

WIND PARK KARDAM

16,8 MW

Wind park Kardam

- 🇧🇬 Bulgaria
- 🇧🇬 8 turbines Suzlon S88 – 2,1 MW
- 🇧🇬 Total capacity 16,8 MW
- 🇧🇬 Operation:
 - 12,6 MW – in operation since November 2010
 - 4,2 MW – start of operation December 2012



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OVERVIEW

Country	Bulgaria, Dobrich region
Park capacity	16,8 MW
WTG	8 x Suzlon S88, nominal capacity 2,100kW
Hub height	79 m
Development stage and start of operation	12,6 MW – in operation since November 2010 4,2 MW – in development, start of operation in Dec 2012
Wind potential at hub height	6,9m/s
Expected energy yield (P50, incl. wake losses)	45.599.000 kWh / p.a.
Feed-in tariff	188,29 BGN/MWh \approx 96,27 €/MWh* (for the first 2.250 full effective working hours p.a.) 172,95 BGN/MWh \approx 88,43 €/MWh* (after 2.250 full effective working hours p.a.) *Exchange rate 1€ \approx 1.95583BGN



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Key figures	
Revenue from power production	3.960.452 € /p.a.
Surplus of funds (cumulated after 20 years)	74.335.563 €
Performance figures	
Period of depreciation	20 years
IRR (before taxes)	8,03%
IRR (after taxes)	7,28%
Period for return	9 years
Prime-cost after indirect expenses	0,04073 €/kWh
Feed-in tariff sales price	0,09627 €/kWh

Calculation of profitability is based on a conservative energy yield expectations by taking the lower P75 value into account for calculation (P75 = P50 – 9,78% reductions).



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Wind Farm 1/2

The wind farm Kardam is located in the northeastern Bulgarian Province of General Toshevo next to the Romanian border. It is situated about 32 km west of the Black Sea coast and a few kilometers northeast of the town General Toshevo.

The area is part of the mostly flat coastal plain which slopes east towards the sea. Elevations range between 170 m and 190 m. In a westward direction, elevations increase slightly to above 200 m while the site is freely exposed towards the northern and eastern sectors. Surface roughness is characterized by large open fields bordered by small hedges and lines of trees along the roads. Bird sanctuaries or Natura2000 environmental sites are not located in the surrounding area of the wind farm. The northeastern region of Bulgaria is known as the central wind area in the country. Up to date all major wind farms with a total capacity of more than 150 MW are operating there.



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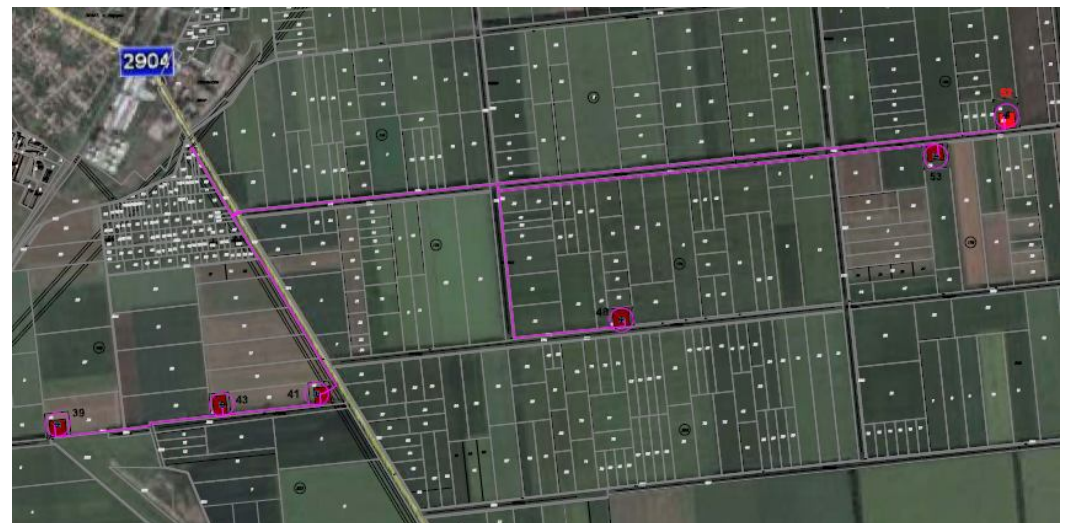
Wind Farm 2/2

The wind farm consists of 8 wind turbines (WTG), type Suzlon S88. The turbine's rated power is 2.100 kW. The machines operate on a hub height of 79 m with a rotor diameter of 88 m.

