Planning and development of wind farms - an overview

A wind energy project can be roughly divided into three phases:

* the planning,
* the construction and
* the operation of wind turbines.

At each stage there is to consider the following three aspects:

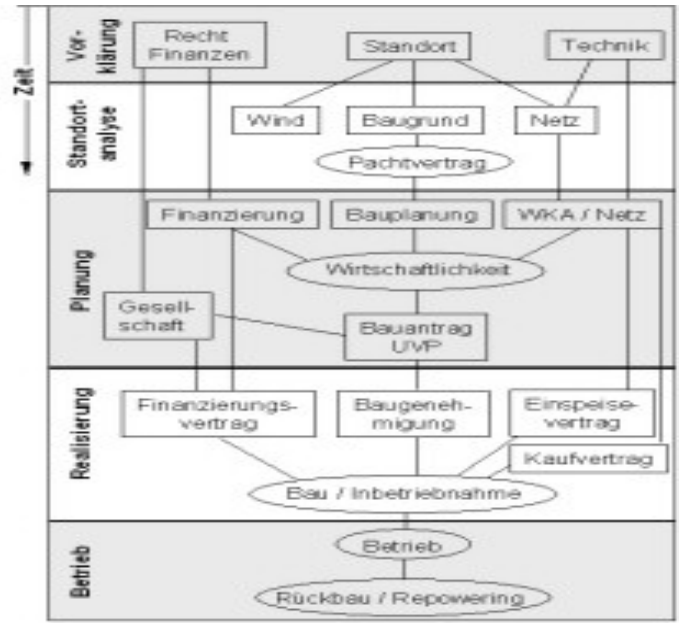
* technical aspects,
* licensing and legal aspects
* economic aspects.

Planning a wind farm

Figure ١ shows schematically the timing of the planning process to implementation of the project and the operation and dismantling of the facilities. The planning phase is divided into sections:

* the primary treatment,
* the site analysis and
* the actual planning

Figure ١: Flow diagram of a wind power



Project

As part of primary treatment, the basic feasibility of the project will be tested at the chosen location before proceeding with further formal and cost-prone steps of site analysis and planning.
First Technical aspects of planning
Assessment of wind conditions

Particular importance when selecting the site of assessment and evaluation of the wind conditions. Because ١٠% less than expected wind speed mean a reduced yield of about ٢٠%, which can quickly lead to economic problems. A first step towards the wind forecast is next to be determined from the evaluation of the general meteorological data wind speed values to examine the topography of the selected location, ie the site structure, and the nature and size Bodenrauigkeiten the boundaries of the site. Furthermore, some obstacles, such as tree lines, exist buildings or wind turbines to register accurately. Even here, the attraction of an experienced professional counselor is required by the then should the rest of the

procedure and methodology for accurate determination of the wind energy potential are determined. For the measurement, simulation of the wind conditions of a site, and evaluating different methods are common. Depending on local conditions, but also by the quality of any regionally available wind data, eg from monitoring stations will then decide which methods should be used and how long its own wind measurements are required to assess the site conditions are safe.

First estimate of installed capacity and energy yield
Decisive factors in the question of how many plants will come at which rated power is used, the available area and especially the access network.

