Translation from Romanian

NATIONAL REGULATORY AUTHORITY IN THE ENERGY DOMAIN

ORDER
approving the Procedure with respect to energising for the test period and certifying the technical compliance of wind & photovoltaic power parks and cancelling par (4) of article 25 from the Technical norm 'Technical conditions to connect photovoltaic power parks to electricity networks of public interest', approved by Order 30/2013 of the president of the National Regulatory Authority in the Energy Domain

Taking into account the provisions of article 36 par (7) letter n) and of article 70 from the Electricity and natural gas law 123/2012,

Based on the provisions of article 5 par (1) letter d) 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 1 — Approval is provided for the Procedure with respect to energising for the test period and certifying the technical compliance of wind & photovoltaic power parks, elaborated by the National Power Grid Company Transelectrica SA, provided in the Annex which is integrant part of this order.

Article 2 — Economic operators that hold wind and photovoltaic power parks commissioned before the enactment of this order are obliged to get the technical compliance certificate according to the provisions of the procedure provided in article 1 by 30 June 2014.

Article 3 — The National Power Grid Company Transelectrica SA, concessionaire distribution operators and economic operators holding wind and photovoltaic power parks apply the provisions of this order, and the specific departments from the National Regulatory Authority in th Energy Domain supervise their compliance.

Article 4 - The failure to comply with the provisions of this order is sanctioned according to the Electricity and natural gas law 123/2012.

Article 5 - Paragraph (4) of article 25 from the Technica norm 'Technical conditions to connect photovoltaic power parks to electricity networks of public interest', approved by Order 30/2013 of the president of the National Regulatory Authority in the Energy Domain, published in Romania's Official Gazette, Part I, no. 312 of 30 May 2013, is cancelled upon the enforcement date of this order.

Article 6 - This order is published in Romania's Official Gazette, Part I.

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

Bucharest, 23 October 2013
No. 74

ANNEX

PROCEDURE
With respect to energising for the test period and certifying the technical compliance of wind & photovoltaic power parks

CHAPTER I
Purpose

1.1. This procedure sets the criteria, application and phase of notification process for testing a wind or photovoltaic power park, and the certification of the wind or photovoltaic power park's compliance with the technical norm requirements for connection to public interest networks.

1.2. The procedure provides- phases, documents and tests needed to prove the wind or photovoltaic power parks' compliance with technical requirements for connection to public interest networks, in order to grant the energising permit for the test period, to operate the plant in the test period and certify the technical compliance at the end of this period.

CHAPTER II
Application

2.1. The transmission and system operator, National Power Dispatcher (NDC), network operators (NSO) and applicants apply this procedure

2.2. Compliance with technical requirements to be connected to the National Power System is certifying observance by the:

a) RET-/RED-connected WPP of the provisions in the Norm Technical conditions to connect WPP to public interest networks approved by Order 51/2009 of ANRE president, as later amended and added;

b) RET-/RED-connected PVPP of the provisions in the Norm Technical conditions to connect PVPP to public interest networks approved by Order 30/2013 of ANRE president. Compliance certification is a requisite for power parks and generating units using renewable energy sources in order to get the licence, the accreditations from ANRE and the connection certificate.

2.3. This procedure is applied to wind and photovoltaic power parks with installed capacity higher than 1 MW.

2.4. The procedure deals with the following stages of certification for technical compliance:

2.4.1. Checking up the fulfilled requirements in view of energising for the test period;

2.4.2. Energising for the test period and the operation of the WPP and PVPP during such test period;

2.4.3. Issuing the compliance certificate for the fulfilled requirements from the technical norms of connection to public interest networks (NT 51 and NT 30).

CHAPTER III
Definitions and abbreviations

3.1. The terms used in this procedure are defined in the Electricity and natural gas law 123/2012, the Technical Code of the electricity transmission grid approved by Order 20/2004 of ANRE president, as later amended, the norm Technical conditions to connect wind power parks to public interest electricity approved by Order 51/2009 of ANRE president, as later amended and added, and in the norm Technical conditions to connect photovoltaic power parks to public interest networks approved by Order 30/2013.

3.2. The following abbreviations are used in this procedure:

ANRE — National Regulatory Authority in Energy;

ATR — technical connection approval;

WPP — wind power plant;

DWPP — dispatchable wind power plant, with installe capacity higher than 5 MW;

NDWPP — non-dispatchable wind power plant, with installe capacity lower or equal to 5 MW;

PVPP — photovoltaic power park (synonym: photoelectri power plant);

DPVPP — dispatchable photovoltaic power park, wit installed capacity higher than 5 MW;

NDPVPP — non-dispatchable photovoltaic power plant, wit installed capacity lower or equal to 5 MW;

CDC — certificate of technical compliance;

Cod RED — Grid Code for electricity distribution network;

Cod RET — Grid Code for electricity transmission network;

Commercial Code — Commercial code of the wholesal electricity market;

CTES — Technical-economic scientific comitee;