The minimum distance between the turbines is between 400 and more than 700 meters. Thus, reductions in park efficiency through wake losses are limited to a minimum.

6 turbines with capacity 12,6 MW are already in operation since November 2010.

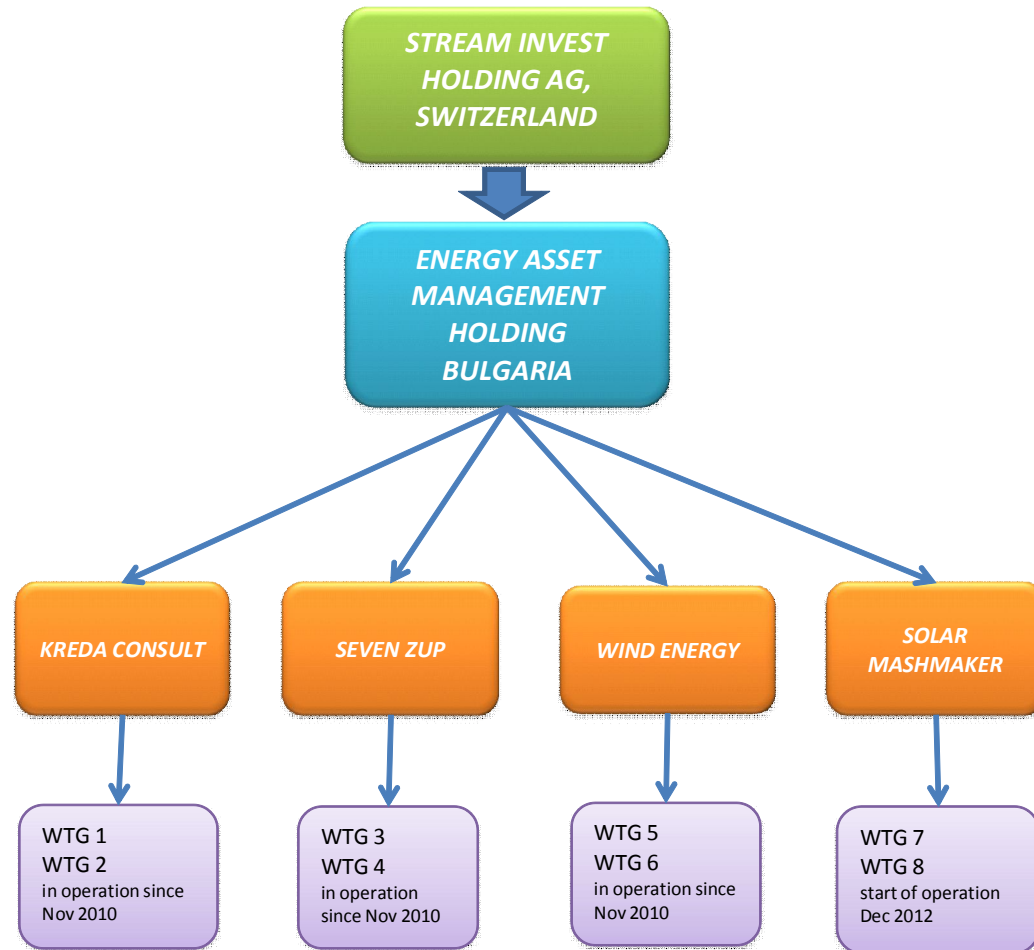
The project for the additional 2 turbines is under development and the WTGs are planned to be erected and start operation in December 2012 (grid connection is granted under a contract signed with the National Electricity Company).



