





Versatile, efficient, dependable – and popular

The highly efficient operation and flexible configuration of the V52 make this turbine an excellent choice for all kinds of wind conditions. In addition, thanks to its modest dimensions, the V52 is simple and cost-effective to trans-port and install. If you add in robust construction, thoroughly tested components and an enviable track record, it is easy to see why Vestas has erected more V52s than any other turbine in its portfolio – approximately 1500 turbines, all over the world.

One of the factors that contribute to the success of the V52 is OptiTip®, its pitch regulation system. This system features microprocessors which control the pitching of the blades, thus ensuring continuous adjustment to maintain optimal blade angles in relation to the prevailing wind. At the same time, OptiTip® makes it possible to keep sound levels within the limits stipulated by local regulations.

#### The optimal solution

Another innovative feature of the V52 is the OptiSpeed®\* generator. This is a significant advance in wind turbine technology and makes a major contribution to the effi-ciency of the V52. In practice, it allows the turbine rotor speed to vary between 14 and 31 rpm depending on the conditions at any given time.

While the technology involved may be advanced, its pur-pose is simple: to maximise output. It does this by tapping the higher efficiency of slow and variable rotation, storing excess energy in rotational form and exploiting the full force of transient gusts. All told, OptiSpeed® boosts annual energy production.

As an added benefit, OptiSpeed® also reduces wear and tear on the gearbox, blades and tower on account of lower peak loading. Moreover, as turbine sound is a function of wind speed, the lower rotation speeds made possible by OptiSpeed® naturally reduce sound levels.

Finally, OptiSpeed® helps the V52 deliver better quality power to the grid, with rapid synchronisation, reduced harmonic distortion and less flicker.

Quite simply, OptiSpeed® means more output, better quality power and less mechanical strain and sound







#### Proven Performance

Wind power plants require substantial investments, and the process can be very complex. To assist in the evaluation and purchasing process, Vestas has identified four factors that are critical to wind turbine quality: energy production, operational availability, power quality and sound level.

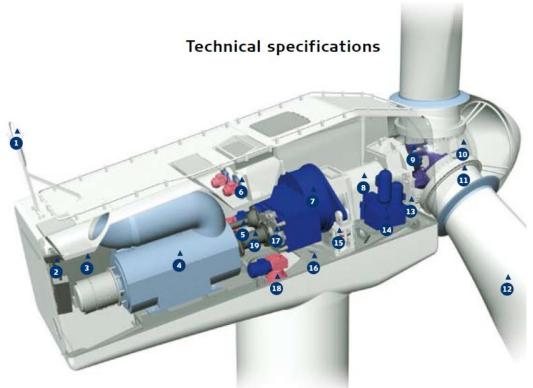
We spend months testing and documenting these perform-ance areas for all Vestas turbines. When we are finally satis-fied, we ask an independent testing organisation to verify the results – a practice we call Proven Performance. At Vestas we do not just talk about quality. We prove it.

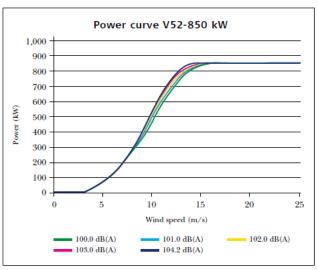


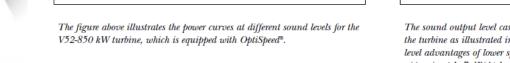












- Ultrasonic wind sensor
- 2 Service crane
- 3 VMP-Top controller with converter
- OptiSpeed® generator
- 5 Pitch cylinder

- 6 Oil and water coolers
- Gearbox
- 8 Main shaft
- Pitch system
- 10 Blade hub

Blade bearing

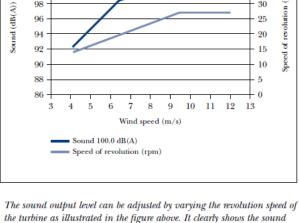
16 Machin

Mechai

18 Yaw gear

Composite disc coupling

- Blade
- 13 Rotor lock system
- Mydraulic unit
- 15 Torque arm



Wind/sound

104

102 100

The sound output level can be adjusted by varying the revolution speed of the turbine as illustrated in the figure above. It clearly shows the sound level advantages of lower speeds of revolution because the sound level is approximately 7 dB(A) lower at 4 m/s than at 8 m/s. For other sound levels, the benefit can be as much as 10 dB(A). Please note that a decrease of 3 dB(A) represents a halving of the sound level.