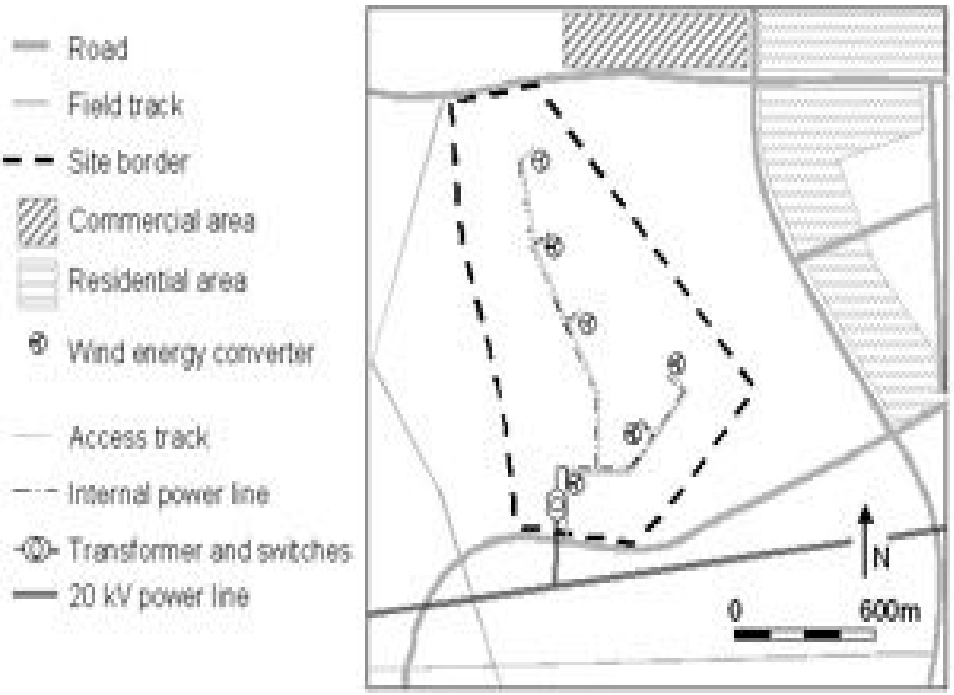
It should advance through a request to the local network operators the possible link performance, the distance to the next possible entry point and the voltage level will be clarified for the network connection. For larger wind farm power (> ٢٠ MW), it may be advisable or even necessary, to build its own substation. From these two conditions (available area and network capacity) number and rated output of eligible wind turbines can be estimated. This is the basis for the first earnings forecast
The expected yield is determined by sector with the result obtained for each wind direction sector frequency distribution function of wind speed and the performance characteristics of the proposed wind turbines. This is necessary in order for the installation of equipment at the wind farm to find in terms of total energy yield optimal arrangement of the plants and the inevitable interactions with each other (mutual Windabschattung) to minimize. This happens when wind farm layout (see Figure ٢).

Design of wind farm layouts

the primary criterion for the optimal arrangement of wind turbines at the proposed site is of course to achieve the highest possible energy yield of wind farms over the entire operating period. But the installation requirements and costs as for wiring of the transformer and equipment to transfer stations and the closure Weger for installation, maintenance and service vehicles have an impact on the system configuration. Meanwhile, there are good planning tools, such as Software as WinPro, wind farmers, among others, the wind farm to be optimized designs efficiently and quickly.

Further restrictions on the wind farm layout, e.g. by prescribed distances from cultivations, environmental regulations or specified maximum height, not only from technical considerations but also by laws and regulations of public agencies. It is convenient to gather information in advance about such limitations before making regulations under the approval process, time-consuming and costly changes to the planning required.

Figure ٢: Wind farm layout with planned infrastructure [١]



Local conditions

the ownership of the relevant land parcels are to be clarified and leases with the landowners, or at least pre-contracts to complete. The investigation of local conditions is done primarily to ensure the practical implementation of the project. It should be noted for this

whether the plants can be built stable,
the site with all necessary equipment is available and
the extent to which transmission lines for power supply are required.

Furthermore, for the entire lifetime of access to all facilities for servicing, maintenance and repair must be guaranteed.

For each wind turbine own soil survey is needed to clarify the minimum carrying capacity of the ground for the foundation. Hence the foundation designs. Foundations are usually flat or soft pile foundations in soils.

The access roads and transport facilities for the preparation and the space on site for the crane installation must be examined. The delivery of major plant components, such as tower sections and rotor blades impede the construction site may cultivations (for example, historic buildings), under bridges, power lines, traffic signs, railway lines, antennas, curvy roads with avenue trees, water, etc. In addition, climatic

conditions, such as temporary to note heavy rain and storms.