NPD — National Power Dispatcher, division of the TSO;

NDC — Central Power Dispatcher;

EMS — energy management system;

FO, FO-OPGW — optical fibre;

WT — power park module Wind
– wind turbine;

LEA — overhead line (OHL);

LES — underground line;

LVRT — low voltage ride through;

NT 51 — Technical conditions to connect wind power park to public interest networks approved by Order 51/2009 ofANRE president, with later amendments and additions;

NT 30 — Technical conditions to connect photovoltaic powe parks to public interest networks approved by Order 30/2013 o ANRE president;

DSO — distribution system operator;

NSO — network system operator; this can be the concessionnaire transmission and system or distribution operator;

TSO — transmission and system operator- National Power Grid Company Transelectrica SA (Transelectrica);

CP — common point of coupling;

Pi — installed capacity;

PIF — commissioning/energezing;

PSL — power standard lab;

RAR — fast automatic re-closure;

RED — electricity distribution network;

RET — electricity transmission grid;

SCADA — IT monitoring, control and data acquisition system of a technological process or installation;

SCADA/EMS — Supervisory Control and Data Acquisition/ Energy Management System;

SCADA/DMS — Supervisory Control and Data Acquisition/ Distribution Management System;

NPS — National Power System;

STC — standard test condition: 1000 W/m^2 radiance, atmospheric mass AM- 1.5 and photovoltaic cell temperature- 25°C;

THD — total harmonic distortion factor;

ZVRT — zero voltage ride through

LVRT — Low Voltage Ride Through

CHAPTER IV
Reference documents

4.1. Electricity and natural gas law 123/2012;

4.2. Technical Code of the electricity transmission grid approved by Order 20/2004 of ANRE president, with later

amendments;

4.3. Technical Code of the electricity distribution network approved by Order 128/2008 of ANRE president;

4.4. Technical norm Technical conditions to connect wind power parks to electricity networks of public interest approved by Order 51/2009 of ANRE president, with later amendments and additions;

4.5. Technical norm Technical conditions to connect photovoltaic power parks to electricity networks of public interest approved by Order 30/2013 of ANRE president;

4.6. Metering code of electricity approved by Order 17/2002 of ANRE president;

4.7. Applicable regulation for users' connection to electricity networks of public interest;

4.8. Regulation setpoint users' connection solutions to electricity networks of public interest approved by Order 129/2008 of ANRE president;

4.9. Methodology on issuance of location endorsements by network operators approved by Order 48/2008 of ANRE president, with later amendments;

4.10. Technical norm with respect to delimiting the protection and safety areas for power capacities, revision I, approved by Order 4/2007 of ANRE president, with later amendments and additions;

4.11. Performance standard for electricity transmission & system services approved by Order 17/2007 of ANRE president;

4.12. Performance standard for electricity distribution services approved by Order 28/2007 of ANRE president;

4.13. General regulation of manoeuvres into medium and high voltage electricity installations, NTE 009/10/00, RGM/2010.

CHAPTER V
Responsibilities

5.1. **Applicant's responsibilities**

The applicant is holder of the WPP/PVPP settting permit or holder of a licence for commercial operation of a WPP/PVPP commissioned before the enactment of this procedure.

a) Drawing up the technical documentation according to annex 1 (for WPP), respectively annex 2 (for PVPP), depending on the power park type;

b) Submitting the energising request for the test period, accompanied by technical documents and also specifies the planned date for commissioning:

— To NPD for power parks with installed capacity higher or equal to 10 MW;

— To the DSO that issued the technical connection endorsement for the WPP/PVPP or to other holder of electricity distribution network where the WPP/PVPP is connected, in case of power parks with installed capacity lower than 10 MW;

c) Conducting by means of licensed companies type A the tests checking the performance in terms of technical compliance with the connection requirements of the plant to public interest networks, according to the procedures of annex 4 (WPP) and annex 5 (PVPP), depending on the plant type;

d) Submitting the results of the preliminary and final tests to NPD in case of power parks with installed capacity higher than 5 MW and to the DSO for power parks with installed capacity lower or equal to 5 MW;

e) Submitting the request to get the technical compliance certificate, if applicable,- to NPD for power parks with installed capacity higher than 5 MW, respectively to the DSO for pow parks with installed capacity lower or equal to 5 MW; th models of such requests are given in annexes 6 and 7;

f) For such test period he concludes the operation agreement and, if applicable, the contract(s) for electrici transmission, distribution or supply according to applicab norms;