WIND PARK KARDAM

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- ✚ The Kardam 16,8 MW Wind farm is split into 4 asset companies (SPV's).
- ✚ Each SPV owns and operates two Suzlon S88 2.1 MW turbines.
- ✚ All SPV's are owned by Bulgarian company Energy Asset Management Holding EOOD, a daughter company of Swiss Stream Invest Holding AG.
- ✚ The wind farm will be sold as a share deal.



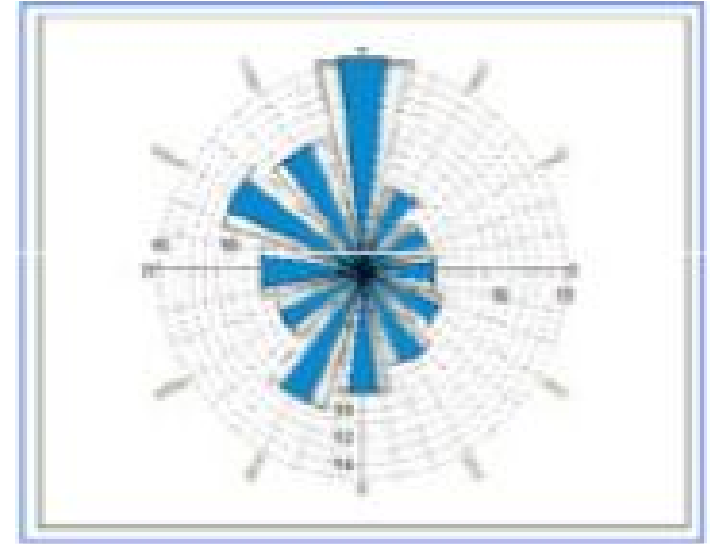
WIND PARK KARDAM

16,8 MW

Wind Data 1/2

For the wind energy yield assessment, wind data was used from a measurement site near Bezhanovo, about 17,5 km east of the project site. The measurement period lasts from September 2006 until January 2008. Long-term scaling of the measured wind speeds was done using a combined regression model with weighted data from a nearby weather station and a NCEP grid point. Resulting long-term mean wind speed at 50m is 6,12 m/s.

The main wind directions at the project site are Northwest, North and Northeast. The wind speed at hub height was calculated applying the wind shear exponent as derived from Bezhanovo wind measurement.



The main results for the wind farm :

- Energy yield (p50v-12,6 MW) 34.199.800 kWh
- Park efficiency 97,65%
- Capacity factor 30,98%
- Wind speed at hub height (79m) 6,9 m/s

The above results were taken from the wind expertise, which was done by German wind consultant Dr. Littmann Consulting. Two further studies from TerraWatt GmbH and Suzlon are existing and confirm the written results.

Detailed Results of Model Computations

Kardam	SUZLON		S88											
WEC	UTM WGS 84	Zone 35	elevation	manufacturer	type	power	rotor	hub height	energy yield	energy yield	park effic.	wind speed	A (Sum)	k (Sum)
	east	north	[m]			[kW]	[m]	[m]	free [MWh]	Park [MWh]	[%]	[m/s]	[m/s]	
K 1	593.255	4.844.541	170	Suzlon	S88-2.1 MW	2.100	88	79	5.904,99	5.699,80	96,4	6,9	7,8	2,561
K 2	592.882	4.844.503	176	Suzlon	S88-2.1 MW	2.100	88	79	5.924,35	5.785,50	97,6	6,9	7,8	2,561
K 3	592.857	4.843.817	175	Suzlon	S88-2.1 MW	2.100	88	79	5.903,76	5.720,70	96,8	6,9	7,8	2,561
K 4	590.430	4.843.545	178	Suzlon	S88-2.1 MW	2.100	88	79	5.742,30	5.613,20	97,7	6,9	7,7	2,568
K 5	589.934	4.843.481	180	Suzlon	S88-2.1 MW	2.100	88	79	5.763,87	5.656,40	98,1	6,9	7,7	2,568
K 6	589.178	4.843.373	188	Suzlon	S88-2.1 MW	2.100	88	79	5.764,27	5.724,20	99,3	6,9	7,7	2,576
sum/mean									35.003,50	34.199,80	97,7	6,9	7,8	2,57