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#### VESTAS V52 850 52.0 !O!

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Empresa VESTAS Tipo/Versión Potencia nominal 850,0 kW Generador segundario O U KW Diámetro del rotor 52,0 m Torre Tubular Frecuencia de la red 50/60 Hz

País de origen Tipo de pala VESTAS Tipo de generador Un generador Rpm, potencia nominal 26 0 rpm Rpm, inicial 0,0 rpm

Altura(s) de buje 49.0; 36.5; 40.0; 44.0; 55.0; 60.0; 65.0; 70.0; 74.0; 86.0 m 2.30 m Anchura máx, de pala

Anchura de pala a 90% del radio40 m Válido Creador FMD

20/11/2000 11:13 Creado Modificado 20/11/2000 11:13

Curva de potencia: Level 0 - calculated - 104,2 dB(A) - 11-2004

Manufacturer Fuente

Por defecto Velocidad Densidad del Ángulo Regulación de Tipo de curva Ct Fecha Creador Creado Modificado potencia

viento de aire de la punta de

palas

30/11/2004 00:00 EMD 16/11/2000 08:29 28/06/2005 11:50 Si 25,0 Def. por el usuario Special calculated, guaranteed power curve for standard operation.

For different air densities, different calculated power curves are available at Vestas, Powercurves based on item no: 946506,R8 dated 2004-06-14. Please contact Vestas for information on latest power curves.

Curva de notencia Velocidad del viento [m/s] 3,00 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 [kVV] 0,00 25,50 67,40 125,00 203,00 304,00 425,00 554,00 671,00 759,00 811,00 836,00 846,00 849,00 850,00 Potencia

0,000 0,306 0,415 0,445 0,455 0,456 0,448 0,426 0,388 0,388 0,284 0,234 0,193 0,159 0,133 Velocidad del viento [m/s] 19,00 20,00 21,00 22,00 23,00 24,00 25,00 [KVV] 850,00 850,00 850,00 850,00 850,00 850.00 850.00 Potencia 0.095 0.082 0,071 0,061 0,054 0,047 0,042

Ce Curva Ct

Velocidad del viento [m/s] 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 18,00 19,00 20,00 21,00 22,00 23,00 24,00 25,00 0.81 0.82 0.82 0.82 0.82 0.80 0.73 0.65 0.56 0.49 0.39 0.30 0.25 0.20 0.17 0.14 0.12 0.11 0.09 0.08 0.07 0.06

Curva de potencia: Level 1 - calculated - 103.0 dB(A) - 11-2004

Manufacturer Fuente

Fecha Creador Creado Modificado Por defecto Velocidad Densidad del Ángulo Regulación de Tipo de curva Ct

viento de aire de la potencia punta de

palas

30/11/2004 00:00 EMD 16/11/2000 08:29 23/06/2005 15:34 No 25.0 1.225 Paso Def. por el usuario Special calculated, guaranteed power curve for noise optimization

For different air densities, different calculated power curves are available at Vestas. Powercurves based on item no: 946506.R8 dated 2004-06-14. Please contact Vestas for information on latest power curves.

Curva de potencia

Velocidad del viento [m/s] 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00 17.00 18.00 [kW] 25,50 67,40 125,00 202,00 302,00 418,00 543,00 658,00 748,00 804,00 832,00 844,00 848,00 850,00 850,00 Potencia 0.306 0.415 0.445 0.453 0.453 0.441 0.417 0.380 0.333 0.281 0.233 0.192 0.159 0.133 0.112

WindPRO es un programa desarollado por EMD International A/S. Niels Jernesvei 10. DK-9220 Aalborg Ø, Tel. +45 96 35 44 44. Fax +45 96 35 44 46. e-mail: windpro@emd.dk

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#### VESTAS V52 850 52.0 !O!

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Velocidad del viento [m/s] 19.00 20.00 21.00 22.00 23.00 24.00 25.00 [kW] 850,00 850,00 850,00 850,00 850,00 850,00 850,00 0.095 0.082 0.071 0.061 0.054 0.047 0.042

Curva Ct

Velocidad del viento [m/s] 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 18,00 19,00 20,00 21,00 22,00 23,00 24,00 25,00 0,81 0,82 0,82 0,82 0,82 0,80 0,73 0,65 0,56 0,49 0,39 0,30 0,25 0,20 0,17 0,14 0,12 0,11 0,09 0,08 0,07 0,06

Curva de potencia: Level 2 - calculated - 102.0 dB(A) - 11-2004

Fuente Manufacturer

Fecha Creador Creado Modificado Por defecto Velocidad Densidad del Ángulo Regulación de Tipo de curva Ct viento de aire de la potencia

punta de palas

[kg/m3] [°] 30/11/2004 00:00 EMD 16/11/2000 08:29 23/06/2005 15:35 No 25,0 1,225 0.0 Def. por el usuario Special calculated, guaranteed power curve for noise optimization

corte

For different air densities, different calculated power curves are available at Vestas. Powercurves based on item no: 946506.R8 dated 2004-06-14. Please contact Vestas for information on latest power curves.