The location and type (eg, the voltage level) of network access to be determined. In the simple case of a short branch line from the wind farm will be built to supply point. If necessary, the power line will also be placed directly next to the substation. There is either appropriate or available network capacity; it is added to a separate cell in the substation. Very large projects often require a separate substation so that the wind farm will feed into higher voltage levels. The path lengths and the nature of the cable route shall be assessed with technical and economic considerations. For long cable runs may be a more complex design with its own environmental impact assessment (see below) is required

٢- Legal aspects of consent

In considering approval of the legal admissibility of a wind farm or a single wind turbine, the relevant building regulations shall prevail.

Moreover, in most countries during the planning phase to consider the environmental impacts of the plant. This is usually done as part of an Environmental Impact Assessment (EIA).

Ecological impacts of wind turbines

it will determine whether the environmental disturbance can be tolerated by the construction and operation of wind turbines in terms of nature conservation. The animal and plant health will be checked if necessary by further reports, as to protect the nesting, roosting and resting places by birds.

The competent authority shall examine are to be expected taking into account the statutory criteria have significant adverse environmental impacts. Is there a requirement for environmental impact assessment, then the mapping of habitats, plants and animal species, eg breeding, resting and migrating birds and bats, and the assessment of the significant landscape elements?

Among the evidence on the impact of wind turbines on human health and the environment avifaunistic mapping,

- other aspects of animal and plant protection,
- Schallimmissionsgutachten,
- Shadow reports and
- Aspects of conservation and landscape.

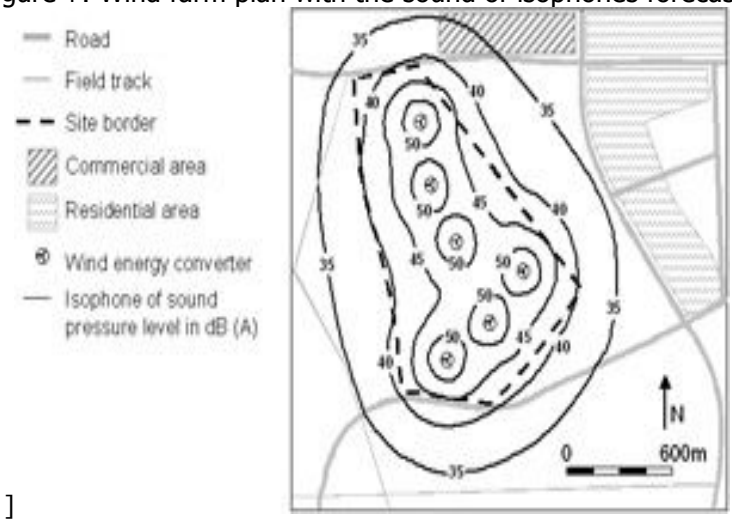
Noise emissions from wind turbines

Legal requirements for noise emissions requirements with the permissible sound levels exist depending on the area (residential, industrial, village area, etc.) and time of day. The acoustic emission measurements on wind turbines in the type test, usually after IEC ٦١٤٠٠-١١, results for each type of system the sound power level as well as any supplements to tonality (eg dominant individual tones) and impulsive (rather low, rhythmic pulses). These features

are perceived by people as being particularly noticeable and unpleasant and come as from the gearbox, generator or inverter. From the results of the type-related sound emission measurements of a system can then predict the noise emissions at the site.

The sound radiation of a wind turbine is not constant but strongly depends on the instantaneous power and thus the wind speed. It is estimated roughly at about ١ dB (A) levels increase with increasing wind speed of ١m / s However, increasing the wind noise e.g. in trees and bushes so that they are usually louder than the engine noise. The sound radiation is still dependent on the direction of what is in the measurements of the independent testing laboratories and also taken into account in planning the programs.

Figure ٢: Wind farm plan with the sound of isophones forecast



[١]

Should that occur, the sound power levels of the affected residents are in doubt, a re-measurement by the Labour Inspectorate is required. Granted, this regulation, for example at night at certain wind direction, so there are systems with variable speed pitch control if necessary, the possibility of a sound-reduced flow noise at low speed operation, and thus reduced. In stable systems with fixed speed and pitch without these technical possibilities are not given. In an emergency threatening the operator a so-called overnight shutdown, resulting in longer periods in significant yield losses. On a cautious sound immission with generous safety margins, therefore special attention must be paid.