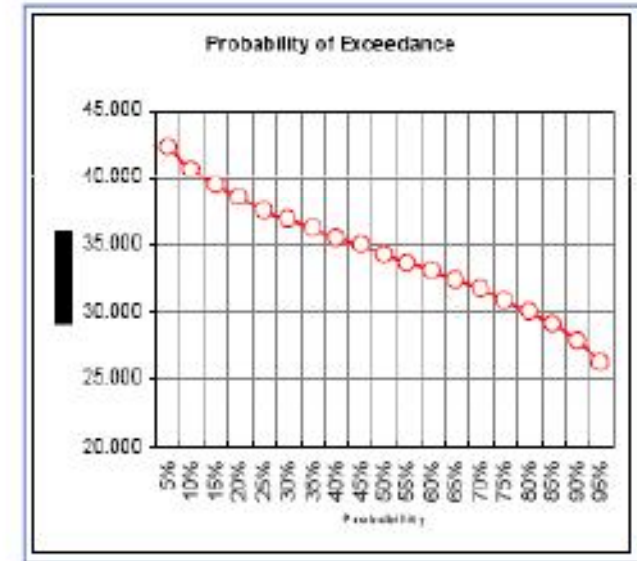
WIND PARK KARDAM

16,8 MW

Wind Data 2/2

The present list shows the expected transgression probabilities of the annual energy production based on installed capacity of 12,6 MW. The overall standard uncertainty estimate assumed by wind consultant Dr. Littmann is 14,6%.

probability of exceedance	Yield MWh	Yield in % of mean
5%	42.289	123,65
10%	40.591	118,69
15%	39.393	115,18
20%	38.394	112,26
25%	37.545	109,78
30%	36.796	107,59
35%	36.147	105,69
40%	35.448	103,65
45%	34.849	101,90
50%	34.200	100,00
55%	33.551	98,10
60%	32.952	96,35
65%	32.252	94,31
70%	31.603	92,41
75%	30.854	90,22
80%	30.006	87,74
85%	29.007	84,82
90%	27.809	81,31
95%	26.111	76,35



Source: Dr. Littman Consulting

Probability	Yield	Full load hours
P50	34.200 MWh	2.714
P75	30.854 MWh	2.449
P90	27.809 MWh	2.207

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Wind Turbines 1/2

Suzlon S88 – 2,1 MW*

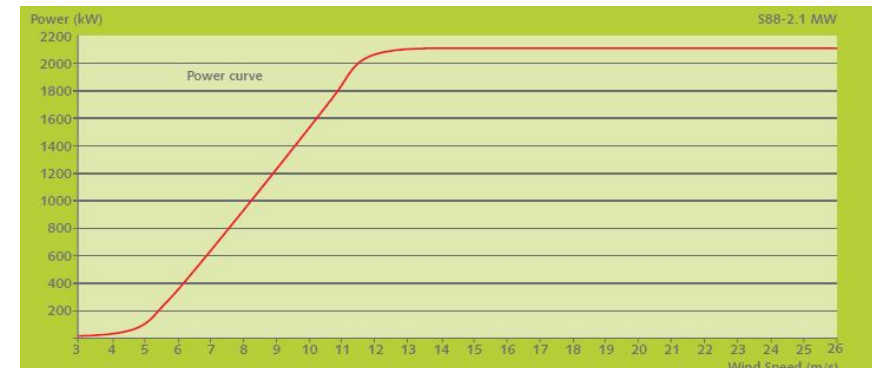
S88-2.1 MW is designed for a medium wind speed regime. The wind turbine concept is based on robust design with pitch regulated blade operation, a three-stage gearbox with 2200 kW rating and flexible coupling to the asynchronous induction generator. The Suzlon flexi-slip system provides efficient control of the load and power control and the turbine operation is effectively controlled by the Suzlon controller. These technologies are all well known in the wind power industry and have proven themselves. The S88-2.1 MW is designed to withstand extreme conditions and operate effectively with low maintenance costs.