Curva de potencia

Velocidad del viento [m/s] 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 18,00 [kW] 25,50 67,40 124,00 201,00 297,00 408,00 525,00 638,00 730,00 792,00 826,00 842,00 848,00 849,00 850,00 Potencia 0.306 0.415 0.441 0.451 0.446 0.430 0.404 0.369 0.325 0.277 0.231 0.192 0.159 0.133 0.112

Velocidad del viento [m/s] 19.00 20.00 21.00 22.00 23.00 24.00 25.00 [kW] 850,00 850,00 850,00 850.00 850.00 850.00 850.00 Potencia 0.095 0.082 0.071 0.061 0.054 0.047 0.042

Curva Ct

Velocidad del viento [m/s] 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 18,00 19,00 20,00 21,00 22,00 23,00 24,00 25,00 Ct 0,81 0,82 0,82 0,82 0,82 0,82 0,80 0,73 0,65 0,56 0,49 0,39 0,30 0,25 0,20 0,17 0,14 0,12 0,11 0,09 0,08 0,07 0,06

Curva de potencia: Level 3 - calculated - 101.0 dB(A) - 11-2004

Fuente Manufacturer

Fecha Por defecto Velocidad Densidad del Ángulo Regulación de Tipo de curva Ct Creador Creado Modificado viento de aire de la potencia punta de

palas [°]

[ka/m31 30/11/2004 00:00 EMD 16/11/2000 08:29 23/06/2005 15:38 No 25,0 1,225 Def. por el usuario Special calculated, guaranteed power curve for noise optimization

For different air densities, different calculated power curves are available at Vestas. Powercurves based on item no: 946506.R8 dated 2004-06-14. Please contact Vestas for information on latest power curves.

Curva de potencia

Velocidad del viento [m/s] 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 18,00 [kW] 25.50 67.40 124.00 199.00 292.00 396.00 508.00 619.00 714.00 782.00 821.00 840.00 847.00 849.00 850.00 Potencia 0.306 0.415 0.441 0.446 0.438 0.418 0.391 0.358 0.318 0.274 0.230 0.191 0.159 0.133 0.112 Ce

Velocidad del viento [m/s] 19,00 20,00 21,00 22,00 23,00 24,00 25,00 [kW] 850.00 850.00 850.00 850.00 850.00 850.00 850.00 Potencia 0.095 0.082 0.071 0.061 0.054 0.047 0.042

Curva Ct

Velocidad del viento [m.k] 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 18,00 19,00 20,00 21,00 22,00 23,00 24,00 25,00 Ct 0,017 0,14 0,12 0,11 0,09 0,08 0,07 0,06

Curva de potencia: Level 4 - calculated - 100.0 dB(A) - 11-2004

30/11/2004 00:00 EMD 16/11/2000 08:29 23/06/2005 15:38 No

Fuente Manufacturer

Fecha Creador Creado Modificado Por defecto Velocidad Densidad del Ángulo Regulación de Tipo de curva Ct viento de aire de la potencia punta de corte palas [kg/m3] [m/s] [°]

25,0

1,225

0,0

Paso

Def. por el usuario

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#### VESTAS V52 850 52.0 !O!

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Special calculated, guaranteed power curve for noise optimization

For different air densities, different calculated power curves are available at Vestas. Powercurves based on item no: 946506.R8 dated 2004-06-14. Please contact Vestas for information on latest power curves.