Shadow of wind turbines

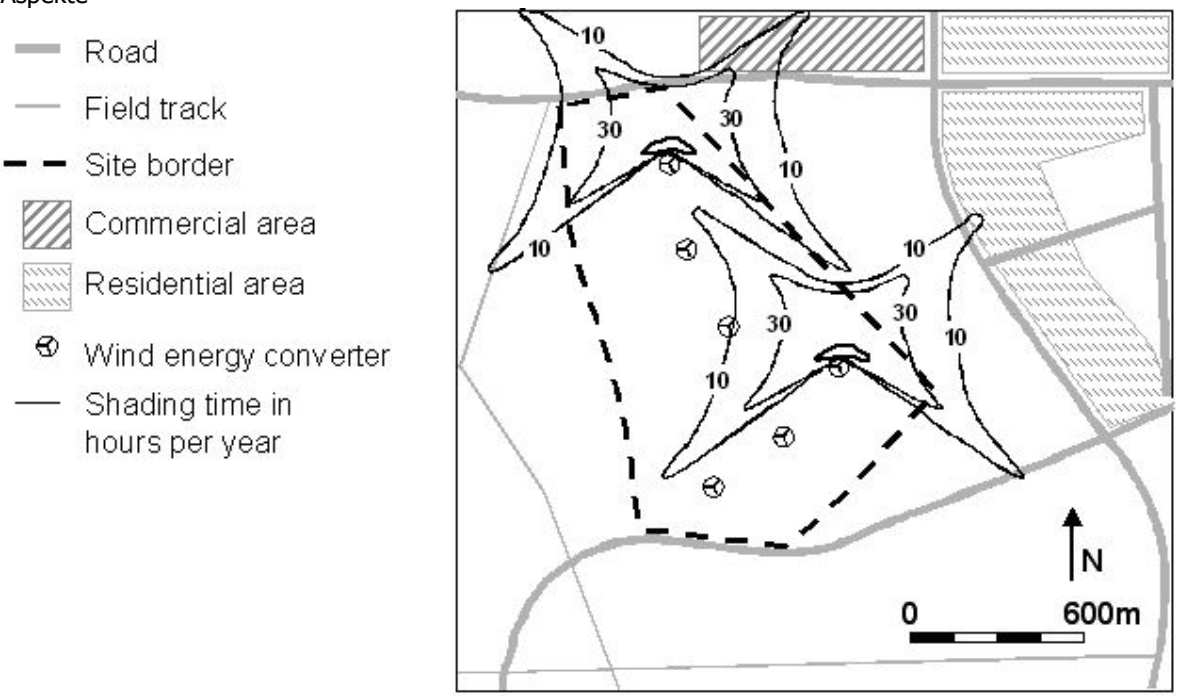
another relevant aspect is licensing the possible occurrence of periodically varying shadow that creates the rotating rotor in sunlight and can be uncomfortable. This point is predicted by calculations in the plan as a "worst case", ie without consideration of atmospheric haze and clouds. The calculations are based on the location-path of the sun orbits, the hub height and rotor diameter of the plants.

Figure ٤ shows an example of such a forecast for two wind turbines of a wind farm. The limit is defined by the legislature a few hours a year. To keep him in difficult locations, the wind turbine will be equipped with a special sensor, which leads to an automatic shutdown if the coincidence of the critical operating conditions is detected. These are ongoing investment in relevant wind direction and speed, clear skies and some sun.

