Translation from Romanian

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ACTS OF THE NATIONAL REGULATORY AUTHORITY IN THE ENERGY DOMAIN

ORDER

On amending and adding the 'Technical norm Technical conditions to connect wind power parks to electricity networks of public interest' approved by Order 51/2009 of the president of the National Regulatory Authority in the Energy Domain

Taking into account the provisions of article 70 from the Electricity and natural gas law 123/2012,

Based on the provisions of article 5 par (1) letter c) and of article 9 par (1) letter h) from the Governmental Emergency Ordinance 33/2007 on the organisation and operation of the National Regulatory Authority in the Energy Domain, approved with amendments and additions under Law 160/2012,

The **president of the National Regulatory Authority in the Energy Domain** issues the following order:

Article I- The Technical norm 'Technical conditions to connect wind power parks to the electricity networks of public interest', approved by Order 51/2009 of the president of the National Regulatory Authority in the Energy Domain, published in Romania's Official Gazette, Part I, no. 306 of 11 May 2009, is amended and added as follows:

1. **Paragraph (3) of article 3 is amended and will read as follows**:

"(3) Definitions

Bus-bar(s) of the Wind Power Park	Electric bus-bar(s) where generating units from one wind power park are discharging output
Wind power park (WPP)	One or several wind units connected in the same point to the electricity network of public interest
Dispatchable wind power park (DWPP)	Wind power park with installed capacity higher than 5 MW
Non-dispatchable wind power park (NDWPP)	Wind power park with installed capacity lower or equal to 5 MW
Generating unit	Assembly of equipment (usually rotating) meant to generate electricity by converting other forms of energy
Wind generating module – Wind Turbine (WT)	Generating unit meant to change the wind kinetic energy into electricity
Network operator	According to each case, the transmission and system operator, a distribution operator or another holder of electricity network of public interest
Nominal power of a wind module	The maximum electric power that a wind generating unit can generate uninterruptedly under normal operational conditions; this value is provided by the manufacturer
Available power- Pd (of a WT or WPP)	Maximum electric power that can be generated uninterruptedly by the WT/WPP under momentary (technical and environmental) conditions specific for its location
Installed capacity (of a WPP)	Sum of the nominal power values of the WT constituting the WPP
Connection point (CP)	Physical point in the electricity network where an user is connected
Delimiting point	Place where the user's installations are delimited as property from the network operator's. The WPP delimiting point is set in the ATR.
Common point of coupling	Point of an electricity network, closest in electric terms from a user, where other users are or can be connected, usually represented by the delimiting or by the metering point, as set in the ATR.

2. **Article 4 is amended and will read as follows**:
"Article 4- The following standards will be taken into account as recommendations when applying this norm:
a) SR EN 61400-1 Wind turbines, Part 1- Design terms, applicable edition;
b) SR EN 61400-2 Wind turbines, Design terms for small turbines, applicable edition;
c) SR EN 61400-21 Wind turbines, Part 21- Measuring and evaluating the energy quality characteristics of wind turbines connected to an electricity network, applicable edition;
d) SR EN 50436 Guidelines to connect micro-generators in parallel to the low voltage public distribution networks, applicable edition;
3. **Paragraph (3) of article 10 is amended and will read as follows**:
"(3) DWPP is disconnected if frequency reaches a higher value than what corresponds to DE segment on the characteristic curve shown in figure 2. The re-connecting terms are set by the TSO".
4. **Paragraph (4) letter a) of article 10 is amended and will read as follows**:
"a) to provide active power decrease by at least 40% of the available or set power / Hz when frequency exceeds 50.2 Hz";
5. **Paragraph (4) of article 16 is amended and will read as follows**:
"(4) The response of the voltage control system should be minimum 95% of the available reactive power within 30 seconds".
6. **Article 17 is amended and will read as follows**:
"Article 17- Under the network normal operational conditions the DWPP should not generate in the CP fast voltage fluctuations higher than ±4% of the nominal voltage, in case of medium and high voltage, and no higher than ±5% of the nominal voltage, in case of low voltage".
7. **Article 19 is amended and will read as follows**:
"Article 19- Regardless of the number of WTs and of auxiliary equipment in operation and no matter what the power output is, DWPP should provide qualitative electricity in the CP according to applicable technical requirements".
8. **Article 22 is cancelled**.
9. **Article 24 is amended and will read as follows**:
"Article 24- (1) In justified circumstances pointed out by one's own studies the network operator can require additional or more restrictive terms than what is mentioned in chap. V with a view to provide safe operation of the electricity networks.
(2) DWPP with installed capacity higher than 5 MW and lower or equal to 10 MW are exempted from applying the provisions of articles 10÷12, 16, 21 and 23".
10. **Article 25 is amended and will read as follows**:
"Article 25- (1) In case of one DWPP with installed capacity ≥ 1 MW but up to 5 MW the minimum requirements are those provided in articles 5÷9, 13÷15 and 17÷20".
(2) NDWPP with installed capacity ≤ 1 MW should comply with these minimum requirements:
a) It should provide possible remote connection / disconnection;
b) It should operate in parallel with the network without generating voltage fluctuations higher than ±4% of the nominal voltage in case of medium and high voltage and no higher than ±5% of the nominal voltage in case of low voltage;
c) It should comply with the qualitative terms for the generated electricity, as set by the network operator, according to applicable technical rules;
(3) In justified circumstances pointed out by one's own studies, the grid operator can require for the NDWPP additional or more restrictive terms than what is mentioned in chap. VI, with a view to provide safe operation of the electricity network".