GEARBOX

Suzlon has always placed significant focus on gearbox design. The design philosophy is based on years of experience with wind turbines in harsh environments and our internal design standards exceeding the industry standards. The power rating of the Winergy gearbox for the S88-2.1 MW is actually 2.2 MW. With the acquisition of Hansen Transmission, Suzlon is further able to secure supply and design development of superior gearbox technology for the benefit of our customers.

PITCH SYSTEM

The full-span blade pitching system is based on electrical motors with individual power backup which allows fast and efficient pitching of the blades. With a resolution of 0.1° and a special fast-pitching mode, the S88-2.1 MW allows optimal power output as well as fast and safe braking of the rotor.



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Wind Turbines2/2

MODEL	S_88 – 2.1 MW
OPERATING DATA	
Rated power	2.1 MW
Cut-in wind speed	4 m/s
Rated wind speed	14 m/s
Cut-out wind speed	25 m/s
50 years gust wind speed	59.5 m/s
Hub height	79 m (Foundation top equal to ground level)
Wind Class	IEC-IIA
Rotational Speed	15 to 17.6 rpm
ROTOR	
Pitch system	Pitch regulated, electrical
Diameter	88 m
Swept area	6082 m ²
Blade material type	Epoxy bounded fibre glass
GENERATOR	
Type	Asynchronous slip ring type induction generator
Rated power	2100 kW
Rated voltage	690 / 600 V
Frequency	50 / 60 Hz
Protection	IP 54, IP23 for slip ring unit
Cooling system	Air cooled
Insulation	Class H
Slip control	Unique Flexi-Slip providing slip up to 16.67%
BRAKING SYSTEM	
Aerodynamic brake	3 independent systems with blade pitching mechanism
Mechanical brake	Hydraulic fail-safe disc brake system
GEARBOX	
Type	3 stages (One planetary & Two helical)
Ratio	1:98.8 / 1:118.1
Nominal load	2200 kW

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Capital and Operational Expenditures

Capital Expenditures	
Wind farm	36.624.000 € Total
Including:	<ul style="list-style-type: none">- 8 turbines Suzlon S88 turnkey- Land plots- 100% shares of 4 project SPVs with all rights and permits
Operational expenditures p.a.	
Land lease	0,00 €
Administrative and technical management	1,5*% of the revenues
Operation and Maintenance Warranty	5 years
Insurance	33 000*€
Electricity consumption (incl. reactive energy)	42 000*€

*estimated approximately



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Project Advantages & Risk Assessment

Country:

- ✚ Feed-in Tariff over 15 years
- ✚ Low taxes
- ✚ Euro-bound currency

Wind park:

- ✚ Strong wind site
- ✚ State of art turbine technology
- ✚ Possibility to extend the wind farm with two turbines, totaling the power to 16,8 MW
 - Very low operating costs
 - No land lease costs
- ✚ 5 years free maintenance contract
- ✚ Strong performance figure with high returns

