



Wind power and desert?!

It is a risk and challenge not only for the material but also for man and machine likewise.

In particular during the past century the generation of power from regenerative energy sources has increased steadily. This development was not at least driven by the concept of the energy revolution recently established in Germany with the phased ending of nuclear energy and the withdrawal from coal power at the same time. This process taking place worldwide more or less quickly, which has a long tradition of a social and political shift of thinking, has the markets, which have already grown for years, spurred once again. At this, in particular the generation of wind energy as an emission-free and increasingly cost-effective alternative for the power supply can be seen as significant, whereas the targeted work in research and development in the material, machine and raw material technology has clearly left its mark. Apart from the increasing size and associated with this clearly increased efficiency and effectiveness of the plants currently under construction, the increased availability and financial feasibility is of importance. Not only by this it became possible that in countries difficult to access, in terms of geography as well as economy, numerous projects have been initiated all over the world, in order to make wind energy usable as alternative source of energy.

In view of this, the following project has to be seen, which has started last year as the largest - until today - wind farm in Chile under the name of San Juan. After the completion planned for 2017, on the 3,000 hectare site belonging to the Chilean energy supplier Latin America Power (LAP) 184.8 MW shall be generated with 56 wind turbines from the Danish company Vestas. This energy generated with wind shall then reach the connection point in Punta Colorada via a 86 km long 220 kV power line and a connection to the local power grid shall already take place in September 2016.

The peculiarity of this project is not only the fact that the wind farm, costing USD 430 million in total, which could only be pre-financed to one third by the LAP, was built in one of the emerging markets of the South American continent but in particular its location: the site, on which the wind park shall be built is in the middle of one of the driest deserts in the world- the Atacama Desert. It is in the rain shadow of the Andes



and spreads out over a distance of almost 1,200 km in the North of Chile so that in some regions not one single drop of rain has fallen since the beginning of the recording. In addition, there are extreme temperature differences, which can range on average from 30°C during the day to -15°C during the night. The wind farm itself is in the coastal region of Chañaral de Aceituno, which is approximately 60 km south of the city Puerto las Huasco.





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The quite difficult local conditions pose not only stringent requirements for the actors and the necessary installation technology. More challenging are the climatic conditions for the material used for the installation of the wind tower foundations. The **V1/60 HF PAGEL** super high strength grout, which has been intended for the horizontal grouting between the wind tower and the foundation, can easily be processed in a temperature range between +5°C and +35°C. During the construction time, however, the record peak values reached up to +45°C with a corresponding heating of the material and the mixing water. In addition, the geographic location involves by definition another problem: the access to fresh water, which is not only intended for the mixing of the grouting mortar but also for the pre-watering of the foundation is proving to be extremely difficult as water is only available by tankers from the nearest town, that has water in drinking water quality. Of course, no drop must be wasted, therefore it would be ideal to re-use the water used for the pre-watering as well, even if this might be contaminated, due to the process, with dust and sand from the desert. Above and beyond, finally the very low water-solid substance-value of the **V1/60 HF PAGEL** super high strength grout is worth mentioning (1.8 litres for each 20 kg bag of dry material). This is on the one hand counteracting, to a low degree, to the extent of the water shortage, however on the other hand, it is highly problematic in view of the high temperatures as well as the influence of wind and insolation and requires an adequate curing.



The only possibility to address these impassabilities with a functioning solution, was to perform the horizontal grouting between the tower and the foundation only at night, as only then, the temperatures fell to an acceptable level at 20°C. Nonetheless, the material and the mixing water - heated up by the high temperatures during the day - had to be cooled down by means of cooling containers, so that it became possible to grout up to three towers on average each day. All in all, it was the curing with a duration of at least three days, which has posed special problems to the processing team as the in any event quickly rising temperatures at dawn would additionally be increased by the negative effects of the strong wind and the direct insolation. As a result, the curing had to be performed with extreme care to enable a controlled hardening process, which was in the end indispensable for the success of the project.



All in all, the project was very successful despite the more than difficult conditions at the location. In only four weeks, a total of 190.000 kg **V1/60 HF PAGEL** super high strength grout were processed and the processing as well as the curing could be carried out without greater difficulties. Moreover, this project shows that even in adverse conditions, not only of geographical but also economic nature, next generation projects, beneficial for the energy politics for a cleaner environment, can be planned, carried out and completed successfully.

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