平成 19 年度環境省委託事業

CDM/JI Study in FY2007

Wind Power Electricity Generation in Slovakia

Summary

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Contents

1 Description of the project

1.1 Description of the project

This whole project does the wind power generation of total 90.75MW in the west of The Slovak Republic. The wind parks of the project are located at two local spots as TRNAVA province, Senica district, Stefanov village, and NITRA province, NoveZamky district, Svodin village. Each site has a name as “Stefanov Project” and “Svodin Project” respectively from names of those two villages.

Table 1 Description of “Stefanov Project”

Item	Index or Specification	Note
Business operator	VENTUREAL Slovakia s.r.o.	
Type of wind turbine	V100, 2.75 MW	Manufacturer：Vestas
Number of installed wind turbines	16	Total amount of power generation capacity: 48 MW
Distance to the power grid	5.0 km	An electrical substation equipment of 22/110kV will be newly constructed as the connection to the grid.
Province	Trnava province, Senica district	About 70km north from the capital city Bratislava.
Annual average wind speed	6.4 m/s	
Expected power generation	About 90,000 MWh	Potential of annual power generation
Start of operation	In the middle of 2008	

Table 2 Description of "Svodin Project"

Item	Index or Specification	Note
Business operator	VENTUREAL Slovakia s.r.o.	
Type of wind turbine	V100, 2.75MW	Manufacturer：Vestas
Number of installed wind turbines	17	Total 51 MW
Distance to the power grid	5.0 km	Necessary to construct a new electrical substation of 22/110 kV as the connection

		to the grid.
Province	Nitra province, NoveZamky district	About 150km east from the capital city Bratislava.
Annual average wind speed	6.1 m/s	
Expected power generation	About 88,000 MWh	Potential of annual power generation
Start of operation	In the middle of 2008	

1.2 Location of the project sites

Geographic locations of the two project sites are presented in Figure 1.

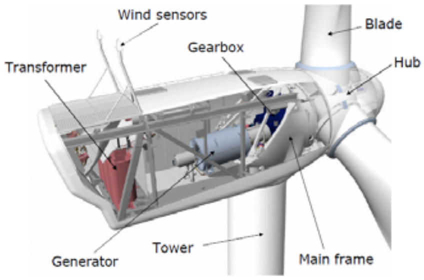
Source: Google

Fig. 1 Site locations for the wind power generation

1.3 Wind power technology introduced to the project

V100 series 2.75MW, a new product from Vestas company, will be introduced to this project. The V100-2.75MW is capable to generate electricity with every wind direction . The rated speed of rotor can be changed within the range of 60% based on the OptiSpeed technology that Vestas Co. has developed.

As a result, it can even harness the force of wind gust, then the potential of annual power generation has been improved comparing to Vestas' previous products. Moreover, a low peak load contributes to reduce mechanical wear and cracks on the gear, the wings, and the tower. In addition, its lower rotational speed leads noise-reduction respectably.



Source：http://www.exportinitiative.de/media/article006029/2_J.%20Clausen_VESTAS.pdf

Fig. 2 Internal structure outline of V100-2.75MW

2 Baseline scenario

This project is a wind power generation project, and brings out neither immediate GHG emissions nor the reductions from the project itself. On the other hand, the electric power generated by the project will be connected and transmitted through the power grid, thereafter; it comes to reduce certain emissions from other fossil fuel power plants over the grid in the country.

In the methodology of the carbon intensity calculation is used the build margin (BM) and operating margin (OM) approach as specified in "Tool to calculate the emission factor for an electricity system" (Version 01).

STEP 1. Identify the relevant electric power system.

The electricity grid of Slovakia is chosen as a relevant electric power system.

STEP 2. Select an operating margin (OM) method.

Calculation of the Operating Margin emission factor ($EF_{grid,OM,y}$) should be based on one of the four following methods:

- Simple OM, or
- Simple adjusted OM, or
- Dispatch Data Analysis OM, or
- Average OM.

Dispatch data analysis should be the first methodological choice, but in this case data are not available in full for Slovakia. Thus, and on the ground of fact that low-cost/must-run resources constitute more than 50% of total grid generation, calculation of the operating margin emission factor based on the method, "Simple adjusted OM" was used.

STEP 3. Calculate the operating margin emission factor according to the selected method.

