, for example for thermal power station plants, by the end of 2014. As the unit certification precedes the plant certification, units have to be certified beforehand. This means that the deadline for unit certification is brought forward by the amount of time needed for undertaking the plant certification.

如果连接到中压电网，根据德国能源与水工业协会（BDEW）中压指南修订版，发电站必须遵守要求的时间取决于主要能源类型。在此基础上，所有发电站都已经有义务满足这些要求。然而，截至到2014年底前，可以通过电站证书的方式延期提供满足要求的证明，例如对于火力发电站。由于设备认证先于电站认证，因此设备必须事先进行认证。这意味着设备认证的截止日期会因进行电站认证所需的时间而提前。

What are the benefits of certification?
认证有哪些好处?

- Competitive advantage
  竞争优势
- Fulfillment of national market regulations
  满足国家市场法规
- Permission to connect to the grid
  获得连接到电网的许可
- Independent, neutral inspection
  独立、中立的检查
- Right to use the TÜV NORD CERT "Grid Code Compliant" test mark in association with the unit and component certification
  有权在设备和组件认证中使用"TÜV NORD CERT '符合电网规范' "测试标志。

Why TÜV NORD CERT?
为什么选择 TÜV NORD CERT?

- Accredited since 2009 for generation units, plants and components by the official German accreditation body (DAkkS) for – among others – Germany (BDEW MSRL; VDE-AR-N 4105; TransmissionCode), Italy (CEI 0-16; 0-21), Spain (PO 12.3; PVVC), Great Britain (G 59)
  自2009年以来，获得德国官方认证机构（DAkkS）对发电设备、发电站和组件的认证授权，认证范围包括德国（BDEW MSRL；VDE-AR-N 4105；输电网准则）、意大利（CEI 0-16；0-21）、西班牙（PO 12.3；PVVC）、英国（G 59）等国家和地区。
- Officially recognised by the Fördergesellschaft Windenergie und andere Erneuerbare Energien – FGW e.V. (German society for the promotion of wind energy and other renewable energies)
  得到德国风能及其他可再生能源促进协会（FGW e.V.）的官方认可
- More than one hundred unit and plant certifications already completed
  已经完成了一百多项设备和发电站认证
- Participation in expert sector committees such as VDE|FNN, VDE|DKE and FGW
  参与VDE|FNN、VDE|DKE和FGW等专业部门委员会
- Strong international network in the grid connection industry, consisting of measuring institutes, model developers and research institutions
  在电网连接行业拥有强大的国际网络，包括测量机构、模型开发人员和研究机构
- Organization of professional events and forums, e.g. the Thermal Power Plants (BHKW) Forum
  组织专业活动和论坛，如热电厂（BHKW）论坛

Making use of synergies
利用协同效应

- Recognition of measuring results for certification according to further national grid connection standards and regulations
  根据进一步的国家电网接入标准和规定，为认证认可的测量结果。
- Recognition of factory monitoring in the context of further certifications by TÜV NORD CERT
  在 TÜV NORD CERT 的进一步认证中认可工厂监控
- One-stop shop: certification according to European Community Directives (Low-voltage, EMC and Machinery Directive), quality, environmental and energy management in accordance with the ISO Standards and unctional Safety Standards, particularly fault tolerance of protective equipment
  一站式服务：根据欧盟指令（低电压指令、电磁兼容性指令和机械指令）的认证，依据 ISO 标准的质量、环境和能源管理以及功能安全标准认证，特别是保护设备的容错性认证
- Useful contact who can recommend suitable project partners for the measurement and development of simulation models
  推荐仿真模型开发和测量领域合适的项目合作伙伴的有用联系人