Figure ٤: Wind farm plan with contours of the shadow duration in hours per year [١]

٢. Wirtschaftliche

Aspekte



For the realization of a wind farm is the cost of crucial importance. Is this not the case, the project is not worthwhile and should not therefore be implemented first. It should be noted that over the operating life of approximately ٢٠ years, various cost items such as the real income thereon and any necessary repairs are associated with forecast uncertainties. For the economy on the one hand, the investment costs, which depend mainly on the cost of wind turbines themselves and the relevant operational costs. On the other hand, the income to pay for the electricity fed into the grid is decisive. Here, a possible long-term carriage agreement (PPA: power purchase agreement) will be completed with fixed prices. Only with adequate duration of the electricity input (usually a minimum of ١٠ years) and the prevailing legal certainty, the financial viability of the project given. In evaluating the economic efficiency must already be calculated appropriately in the planning costs for ongoing operations (maintenance, repair, insurance, etc.) as well as provisions for the decommissioning of the wind turbines. Otherwise, neither is likely to convince investors and banks from the financing of the project can still operate the wind farm to provide economically secure. Is planning a wind energy project, however, is done with positive results in all its stages, the implementation and subsequent operation can begin.

Further links (listed by WWEA)

Wind Power Planning

Distance Education Course at Gotland University, Sweden [download here]
"Developing Wind Power Projects" (٢٠٠٦), new book of gates Wizelius Gotland University, Sweden
http://shop.earthscan.co.uk/ProductDetails/mcs/productID/٧٣٤
Gasch, Robert / Twele, Jochen: Wind Turbines: Fundamentals, Design, Construction and Operation, ٤ Edition, New York: Teubner ٢٠٠٥
http://www.teubner.de/index.php; do = show / sid = ٧٢٩٣٦٠٨٩٤٥٠٩٤a٢٨٥b٦٦a٥٠٢١٤٢٨٣٩/site = t / = ١٧٣٨ book_id

[١] Source: Shortened version of chapter planning, operation and efficiency of wind turbines from:

Gasch / Twele (Ed.): Wind Turbines - Fundamentals and Design, Construction and Operation, Springer-Verlag, ٢٠٠٥

Text:
Prof. Dr.-Ing. Jochen Twele, FHTW
Dr.-Ing. Christoph Heilmann, German Wind Guard Dynamics Ltd.
Dipl.-Ing. Jan Liersch, German Wind Guard www.windguard.deKosten Dynamics GmbH, of wind turbines

In Germany in renewable energy sources and to identify specifically in the field of wind energy is a positive development. Due to very favorable conditions and state subsidies and development aid, the technological development of wind turbines in the ٩٠ years has been greatly accelerated. Details concerning the construction, the cost and maintenance of wind turbines they receive from us.

Cost of a wind turbine

The price of wind turbines and thus for the production of wind power in recent years has sunk. This fact is attributed to the production of larger quantities, as well as improved and more efficient production systems engineering. The price for the construction of a wound power plant, including installation and setup, is calculated from the installed power per kilowatt. Early ٩٠s, the price of a kilowatt still at ١٢٦٠ €. By ٢٠٠٤ this price fell by almost a third to € ٨٩٠ per kilowatt. A plant with one megawatt of installed capacity will cost € ٨٩٠ ٠٠٠ therefore.

Meanwhile, prices for the construction of a wind turbine has fallen even further. Meanwhile, the cost of construction, including installation and acceptance, between ٦٠٠ and ٨٧٠ euros per kilowatt of installed capacity. However, this applies only to investments in the order of ١٠٠ to ١,٠٠٠ kilowatts. For larger installations, the prices are currently € ٧٧٠-١٠٣٠ per kilowatt.
Construction of a wind turbine

First of all, is required for the construction of a wind turbine a building permit. To obtain this, the client must send a corridor card statement with detailed description

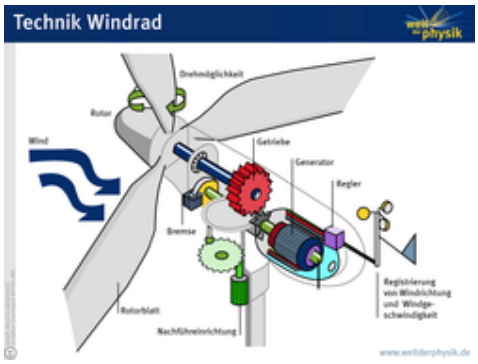
of the location of the relevant building authorities. The building is subject to the guidelines states, must be adhered to which certain minimum distances from neighboring properties. Depending on the landscape of different types of systems are approved differently. The approval guidelines vary from state to state here, but can be requested from your relevant building authorities. Depending on the settlement of the area in which to develop the wind turbine, the creation of a noise report may be required.

