



TURBINE RETROFIT

MULTI BRAND RETROFIT



A photograph of a worker in a white hard hat and dark jacket, viewed from the side, working on a control panel. The panel has several black cables connected to it. The worker is wearing a white hard hat with a red chin strap and a dark jacket with white stitching. The background is a plain, light-colored wall.

GLOBAL RETROFIT SPECIALISTS

FIRST-MOVERS & global LEADERS in turbine retrofit technology.

Based on decades of know-how, DEIF Wind Power Technology is specialised in turbine upgrade and retrofit.

We operate as retrofit project partners to upgrade performance of turbines and entire wind parks. We take responsibility to evaluate owners' assets, and deliver the best solution; supporting from business plan development to customising the retrofit solution for optimised performance.

Our retrofit solutions are based on innovative control technology - installed in more than 5.000 turbines so far. DEIF Wind Power Technology covers more than 15% of the Chinese market – and retrofitted the first wind park in 2007.



EUROPE'S LARGEST ONSHORE WIND PARK*



* See www.deifwindpower.com

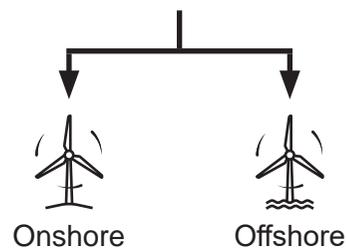
WIND POWER

ROBUST SOLUTIONS AND KNOWLEDGE SHARING ARE HALLMARKS OF DEIF WIND POWER.

As a renowned technology partner and supplier of robust components for turbine pitch and control, DEIF Wind Power designs and manufactures complete control systems for both new and existing wind turbines of any size.

Building on years of experience, DEIF's performance-optimising solutions include wind turbine operation, modeling, control strategies, grid compliance, and pitch and park control systems. Controlling wind park power production accurately and quickly, they will help you produce more green power at the lowest possible cost.

INDUSTRIES



MULTI BRAND RETROFIT

Retrofit solutions for:

GAMESA G47 / G52

VESTAS V47 / V52

REPOWER MD 77

SENVION MM82 / MM92

VESTAS V80 / V90

SUZLON S64 / S88

NORDEX N80 / N90







Pain

- ▶ Access to original OEM spare parts are limited and expensive
- ▶ Low tariffs which lead to reduced income
- ▶ Need for life-time extension
- ▶ Expensive spare parts from the OEM
- ▶ Low efficiency of turbine performance
- ▶ Closed SCADA and asset management interface

MAXIMISE AVAILABILITY

As an operator and owner of turbines, you are likely to possess the best and unique knowledge of how your turbines operate, including how they could be improved and optimised. Aiming to ensure optimum operation under all

conditions, we master the control of the turbine, and remain dedicated to help owners and service companies address features deemed impossible by the OEM. Utilising our well-proven control software, we can implement site-specific

Solution

- ▶ Solutions developed as 1:1 replacements either directly or using prepared mounting kits.
- ▶ 5 year standard and up to 10 year extended warranty.
- ▶ Technology upgrade ability
- ▶ Direct cost savings on own "OEM" spare parts supply and new warranty
- ▶ Closing 10-15 years of knowledge in control software
- ▶ Access to a full open turbine information mapping

Gain

- ▶ Higher availability and efficiency
- ▶ Higher AEP and revenue
- ▶ Lower O&M cost
- ▶ Extended turbine life-time
- ▶ New management system (SCADA) interface
- ▶ Automatic reset of alarms
- ▶ Full control of turbine parameters
- ▶ New intelligent power and speed control
- ▶ Derating strategies to avoid stops
- ▶ State-of-the-art turbine control software
- ▶ Maximum payback time < 3 year on investments

parameter and running condition adaptations into the turbine or park operation strategy.

Address the pains, achieve the gains.

RETROFITTING

WITH A CLEAR GOAL FOR YOUR BUSINESS CASE

Retrofitting turbines is a process to build enough knowledge about the running condition of the individual turbine. The DEIF process ensures a solid foundation on which we can build the business case to support the investment.



1. Preperation

- ▶ 1 year SCADA data
- ▶ Measurement campaign
- ▶ Customer input
- ▶ Requirement specification
- ▶ Order agreement

2. Development

- ▶ Solution Design
- ▶ Design diagram, Controller hardware configuration
- ▶ Controller software development
- ▶ Solutions documentation, Solutions test and verification
- ▶ FAT



PARTNER APPROACH

DEIF is your partner in this path where we prepare, develop, implement, verify and support a new retrofit solution on any turbine from beginning to successful implementation.

Please contact us for more information about our measurement approach and what this can do for your decision and comfort in terms of selecting the right retrofit partner.