11. **Article 26 is amended and will read as follows**:

"Article 26- The electricity generator that holds WT/WPP with installed capacities higher than 1 MW should provide continuous transmission of information to the network operator".

12. **Article 28 is amended and will read as follows**:

"Article 28- The producer holding a WPP is compelled to provide the TSO with generation forecasts- active power- based on meteorological data, for the mid (1-3 days) and short (4-24 h) term".

13. **Article 29 is amended and will read as follows**:

"Article 29- (1) The applicant for ATR (Technical Connection Approval) and the electricity generator by WT/WPP will send to the network operator the technical data provided in table 1 or 2 of each WPP he asks connection, respectively commissioning tests for, and in such tables:

S - Standard planning data, notified in the connection request, necessary in order to elaborate the solution study;

D - Detailed planning data, notified at least 3 months before commissioning;

T - determined (recorded) data after the tests included in the testing, monitoring and control activities. Such data are determined during commissioning tests and are transmitted to the network operator within maximum 10 days from commissioning.

(2) The WT/WPP is commissioned and put in operation only following operational tests, integration in the network operator's SCADA system and transmission of test results to this one, as provided in tables 1÷5, determined according to the procedure given in article 20 par (5)".

Table 1 – Data for the DWPP

Description of data (symbol)	Measuring units	Data category
Manufacturing company of the wind unit	Name	S
Number of wind units constituting a DWPP	Number	S
Type of wind generating units constituting a DWPP	Description	S
Type approval for the wind generating unit	Certificate number	S
Network connection, location of bus-bar and delimiting point	Text, diagram	S
Nominal voltage in the delimiting point	kV	S
Electrical diagram of the entire wind power park	Diagram	D
In the wind power park		
Nominal active power of the DWPP	MW	S
Apparent maximum nominal power at the bus-bar of the DWPP	MVA	S
Net maximum active power at the bus-bar of the DWPP	MW	D
Operational frequency at nominal parameters	Hz	D
Maximum/minimum variation rate of active power that can be achieved in the DWPP	MW/min	T
Auxiliary service consumption at maximum power generated at bus-bar level	MW	T
Special connection/disconnection conditions of the wind power park, others than those of the component wind units	Text	S
Mathematical model of the wind power park and the simulations conducted	Text	D
Active power control in the CP (control loop)	Control diagram, loading-unloading rate	D
Voltage control in the CP (control loop)	Control diagram	D
Power factor control in the CP (control loop)	Control diagram	D
PQ diagram in the CP	Graphical data	T
Parameters of the line connecting to the NPS (National Power		S

System)		
Data about the wind generating units constituting the wind power park		
Type of wind unit (with horizontal / vertical shaft)	Description	S
Number of blades	Number	S
Rotor diameter	m	S
Height of rotor axis	m	S
Control system of blades (pitch/stall)	Text	S
Control system for speed (fixed / two speeds / variable)	Description	S
Type of generator		S
Nominal active power	MW	S
Maximum active power metered at the bus-bar of the DWPP - Medium value in 60 seconds - Medium value in 0.2 seconds	MW	T
Admitted maximum active power	MW	S
Nominal apparent power	kVA	S
Variation rate of active power	MW/min	T
Reactive power specified as average value of 10 minutes depending on the 10 minutes' average value of the generated active power*)	kVAr	S, T
Nominal current	A	S
Nominal voltage	V	S
Start-up wind speed	m/s	S
Nominal wind speed (corresponding to nominal power)	m/s	S
Disconnecting wind speed	m/s	S
Power variation generated by wind speed	Variation curve	S
P-Q diagram	Graphical data	D, T
MV/110 kV transformer units whereby the DWPP is connected to the 110 kV bus-bar		
Number of windings	Text	S
Nominal capacity of each winding	MVA	S
Nominal transformer ratio	kV/kV	S
Short-circuit voltage values per winding pairs	% of Unom	S
Idle run losses	kW	S
Losses on load	kW	S
Magnetising current	%	S
Connection group	Text	S
Control range	kV-kV	S
Control diagram (longitudinal or long-transversal)	Text, diagram	D
Size of control step	%	D
On load control	YES/NO	D
Saturation curve	Diagram	D
Quality parameters of electricity by each unit (designed / achieved)		
Flicker coefficient upon continuous operation*)		S, T
Flicker step factor for switching operations*)		S, T
Voltage variation factor*)		S, T
Maximum number of switches every 10 minutes*)		S, T
Maximum number of switches every 2 hours*)		S, T
At the bus-bar		
Total current distortion factor*)		S, T
Harmonics (up to 50)*)		S, T
Non-symmetry factor of negative sequence		S, T