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No.	Type of Risk	Risk assessment
1.	Country risks/ Political risks	Since 2007, Bulgaria is an EU member state. Despite the financial crisis Bulgaria meets all the Maastricht Criteria for receiving the Euro in 2013.
2.	Project development risks	The project has all required licenses. The electricity production started in November 2010.
3.	Legal risks	The project has all required contracts. All legal risks were eliminated during the project development. Further two banks have undertaken thorough Due Diligence before financing the project.
4.	Construction risks	The project is commissioned and all construction risks are mitigated.
5.	Sales / Off take risks	The Bulgarian grid operating companies are obliged under Bulgarian law to off take all produced electricity and pay the renewable feed in tariff. The tariff is guaranteed for 15 years.
6.	Currency Exchange risks	There is no currency exchange risk from the BulgarianLeva to the Euro, as Bulgaria's currency is pegged at the rate of 1.95583 Leva per euro since July 1997.
7.	Third party Liability Risks	Damages caused by the operation of the wind park are covered by third party liability insurances.
8.	Technical risks	Suzlon, the turbine supplier has given 5 years warranty instead of only 2 years that are common in the industry.
9.	Counter Party Risks	The land of the wind park is owned by the project companies. Thus, any risks related to the leasing of the land will be mitigated.
10.	Operating / Performance Risks	At the operation stage the wind park faces performance risks that the electricity production falls below the forecasted production level. The production shortfall caused by damages to any part of the equipment will be covered by business interruption insurance.

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Disclaimer

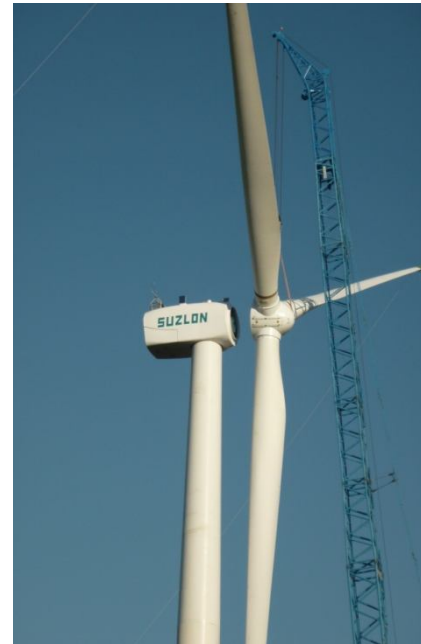
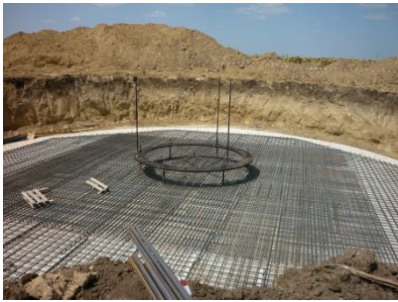
The purchase of a wind park means a long term entrepreneurial engagement with all chances and risks for the investor. All information in this brief description as well as in the calculation of profitability have been prepared with the necessary accuracy. Still a warranty for the actuality, correctness and completeness of the given information cannot be given. Decisive are the original documents that will be submitted at a certain time.

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Appendix 1 – Photo Gallery



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Appendix 2 – Green energy certificates

На основание чл. 21, ал. 1, т. 14 от Закона за енергетиката, чл. 19, ал. 1 от Закона за възобновяемите и алтернативните енергийни източници и биогоривата (ДВ, бр. 49 от 2007г.), чл. 8 от Наредбата за издаване на сертификати за произход на електрическа енергия, произведена от ВЕИ, и свое Решение № С – 1/07.03.2011г.

Държавната комисия за енергийно и водно регулиране

издава

СЕРТИФИКАТ ЗА ПРОИЗХОД
за електрическа енергия, произведена от ВЕИ
№ Е-ЗСП-395_1/07.03.2011г.

на: „Креда консулт“ ЕООД,
бул. Съборни № 11, ет. 4, офис 12, гр. Варна, тел.: 052/607642, 0887777543, факс: 052/607620,
е mail: angelina.milcheva@ecdnormab-bg.com, office.varna@ecdn.bg,
БУЛСТАТ/ЕИК BG 131303733

За електрическа енергия 886,661 MWh, произведена от ВЕИ за периода 11.08.2010г. до 31.12.2010г.

чрез технология на производство на електрическа енергия от: енергосистем вятър
местонахождение: Вятърна електроцентрала, землище на с. Кардам, общ. Генерал Тошева, общ. Добрич.

с обща инсталирана мощност 4.2 MW и инсталирана мощност на съоръжението, произвеждащи електрическа енергия от ВЕИ 4.2 (2x2,1) MW.