Curva de potencia

Velocidad del viento	[m/s]	4,00	5,00	6,00	7,00	8,00	9,00	10,00	11,00	12,00	13,00	14,00	15,00	16,00	17,00	18,00
Potencia	[kW]	25,50	67,40	124,00	197,00	284,00	381,00	485,00	591,00	688,00	763,00	810,00	834,00	845,00	848,00	850,00
Ce		0,306	0,415	0,441	0,442	0,426	0,402	0,373	0,341	0,306	0,267	0,227	0,190	0,159	0,133	0,112

Velocidad del viento	[m/s]	19,00	20,00	21,00	22,00	23,00	24,00	25,00
Potencia	[kW]	850,00	850,00	850,00	850,00	850,00	850,00	850,00
Ce		0.095	0.082	0.071	0.061	0.054	0.047	0.042

Curva Ct

Velocidad del viento [m/s] 4,00 5,00 6,00 7,00 8,00 9,00 10,00 11,00 12,00 13,00 14,00 15,00 16,00 17,00 18,00 19,00 20,00 21,00 22,00 23,00 24,00 25,00 0.81 0.82 0.82 0.82 0.82 0.80 0.73 0.65 0.56 0.49 0.39 0.30 0.25 0.20 0.17 0.14 0.12 0.11 0.09 0.08 0.07 0.06

#### Comparación de curvas HP

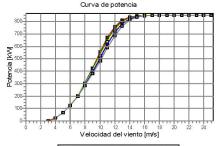
Comparación de carvas in								
Vmedia	[m/s]	5	6	7	8	9	10	
Valor HP	[MWh]	988	1.631	2.300	2.953	3.505	3.994	
Level 0 - calculated - 104.2 dB(A) - 11-2004	[MVVh]	1.093	1.728	2.382	2.999	3.546	4.004	
Valor de control	[%]	-10	-6	-3	-2	-1	0	
Level 1 - calculated - 103.0 dB(A) - 11-2004	[MWh]	1.083	1.709	2.356	2.969	3.513	3.971	
Valor de control	[%]	-9	-5	-2	-1	0	1	
Level 2 - calculated - 102.0 dB(A) - 11-2004	[MWh]	1.065	1.678	2.314	2.920	3.461	3.918	
Valor de control	[%]	-7	-3	-1	1	1	2	
Level 3 - calculated - 101.0 dB(A) - 11-2004	[MWh]	1.048	1.647	2.273	2.872	3.411	3.868	
Valor de control	[%]	-6	-1	1	3	3	3	
Level 4 - calculated - 100.0 dB(A) - 11-2004	[MWh]	1.024	1.604	2.213	2.801	3.334	3.790	
Valor de control	[%]	-4	2	4	5	5	5	

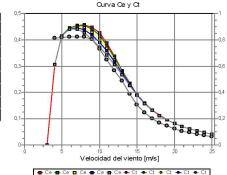
Comparación entre las producciones calculadas mediante las 10 curvas de potencia dadas y las curvas HP (curvas simplificadas, independientes del fabricante, basadas en los parámetros "kw potencia/m2 área de barrido", "sistema de uno dos generadores" y "Stall o Pitch" y sin efecto parque). Para más detalles véase agencia danesa de energia, informe de proyecto J.nr. 51171/00-0016 (véase también manual de WindPRO, capitulo 3.5.2). El método fue refinado en el informe de EMD "20 Detailed

Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide" Jan 2003

Utilicen la tabla para estimar si las curvas de potencia son razonables. Si el valor de control está por debajo del -5%, puede ser que la curva de potencia sea demasiado optimista

debido a inseguridades.





Ruido: Level 0 - - 104.2 dB(A) - 11-2004

Fuente Manufacturer

Creador Creado Modificado Por defecto 30/11/2004 13:33 EMD 25/09/2000 00:00 28/06/2005 11:50 Si Altura de buie Velocidad del viento Lwa ref Depende de la velocidad del viento Tonos puros

Level 1 - calculated - 103.0 dB(A) - 11-2004 Level 2 - calculated - 102.0 dB(A) - 11-2004

Level 3 - calculated - 101.0 dB(A) - 11-2004

Level 4 - calculated - 100.0 dB(A) - 11-2004

[m]	[m/s]	[dB(A)]	[dB(A)/m/s]		
44,0	8,0	104,2		1,0	No
	10,0	103,9		1,0	No
65,0	8,0	104,4		1,0	No
	10,0	103,3		1,0	No
86,0	8,0	104,5		1,0	No
	10.0	102.2		1.0	Mo

World De un programe describen por Eldo International Als Niels Jerresyel 10 OK 9720 Asthon 20 Tel. 145 96 35 44 44, Fax 145 96 35 44 46, e-mail: windpro@emd.d

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#### VESTAS V52 850 52.0 !O!