3. Implementation

- ▶ Commissioning
- ▶ Site installation
- ▶ Safety and Control testing
- ▶ Onsite training
- ▶ SAT

4. Verification

- ▶ Measurement campaign
- ▶ Measurement comparison and approval
- ▶ Load Validations

5. Support

- ▶ 1 year remote support to ensure full compliance with your expectations

Scope of supply and services

Retrofit for immediate profit

Scope of supply and services

DEIF offers an electrical retrofit solution, based on existing sensors, cables and motor built in the existing switchboard of the turbine nacelle and tower. The turbine will operate as originally designed but for many more years, after the upgrade. We reuse as much of the original equipment as possible to ensure a minimum investment but positive for ROI.

Retrofit packages

1. Replacing the complete panels with new designed and manufactured with up to date standards.
2. Renewing existing cabinets with new control system, small breakers, fuses, cables etc.
3. Retrofitting onsite, only controller and necessary sensors, power supplies etc.

The retrofit solution is designed for easy rebuild, without major modification, so it can be completed and tested down to 3 – 4 hours and return in full operation. In corporation with the customer, DEIF's engineers help to install the entire retrofit kit and to complete all modification on selected test turbine.

Modern Turbine Control

Control strategy

DEIF's control strategy builds on technology applied for thousands of MW turbines which is full model based control strategy with advanced control algorithms. Today's fast data processing in new controllers is a standard with faster control loops and faster responses to changes. Overall, it is a smoother control that ensures less loads at same performance.

Control software application

Accumulated knowledge on optimum turbine technology, operation and control that have been developed over the past 10 – 15 is applied for installation of new turbines. These control functions include derating functions, advanced temperature controls etc. that ensures a higher availability and produce more power when wind is available.

Retrofit MD 77 for increased AEP

Control system solution for extending lifetime



“The lifetime of old, robust turbines often exceeds 20 years, enabling owners to increase profits while continuing to produce green electricity”.

Christian Nielsen

Managing Director
DEIF Wind Power Technology



Xiangshui Wind Park, China was only five years old, when the 134 turbines' control systems were out-dated and some even defect. In a tender process, DEIF Wind Power Technology was selected as technology partner to deliver a new control system solution for the 134 1.5 MW Dongfang turbines. The total capacity is 201 MW and is expected to increase AEP by up to 4 %.

The original turbine is very solid model and produced by Dongfang's steam turbine MD 77 licensed by the German turbine manufacturer RePower. The entire wind park is upgraded with DEIF control system technology. Today it is the most modern and optimized wind park in the world.

By replacing this pitch controller the turbines fault handling is optimised by a close communication with the new main controller.

Key benefits:

- ▶ Increased AEP by up to 4 %
- ▶ Life-time extension
- ▶ Complete retrofit solution
- ▶ Full support and training

The Package

Complete retrofit solution



The core in our retrofit solution is the Advanced Wind Turbine Controller, AWC 500, which is a dedicated wind turbine controller – tailor-made for the environment in wind turbines. Older wind turbines are typically not equipped with advanced temperature control which create a high demand for a new controller platform. Here we are fully compatible with -40 - +70 degrees full operation range.

Control solution package

- ▶ AWC 500 Controller solution.
- ▶ Sensor package to improve controller input.
- ▶ Control Strategy for speed and power control
- ▶ Application software with full open parameter and data sets
- ▶ Remote monitoring tools
- ▶ Park Control interfaces with industry de-facto standard protocols.

Documentation and training package

- ▶ Electrical connection diagrams
- ▶ User and service manuals
- ▶ Test and start up procedures
- ▶ Installation and daily operation training

Relevant products



AWC 500



TCM-2



WSS-W



DPS-1



AGI 300

Maximising power production

Vestas V47 controller upgrade



Together with our local partner in Denmark, GNL Service, DEIF has installed the first V47 controller retrofit solution which maximises turbine power production and reduces service costs for the turbine owner.

Setting a new standard for local service and support for the entire turbine lifetime, the solution is in the process of receiving a full rebuilding permission by the Danish Wind Turbine Owners' Association. The permission is supported by DEIF and our complete measurement of the complete behaviour and operation of the turbine.

With a full training and support package, the turbine owner is now able to utilise the full support from his local service partner and benefit from full data access and remote monitoring.

- ▶ 4 % increased AEP
- ▶ Maximise availability and efficiency
- ▶ Reduce service costs by removing the VRCC
- ▶ Lifetime extension with state-of-the-art control
- ▶ Full data access
- ▶ Up to 10 years warranty
- ▶ 20 years supply guarantee

»It is important for us to offer our customers the best support for maximizing his energy production according to today's and the future challenging energy prices. The new retrofit solution is crucial for reducing cost and increase the efficiency of the turbine.«

Gert Nygaard Laursen

Owner
GNL Service



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LEARN MORE AT DEIFWINDPOWER.COM