Председател:
А. Семерджиев

Главен секретар:
Е. Савева

На основание чл. 21, ал. 1, т. 14 от Закона за енергетиката, чл. 19, ал. 1 от Закона за възобновяемите и алтернативните енергийни източници и биогоривата (ДВ, бр. 49 от 2007г.), чл. 8 от Наредбата за издаване на сертификати за произход на електрическа енергия, произведена от ВЕИ, и свое Решение № С – 1/07.03.2011г.

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бул. Съборни № 11, ет. 4, офис 12, гр. Варна, тел.: 052/607642, 0887777543, факс: 052/607620,
е mail: angelina.milcheva@ecdnormab-bg.com, office.varna@ecdn.bg,
БУЛСТАТ/ЕИК BG 175143077

За електрическа енергия 621,257 MWh, произведена от ВЕИ за периода 11.08.2010г. до 31.12.2010г.

чрез технология на производство на електрическа енергия от: енергосистем вятър
местонахождение: Вятърна електроцентрала „Кардам 3.1“, землище на с. Кардам, общ. Генерал Тошева, общ. Добрич.

с обща инсталирана мощност 2.1 MW и инсталирана мощност на съоръжението, произвеждащи електрическа енергия от ВЕИ 2.1 (1x2,1) MW.



Председател:
А. Семерджиев

Главен секретар:
Е. Савева

На основание чл. 21, ал. 1, т. 14 от Закона за енергетиката, чл. 19, ал. 1 от Закона за възобновяемите и алтернативните енергийни източници и биогоривата (ДВ, бр. 49 от 2007г.), чл. 8 от Наредбата за издаване на сертификати за произход на електрическа енергия, произведена от ВЕИ, и свое Решение № С – 1/07.03.2011г.

Държавната комисия за енергийно и водно регулиране

издава

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за електрическа енергия, произведена от ВЕИ
№ Е-ЗСП-399_1/07.03.2011г.

на: „Севин Зул“ ЕООД,
бул. Съборни № 11, ет. 4, офис 12, гр. Варна, тел.: 052/607642, 0887777543, факс: 052/607620,
е mail: angelina.milcheva@ecdnormab-bg.com, office.varna@ecdn.bg,
БУЛСТАТ/ЕИК BG 175143077

За електрическа енергия 687,942 MWh, произведена от ВЕИ за периода 11.08.2010г. до 31.12.2010г.

чрез технология на производство на електрическа енергия от: енергосистем вятър
местонахождение: Вятърна електроцентрала „Кардам 3.2“, землище на с. Кардам, общ. Генерал Тошева, общ. Добрич.

с обща инсталирана мощност 2.1 MW и инсталирана мощност на съоръжението, произвеждащи електрическа енергия от ВЕИ 2.1 (1x2,1) MW.



Председател:
А. Семерджиев

Главен секретар:
Е. Савева

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Държавната комисия за енергийно и водно регулиране

издава

СЕРТИФИКАТ ЗА ПРОИЗХОД
за електрическа енергия, произведена от ВЕИ
№ Е-ЗСП-398_1/07.03.2011г.

на: „Унид енджи“ ЕООД,
бул. Съборни № 11, ет. 4, офис 12, гр. Варна, тел.: 052/607642, 0887777543, факс: 052/607620,
е mail: angelina.milcheva@ecdnormab-bg.com, office.varna@ecdn.bg,
БУЛСТАТ/ЕИК BG 175145060

За електрическа енергия 418,171 MWh, произведена от ВЕИ за периода 11.08.2010г. до 31.12.2010г.

чрез технология на производство на електрическа енергия от: енергосистем вятър
местонахождение: Вятърна електроцентрала „Кардам 2.1“, землище на с. Кардам, общ. Генерал Тошева, общ. Добрич.

с обща инсталирана мощност 4.2 MW и инсталирана мощност на съоръжението, произвеждащи електрическа енергия от ВЕИ 4.2 (2x2,1) MW.



Председател:
А. Семерджиев

Главен секретар:
Е. Савева