The simple adjusted OM emission factor ($EF_{grid,OM\text{-}adj,y}$) is a variation of the simple OM, where the power plants / units (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (*j*). As with the simple OM, it can be calculated:

Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), as follows:

$$EF_{grid,OM\text{-}adj,y} = (1-\lambda_y) \times \frac{\sum_j EG_{j,y} \times EF_{EL,j,y}}{\sum_j EG_{j,y}} + \lambda_y \times \frac{\sum_k EG_{k,y} \times EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

Where $FC_{i,j,y}$, $FC_{i,k,y}$, NCVi,y, EFCO2,i,y, EGj,y and EGk,y are analogous to the variables described for the simple OM method above and where EFEL,j,y and EFEL,k,y should be determined as for the simple OM method above. The indices j and k are subsets of all power sources m supplying electricity to the grid in year y, where k refers to power plants / units which are either low-cost or are must-run and j refers to the remaining power plants / units.

There is no electricity imports in Slovakia.

$$\lambda_y\,(\%) = \frac{\text{Number of hours low - cost / must - run sources are on the margin in year y}}{\text{8760 hours per year}}$$

The low-cost/must-run sources' share of total power production is shown in Table 3. Approximately 83% of electricity is generated by low-cost/must-run power sources which include nuclear and hydro power plants, regional heating plants where power generation is forced and industrial power platns.

Remaining portion of electricity is produced in regulated thermal power plants.

Table 3 Low-cost/must-run resources' share of total power production until 2012.

	2005	2006	2007	2008	2009	2010	2011	2012
Total low-cost/must-run	83.1%	83.4%	83.1%	82.7%	80.6%	73.9%	75.7%	75.2%

Fig. 3 shows the estimation of the number of hours for which low-cost/must-run sources are on the margin in 2006.

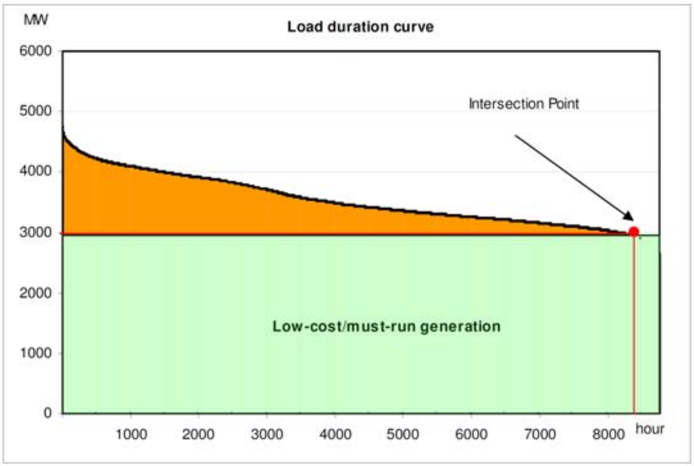


Fig. 3 The estimation of the number of hours for which low-cost/must-run sources are on the margin.

Table 4 Values of lambda within 2003-2012.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lambda λ	0.116	0.009	0.046	0.044	0.054	0.054	0.054	0.054	0.054	0.054

Table 5 Emission factors for low-cost/must-run sources – industrial generators and regional heating.

Industrial generators and Regional heating plants	2002	2003	2004	2005	2006
Total CO2 emissions (tCO2)	2,935,443	2,774,729	2,727,638	2,706,672	2,628,518
Total electricity (MWh)	4,032,394	3,838,110	3,763,026	3,662,697	3,575,420
Must-run EF (tCO2/MWh)	0.7280	0.7229	0.7249	0.7390	0.7352

Table 6 Operating Margin emission factors.

	2002	2003	2004	2005	2006
Lambda	0.116	0.116	0.046	0.044	0.054
Emission factor - regulated PP	0.9357	0.9467	0.9499	0.9485	0.9446
Emission factor - low-cost/must-run	0.7280	0.7228	0.7249	0.7390	0.7352
OM emission factor	0.9116	0.9207	0.9396	0.9393	0.9333

STEP 4. Identify the cohort of power units to be included in the build margin (BM).

The Build Margin emission factor is calculated as weighted average of emission factors for group of five power sources put in operation most recently.

Table 7 Build margin emission factor.

Plant (MWe)	Putting in Operation	Electricity (MWh)	Emissions (t-CO2)	Emission Factor (t-CO2/MWh)
Fluid boiler 110 MWe	2001	491,474	514,190	1.0462
Fluid boiler 110 MWe	2001	491,474	514,190	1.0462
CC 215 MWe	1998	978,224	424,820	0.4343
CC 88 MWe	1997	259,600	119,592	0.4607
Cogeneration unit	2002	36,191	16,719	0.4620
Total		2,256,963	1,589,513	0.7043

STEP 5. Calculate the build margin emission factor.