*) In accordance with tables 3, 4 and 5

Table 2 – Data for the NDWPP

Description of data (symbol)	Measuring units	Data category
Manufacturing company of the wind unit	Name	S
Number of wind units constituting a NDWPP	Number	S
Type of wind generating units constituting a NDWPP	Description	S
Type approval for the wind generating unit	Certificate number	S
Network connection, location of bus-bar and delimiting point	Text, diagram	S

Nominal voltage in the delimiting point	kV	S
Electrical diagram of the entire wind power park	Diagram	D
In the wind power park		
Nominal active power of the NDWPP	MW	S
Maximum apparent power at the bus-bar of the NDWPP	MVA	S
Net maximum active power at the bus-bar of the NDWPP	MW	D
Operational frequency at nominal parameters	Hz	D
Auxiliary services consumption at maximum power generated on the bus-bar	MW	T
Special connection/disconnection conditions of the wind power park, others than those of component wind units	Description	S
Parameters of the line connecting to the NPS		S
Data about the wind generating units constituting the wind power park		
Type of wind unit (with horizontal/vertical shaft)	Description	S
Number of blades	Number	S
Rotor diameter	m	S
Height of rotor axis	m	S
Control system of blades (pitch/stall)	Text	S
Control system for speed (fixed/double speed/variable)	Text	S
Type of generator	Description	S
Type of frequency converter and nominal parameters (kW)		S
Nominal active power	MW	S
Maximum active power metered at the bus-bar of the NDWPP - Medium value in 60 seconds - Medium value in 0.2 seconds	MW	T
Admitted maximum active power	MW	S
Nominal apparent power	kVA	S
Variation rate of active power	MW/min	T
Reactive power specified as average 10 minutes' value depending on the 10 minutes' average value of the generated active power*)	kVAr	S
Nominal current	A	S
Nominal voltage	V	S
Start-up wind speed	m/s	S
Nominal wind speed (corresponding to nominal capacity)	m/s	S
Disconnecting wind speed	m/s	S
Variation of generated power with wind speed	Table	S
P-Q diagram	Graphical data	D, T
LV/MV, respectively MV/110 kV transformer units whereby the NDWPP is connected to the MV or to the 110 kV bus-bar		
Number of windings	Text	S
Nominal capacity of each winding	MVA	S
Nominal transformer ratio	kV/kV	S
Short-circuit voltage values by winding pairs	% of Unom	S
Idle run losses	kW	S
On load losses	kW	S
Magnetising current	%	S
Connection group	Text	S
Control range	kV-kV	S
Control diagram (longitudinal or long-transversal)	Text, diagram	D
Size of control step	%	D
On load control	YES/NO	D
Saturation curve	Diagram	D
Qualitative electricity parameters for each unit (designed / achieved)		
Flicker coefficient upon continuous operation*)		S, T
Flicker factor-step for switching operations*)		S, T
Voltage fluctuation factor*)		S, T
Maximum number of switches every 10 minutes*)		S, T
Maximum number of switches every 2 hours*)		S. T
At the bus-bar		
Total current distortion factor THDi*)		S. T

Harmonics (up to 50) *)		S, T
Non-symmetry factor of negative sequence		S, T

*) In accordance with tables 3, 4 and 5

Table 3 – Reactive power / GGE

Active power at outlet (% of P…)	Active power at outlet (kW)	Reactive power (kVAr)
0		
10		
20		
30		
40		
50		
60		
70		
80		
90		
100		
Reactive power evaluated at P_{mc} (kVAr)		
Reactive power evaluated at P_{00} (kVAr)		
Reactive power evaluated at P0.2 (kVAr)		

Table 4 – Voltage fluctuations

1. **Under continuous operation**

Phase angle of the network impedance, ψk	30o	50o	70o	85o
Annual average wind speed, va	Flicker coefficient, c (ψk, va)			
6.0 m/s				
7.5 m/s				
8.5 m/s				
10.0 m/s				