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Ruido: Level 1 - - 103.0 dB(A) - 11-2004

Manufacturer Fuente

Por defecto Creador Creado Modificado 30/11/2004 13:33 EMD 01/06/2001 14:50 23/06/2005 16:13 No

Altura de buje Velocidad del viento Lwa,ref Depende de la velocidad del viento Tonos puros

[m]	[m/s]	[dB(A)]	[dB(A)/m/s]		
44,0	8,0	103,3	1	,0	No
	10,0	103,2	1	,0	No
65,0	8,0	103,4	1	,0	No
	10,0	103,3	1	,0	No
86,0	8,0	103,7	1	,0	No
	10,0	103,0	1	,0	No

With these values, a special power curve for noise optimization has got to be used. Noise based on item no: 944407.R6 dated 2001-09-26. Please note that the sound power level may differ marginally at other hub heights.

Ruido: Level 3 - - 101.0 dB(A) - 11-2004

Fuente Manufacturer

Creador Creado Fecha Modificado Por defecto 30/11/2004 13:33 EMD 25/09/2000 00:00 23/06/2005 16:21 No

Altura de buje Velocidad del viento Lwa,ref Depende de la velocidad del viento Tonos puros

[m]	[m/s]	[dB(A)]	[dB(A)/m/s]		
44,0	8,0	101,0		1,0	No
	10,0	102,4		1,0	No
65,0	8,0	101,4		1,0	No
	10,0	102,6		1,0	No
86,0	8,0	101,7		1,0	No
	10.0	102.6		1.0	No

With these values, a special power curve for noise optimization has got to be used. Noise based on item no: 944407.R6 dated 2001-09-26. Please note that the sound power level may differ marginally at other hub heights.

Ruido: Level 2 - - 102.0 dB(A) - 11-2004

Manufacturer Fuente

Modificado Creador Creado Por defecto 30/11/2004 13:33 EMD 25/09/2000 00:00 23/06/2005 16:17 No

Altura de buje Velocidad del viento Lwa,ref Depende de la velocidad del viento Tonos puros

[m]	[m/s]	[dB(A)]	[dB(A)/m/s]		
44,0	8,0	102,0	2 2 20 20	1,0	No
	10,0	103,2		1,0	No
65,0	8,0	102,4		1,0	No
	10,0	103,1		1,0	No
86,0	8,0	102,7		1,0	No
	10,0	103,0		1,0	No

With these values, a special power curve for noise optimization has got to be used. Noise based on item no: 944407.R6 dated 2001-09-26. Please note that the sound power level may differ marginally at other hub heights.

Ruido: Level 4 - - 100,0 dB(A) - 11-2004

Fuente Manufacturer

Fecha Creador Creado Modificado Por defecto 30/11/2004 13:33 EMD 25/09/2000 00:00 23/06/2005 16:24 No

Altura de buje Velocidad del viento Lwa,ref Depende de la velocidad del viento Tonos puros

[m]	[m/s]	[dB(A)]	[dB(A)/m/s]		
44,0	8,0	99,7		1,0	No
	10,0	101,2		1,0	N
65,0	8,0	100,1		1,0	N
	10,0	101,4		1,0	N
86,0	8,0	100,4		1,0	N
	40.0	1015		4.0	

With these values, a special power curve for noise optimization has got to be used. Noise based on item no: 944407.R6 dated 2001-09-26. Please note that the sound power level may differ marginally at other hub heights.

ndFRO es un programa desarollado por EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44. Fax. +45 96 35 44 46, e-mait windpro@emd di





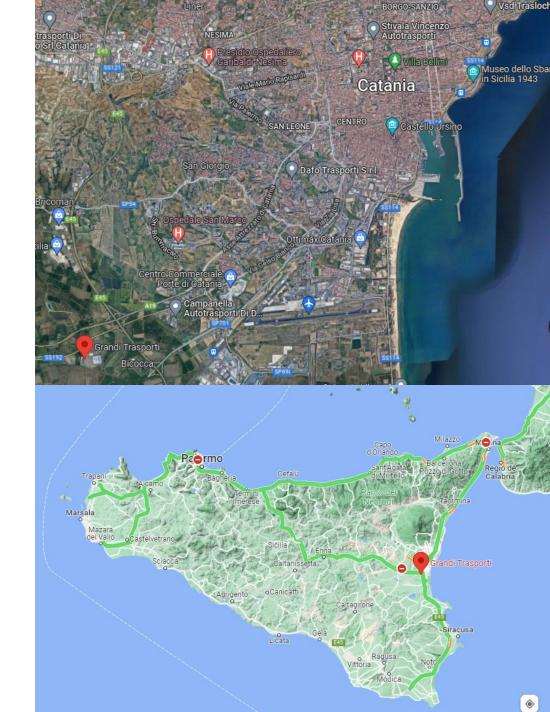
Pick-up address for Vestas V52 turbine.