As shown in Table 7, Build Margin emission factor for Slovakia is 0.7043 t-CO2/MWh.

STEP 6. Calculate the combined margin (CM) emissions factor.

The baseline emission factor, the Combined Margin emission factor, is calculated as weighted average of the OM emission factor and the BM emission factor.

The calculation results are shown in Table 8.

Table 8 Combined Margin emission factors

	2002	2003	2004	2005	2006
OM EF (tCO2/MWh)	0.9116	0.9207	0.9480	0.9388	0.9354
BM EF (tCO2/MWh)	0.7043	0.7043	0.7043	0.7043	0.7043
CM EF (tCO2/MWh)	0.8079	0.8125	0.8261	0.8215	0.8198

3 Monitoring plan and methodology

3.1 Purpose of monitoring plan

Monitoring plan is designed for managing and reporting all amount of green house gas emission reductions related to the relevant project. In monitoring, it is required to ensure that the project performance will appear as high as planned and the emission reduction credit will be actually identified.

A responsible person of the project implementation must response to the inspection requirement of reporting the emission reductions with his proper data evaluation, measurements and traceability of enough reliability, transparency and accuracy. These observations and monitoring systems will be needed to confirm project's effectiveness as a part of verification or certification by selected verifier(s).

This process can also prove the actual reductions of CO2 emissions and give the fair credibility to emission credit buyers.

The unique GHG emission for wind generation as this project is the emissions from fossil fuel power plants located on the power grid over the area. The pivotal point in this case is if the implementation of proposed project could actually reduce a certain amount of these emissions.
The amount of power generation from the project is defined as the important key at monitoring. About the emission factor on the power grid, it was already calculated as the baseline emission factor of this project. In case of executing this project as JI, monitoring might not be necessary since the period of ERU issuance is relatively short - only for 5 years. On the other hand, if implementing it as "Project-backed AAU" trading project, annual monitoring for emission factors might be needed from the viewpoint of conservative emission factor management since the reduction even after 2013 will be possibly added as the Late credit.
VENTUREAL Slovakia s.r.o., the implementation body of this project, will utilize this monitoring plan as their guidance for monitoring the fulfillment of project's emission reductions. This plan may be revised as per the requests of Slovak validator(s) or verifier(s) to ensure more suitable reliability, transparency and conservativeness for the practical environment assessment and the estimation of emission reduction amount.

3.2 Monitoring methodology

In this project, power generation by wind turbines and the necessary data for calculation of emission factor on the grid will be monitored.

3.2.1 Monitoring the amount of power generation

To prove the accuracy of calculated power generation, monitoring process should be conducted by the responsible person of the project. In practice of selling some generated power to a local distribution company, the amount of electricity transmission for concerned period is determined after when two meters, placed by each of the project operator and the distribution company at a grid connection point (a substation), are verified with the same metered records.
For the monitoring of this project, as same, a meter at a substation will be used. The meter is readable with a remote operation through telecommunication lines. Monthly data from meter is processed to be documentations and stored ensuring verifier's convenient access, and all metered records have to be maintained for further demands of an inspection organization.

3.2.2 Data management system

The data management system provides information for continuous data collecting and recording during the monitoring period. The relevant and successive data recording is the most fundamental among all monitoring works. If the successive data cannot be archived in the precise and effective ways, there will be no appropriate validation for emission reductions by implementing a project. Hereafter describes the way of data management for records related to the project.

VENTUREAL Slovakia s.r.o. has complete responsibility for monitoring GHG emission reductions. Procedures of tracing the information from primary data sources towards the calculation of final data should be explained in the written documents.

To realize enough accessibility for verifier(s) to any data related this wind power generation projects, project-related documents and monitoring results are formatted as indexes, all hardcopies are stored by engineering division at the responsible body of the project (the operating company of wind power generation) and their copies are also stored as backup.

3.2.3 Determination of the monitoring result

Determination of the monitoring result for a wind power generation project is mandatory as required to all CDM projects. It is unknown at this point how the validation procedures will be for the coming validation of a JI project like this project (specially the JI based on Track 1 procedures).