2. **In case of switching operations**

Case of switching operation	Switching at start-up speed (Vcut-in)			
Maximum number of switches, N_{10}				
Maximum number of switches, N_{120}				
Phase angle of network impedance, ψk	30°	50°	70°	85°
Flicker step factor, kf (ψk)				
Voltage fluctuation factor, ku (ψk)				
Case of switching operation	Switching at nominal speed (Vn)			
Maximum number of switches, N_{10}				
Maximum number of switches, N_{120}				
Phase angle of network impedance, ψk	30°	50°	70°	85°
Flicker step factor, kf (ψk)				
Voltage fluctuation factor, ku (ψk)				
Case of switching operation	Worst switching between wind units			
Maximum number of switches, N_{10}				
Maximum number of switches, N_{120}				
Phase angle of network impedance, ψk	30°	50°	70°	85°
Flicker step factor, kf (ψk)				
Voltage fluctuation factor, ku (ψk)				

Table 5 – Current harmonics

Rank	Active power at outlet (kW)	Harmonic current (% of In)	Rank	Active power at outlet (kW)	Harmonic current (% of In)
2			3		
4			5		

6			7		
8			9		
10			11		
12			13		
14			15		
16			17		
18			19		
20			21		
22			23		
24			25		
26			27		
28			29		
30			31		
32			33		
34			35		
36			37		
38			39		
40			41		
42			43		
44			45		
46			47		
48			49		
50					
Maximum total current distortion factor (% of In)					
Outlet power for maximum total current distortion factor (kW)					

NOTE:

Deviations from the transmitted values should be notified. Upon request of the grid operator the generator is obliged to transmit the report with test results. Any subsequent amendments should be approved by the network operator. "

14. **Article 30 is amended and will read as follows:**

"Article 30- (1) The network operator makes sure the WPP connection and operation does not lead to violating the operational terms in the frequency and voltage ranges, of the fault over-ride capability and electricity quality set in this technical norm.

(2) In case of DWPP the compliance with the terms of this norm is verified by the TSO. If the DWPP is connected to an electricity distribution network DSO (Distribution Operator) holding such network will cooperate with the TSO, under the latter's coordination, in order to do such verification.

(3) In case of NDWPP the compliance with the terms of this norm is verified by the network operator where installations of the WPP are connected to. In all circumstances the DSO cooperates with the TSO in order to do the verification.

(4) The WPP compliance with the connection rules, including the provisions of this norm, is acknowledged by issuing a certificate of compliance by the network operator responsible for verification, according to the provisions of par (1) ÷ (3).

(5) The compliance with the connection and operation conditions of the WPP is verified and the compliance certificate is issued according to a procedure elaborated by the TSO, after consulting with the DSO and getting ANRE Regulatory Authority for Energy approval. The procedure should comprise the test period and the acceptance terms depending on time".

15. **Two new articles are introduced after article 30, namely 31 and 32, reading as follows:**

"Article 31- (1) Network operators can restrict the WPP access to their electricity network, but only if the connection impacts the safe operation of the NPS by incompliance with technical norms and performance standards provided in applicable technical regulations.

(2) The DSO will transmit to the TSO copies of the technical connection endorsements issued within 3 days from such issuance.
(3) The maximum capacity that can be installed in the WPP with no restrictions, as well as the additional power reserve necessary for SEN safety depending on the installed capacity of the WPP, are set by the TSO according to its own procedure endorsed by ANRE.
(4) The maximum capacity set according to the procedure provided in par (3) represents the maximum installed capacity of all WPP that can operate free of restrictions according to the NPS conditions of the time when such maximum capacity is determined, at least 90% of a year.
(5) TSO uploads each year on its internet page the total installed capacity of the WPP which valid connection endorsements have been issued for, namely the value of the maximum capacity that can be installed in the WPP and the additional power reserve necessary for NPS safety, determined according to the procedure provided in par (3).
Article 32- (1) DSO is responsible to transmit in real time to the TSOTSO the active power values generated by the NDWPP connected in his network, in aggregated manner.
(2) DSO develops its own DMS-SCADA system within maximum 3 years from the enforcement of this norm in order to comply with the requirement of par (1) and provides the interconnection of such system with the EMS-SCADA.
(3) Holders of NDWPP with installed capacity higher than 1 MW and lower or equal to 5 MW, which are commissioned in the following 3 years from the enactment of this technical norm will transmit the active power readings to the EMS-SCADA system according to the solution agreed with the TSO".

16. **The phrase 'connection point' is replaced with 'common coupling point' in article 6, article 7 letter d), article 9 par (1), article 11 par (3), article 16 par (1), article 17 and article 27 par (3).**

Article II- Network operators and users of electricity networks will apply the provisions of this order and the specific departments of the Regulatory Authority for Energy supervise their observance.

Article III- This order is published in Romania's Official Gazette, Part I.

President of the National Regulatory Authority in the Energy Domain
Niculae Havrilet

Bucharest, 17 May 2013
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