Due to the characteristics of the road accesses within the wind farm, the delivery of the wind turbines and components will be made to the following address:

### **GRANDI TRASPORTI**

Contrada Serraci, SNC 95100 Catania, CT

Salvatore Carco +39 348 406 74 28 Email: Salvatore.carco@contitrasporti.it



# **REPOWERING SOLUTIONS**

New concept



We developed specific solutions and tools for different assets that required special market exposure and in-depth knowledge of the area:

- . New/unused and used wind turbines.
- . Wind turbine components.
- . Wind farms, power plants, etc,
- . Remanufactured wind turbines
- If you need to value an energy asset, we can help you. We have extensive experience and proven capability in the valuation of wind turbines, wind farms, etc. Projects from almost all energy industries and for different purposes have been assessed by our team of expert valuers.
- Regional Renewable Energy Platform in Latin America focused on solar and wind assets
- A team of experienced individuals with deep expertise in development, financing, construction and operations.
- Management team active in the renewable energy sector since 2007 Record of more than 3.5 GW under development in Latin America



# REPOWERING SOLUTIONS

Who is behind REPOWERING SOLUTIONS

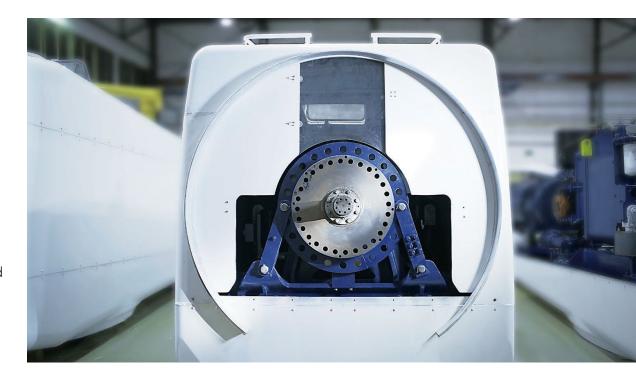
REPOWERING SOLUTIONS is a cluster of companies, specialised in providing a wide range of services for the energy industry from equipment recovery, decommissioning, equipment sales, logistics and transport. It has a long tradition of more than 15 years in which the main objective is to provide our customers with diverse and efficient tailor-made solutions.

We work in the world energy market offering global solutions for the optimisation of investments. REPOWERING SOLUTIONS has been formed as a result of the integration of several corporations with extensive experience in a wide range of specialised energy areas.

Our objective is to offer an integrated, complete and specific solution for each project. Our services range from engineering, sales and distribution to logistics and transport.

We give special consideration to the value recovery of industrial equipment, which is of great importance in our project portfolio. REPOWERING SOLUTIONS' mission is to offer those technical and financial proposals that respond to the fundamental questions that arise in any new power generation project: what is the best technological response that combines the best degree of efficiency and effectiveness with the lowest investment?







We seek innovative solutions for our customers, who can rely on our company as an ally that adds value to their business, with the integral offer of products and services to the logistics chain.

We have the experience and the highest technical level, being the integrating solution of logistics services, delivering integrated logistics and foreign trade solutions to our customers.



2013
Signing of an agreement with the multinational ABB (Asea Brown Boveri) for the retrofit of wind turbines from the repowering of wind farms in Europe.













2013 Supply, installation and commissioning of wind farm in Picerno (Italy) 4 TURBINES NORDTANK 200Kw













2013 Supply, installation and commissioning of Lagerway 80kW wind turbine La Coruña (Spain) - Managua (Nicaragua)













2013 Supply, installation and commissioning of VESTAS V27 wind turbine in UNITED KINGDOM







2013 Supply, installation and commissioning of VESTAS V27 wind turbine in UNITED KINGDOM



















2013 Supply, installation and commissioning of Vestas V27 wind turbine in Las Palmas de Gran Canaria



2014 Supply, installation and commissioning of VESTAS V44 wind turbine in La Muela (Spain)























## 2014 Dismantling of 4 Vestas V47 turbines Hamburg - Germany











2014 Dismantling of 24 VESTAS WD34 turbines Coal Clough Wind Farm in Burnley ENGLAND (SCOTISH POWER - IBERDROLA)





#### 2015-2016 Sale of 14 new wind turbines models manufactured in 2007 - Vestas V80, V90 2MW and V90 3MW













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