However, if the same level of CDM validation is required, it is foreseen that the validation takes place semiannually or quarterly and an independent organization validates the evidence of emission reductions as described and expected in the PDD.

3.2.4 Responsibilities for the determination

The responsibilities of VENTUREAL Slovakia s.r.o. for determination are following;

- To contract with the verifier to achieve the agreement for validation activity schedule during crediting period, based on the requests of the emission-right buyer and the Ministry of Environment in Slovak Republic as a competent authority (or JISC, if necessary)
- To cooperate to the verifier, by providing all necessary information, etc., for a smoother validation process
- As the responsible person for project implementation, to cooperate completely to the verifier, to educate staff, to be available for any interviews and to response sincerely to all the questions from IE.
- To assign staff responsible for monitoring and validating, to be also responsible for all the process of monitoring and validating and to act as the contact window for the verifier.

4 Calculation of GHG emission reductions

4.1 How to calculate GHG emission reductions

This project is a wind power generation business, without bringing out neither direct nor indirect GHG emissions from the project itself. The type of GHG is only CO2. For that reason, the amount of GHG emission reduction is calculated as;

$$ER_{GHG} = EF_{GRID} \cdot Elec_{PROJECT}$$

ER_{GHG} : amount of annual GHG emission reductions

EF_{GRID} : baseline emission factor including transmission loss

$Elec_{PROJECT}$: power generation by wind power

4.2 Calculation of emission reductions

The expected power generation and GHG emission reductions at Stefanov and Svodin project are presented in Table 9 and Table 10.

Table 9 Amount of power generation and emission reductions at Stefanov project

		2008	2009	2010	2011	2012
CM Emission Factor	(tCO2/MWh)	0.8663	0.8685	0.7523	0.7580	0.7462
Electricity	(MWh)	0	44,982	89,964	89,964	89,964
Baseline Emissions	(tCO2)	0	39,067	67,680	68,193	67,131

Table 10 Amount of power generation and emission reductions at Svodin project

		2008	2009	2010	2011	2012
CM Emission Factor	(tCO2/MWh)	0.8663	0.8685	0.7523	0.7580	0.7462
Electricity	(MWh)	0	44,179	88,358	88,358	88,358
Baseline Emissions	(tCO2)	0	38,369	66,472	66,975	65,933

Table 11 Total amount of baseline emissions

		2008	2009	2010	2011	2012
CM Emission Factor	(tCO2/MWh)	0.8663	0.8685	0.7523	0.7580	0.7462
Electricity	(MWh)	0	89,161	178,322	178,322	178,322
Baseline Emissions	(tCO2)	0	77,436	134,152	135,168	133,064
Baseline Emissions Accum.		0	77,436	211,588	346,756	479,820

The total amount of GHG emission reductions from these two sites is presented in Table 12.

Table 12 Total amount of GHG emission reductions for both sites

		2008	2009	2010	2011	2012
Baseline Emissions	(tCO2)	0	77,436	134,152	135,168	133,064
Project Emissions	(tCO2)	0	0	0	0	0
Emission Reductions	(tCO2)	0	77,436	134,152	135,168	133,064

As examined above, the total amount of GHG emission reduction for both of Stefanov and Svodin project (the total for the first commitment period) is estimated to 479,820 tones of CO2 equivalent.

5 Information related to environment assessment

Environmental assessment has been performed by the VENTUREAL Slovakia Co. since the beginning of 2006, and as soon as completed as a report, a next process will be undertaken for final approval by the signature of the director of a bureau which specializes in environmental assessment in Ministry of the Environment. "Noise", "Impact on scenery", and "Impact on birds" are the three important issues in the environmental assessment which requires the approval regarding wind power generation business. In the present circumstances, it is understood that it has gone extremely well the explanation to the public meetings, local governments, etc. General reactions are positive due to the potential increase of job opportunities and the subsidy (6-7 EUR/MWh) (from xxx?) to the local governments of the power generation sites. A person in charge at VENTUREAL Slovakia s.r.o., however, made a comment that it possibly becomes a most difficult point to pass the above bureau in Ministry of the Environment since its current director is rigid to a large extent.

6 Others

6.1 Other indirect impacts

Other indirect impacts are not considered to exist at this point.

6.2 Stakeholders' comments

VENTUREAL Slovakia s.r.o. the business operator is making a collection of stakeholders' opinions and responding to them regarding to its wind power generation business itself. At this stage, mostly favorable opinions are received from each stakeholder.