Maintenance of wind turbines

Regular maintenance and inspection of a wind turbine is designed for efficiency and safety of these essential. In more extreme locations, e.g. on the open sea, should be shortened maintenance intervals, approximately every six months here, the inspection will be performed. Otherwise, a maintenance interval of ٢ years should be regarded as reasonable.

For the maintenance of a plant to produce energy with wind should be listed following points should be checked:

- Control of all components including the tower
- Inspect for anomalies such as corrosion, mildew and the like
- Control torque of the screws
- Leak and functional testing
- Monitoring of oil levels and refill this
- Replacement of all filters
- Verification of the laser alignment
- Review of the entire drive train
- Cleaning and adjustment of brakes



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- Gasch, Robert / Twele, Jochen: Wind Turbines: Fundamentals, Design, Construction and Operation, ٤ Edition, New York: Teubner ٢٠٠٥

http://www.teubner.de/index.php; do = show / sid = ٧٢٩٣٦٠٨٩٤٥٠٩٤a٢٨٥b٦٦a٥٠٢١٤٢٨٢٩/site = t / = ١٧٢٨ book_id

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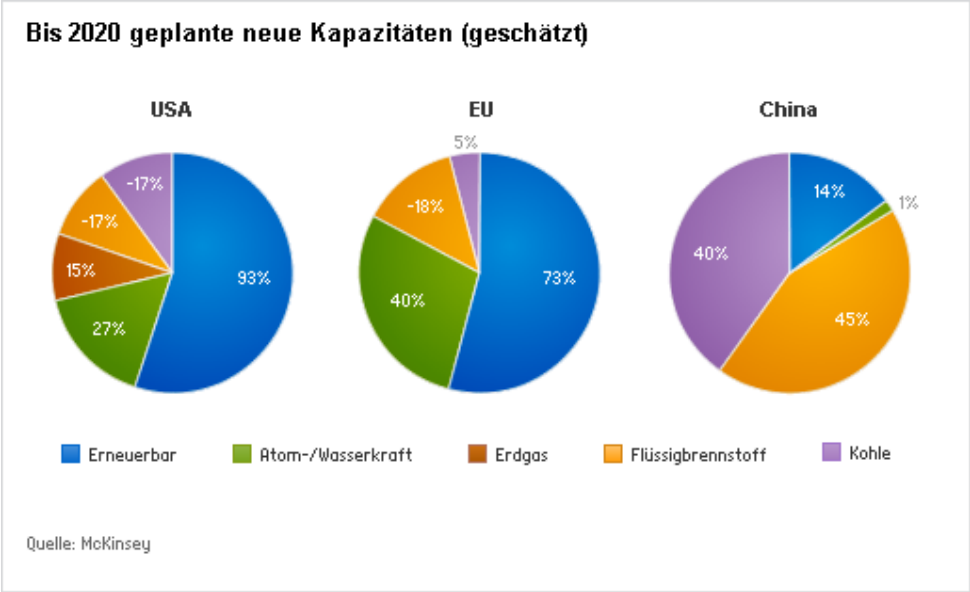

And here are paying for the share of electricity production from wind energy in Germany.

In hier sind ٢ internet seiten die du einige bilder von windkraftanlagen noch here internet ٢ pages you paste it some pictures of wind turbines have to research this and also pictures of the steel structure for the foundations of the systemzu diese forschung paste it and also pictures of the steel structure for the foundations of the systems.

١st www.wind-energie.de
٢nd www.spurio-eisenflechterei.de

versuchmal please translate the whole thing and sign up with me yet.

Thank you

Hawzhen