5.2. **Responsibilities of NPD**

a) Examining the technical documentation submitted by th applicant or transmitted by the DSO;

b) Notifying the energising agreement to the applicant an according to each case, to the DSO based on the compliance transmitted documentation with the requirements of technic norms and with the applicable RET Code;

c) Uploading the time spread-out of dispatchable powe parks commissioning (Pi > 5 MW) on Transelectrica's websit to http://www.transelectrica.ro/Transparenta/eprobe.php;

d) Reviewing the documents with preliminary test result checking the technical compliance with the requirements applicable technical norms, as well as the results of final tests;

e) Participating to the final tests for all dispatchable powe parks with installed capacity above 10 MW and reviewing th results of final tests carried out by dispatchable power plant with installed capacity above 5 MW and lower than 10 MW conducted before the DSO representatives;

f) Issuing technical compliance certificates for fulfille requirements of NPS connection (operation) for dispatchabl power plants with installed capacity higher than 5 MW;

g) Providing transparency with respect to the situation of dispatchable power plants with installed capacity higher than 5 MW found during the test period (notified as provisional operation) on Transelectrica's website to the following address http://www.transelectrica.ro/Transparenta/centraleprobe.php;

h) Providing transparency on the issuance of compliance certificates for dispatchable power plants to the technical requirements of NPS connection, on Transelectrica website to http://www.transelectrica.ro/Transparenta/centraleprobe.php;

5.3. **Responsibilities of the DSO**

a) Reviewing the technical documentation submitted by the applicant for power parks with installed capacity lower or equal to 10 MW, which are connected to his network;

b) Transmitting to NPD the request for the energising permit during the test period of the power plant, within 10 week-days from the submission of all documents according to annexes 1 and 2 for wind and photovoltaic power parks with installed capacity ranging from 5 to 10 MW, which will be connected to the DSO;

c) Informing the NPD about the applicant's submission of technical documents for non-dispatchable wind or photovoltaic power parks with installed capacity lower than 5 MW and higher than 1 MW, within 5 week-days from submission, while also notifying the date when the applicant intends to energise the power plant for tests; DSO sends to NPD the technical data it asks for and requires NPD's opinion about the compliance for inverter type and the WT;

d) Transmitting to the applicant the agreement to energise for the test period of the power plant installations; in case of power plants with capacity higher than 5 MW, the agreement is sent to the applicant based on NPD's agreement, only after having received it;

e) Reviewing the documentation with the preliminary and final test results carried out by the power parks with installed capacity lower or equal to 10 MW, according to the ATR;

f) Participating to the final tests conducted by wind and

photovoltaic power parks with installed capacity lower than 10 MW, commissioned according to the development stage specified in the ATR;

g) Issuing the technical compliance certificate for the fulfilled requirements of connection to public interest networks for the wind and photovoltaic power parks with installed capacity lower or equal to 5 MW and higher or equal to 1 MW, according to the development stage specified in the ATR;

h) Providing transparency of the technical compliance certification process on its own website and transmitting to NPD the situation of compliance certificates issued;

CHAPTER VI
Mode of operation

6.1. Energising wind and photovoltaic power parks for the test period

6.1.1. Such energising for the test period of wind and photovoltaic power parks takes place only when the energising agreement has been received, issued according to each case by:

a) NPD for power plants with Pi > 5 MW;

b) DSO for non-dispatchable power plants (Pi ≤ 5 MW and Pi ≥ 1 MW).

6.1.2. Energising the wind or photovoltaic power park refers strictly to the electricity generating installations (WT, inverters) and to the auxiliary offset means, if applicable, installed in order to cover the reactive power requirements as necessary to be generated / off-set by it (WPP and PVPP).

6.1.3. The energising agreement process for the test period of wind and photovoltaic power parks is provided in annexes 10, 11 and 12, comprising the following stages:

a) Submitting the technical documentation of the WPP, respectively the PVPP;

b) Reviewing the documentation;

c) Submitting the documents certifying preliminary work has been executed for energising, and the request of energising during the test period;

d) Concluding the operational agreement and, if applicable, the contract(s) for electricity transmission, distribution or supply during the test period, while observing applicable norms;

e) Granting the energising right to the power plant;

6.1.4. Submitting the technical documentation of the WPP, respectively the PVPP:

6.1.4.1. The applicant transmits the technical documentation provided in annex 1 (WPP) or annex 2 (PVPP):

a) To NPD, 6 months before the forecasted commissioning date, in case of power plants greater than 10 MW;

b) To the DSO it will be connected to, 3 months before the forecasted commissioning date, in case of power plants with capacity ranging 1÷10 MW, included;

6.1.5. Review of the technical documentation

6.1.5.1. Within 30 calendar days from receipt NPD reviews the documentation of power plants with installed capacity higher than 10 MW, elaborated according to annex 1, namely annex 2, as well as the documentation on the inverters and wind generating units. NPD requires adding the documentation, if applicable, and answers the applicant in writing sending a copy to the respective DSO about the compliance of the technical documentation.

6.1.5.2. Within 5 week-days from receipt the DSO reviews the documentation for power plants with installed capacity higher than 5 MW and lower than 10 MW included, elaborate according to annex 1, namely annex 2, requires adding suc documentation if applicable and transmits the fu documentation to NPD.

6.1.5.3. Within 20 calendar days from receipt NPD review the documentation from the DSO on power plants with installe capacity higher than 5 MW and lower than 10 MW included, th documents on inverters and wind generating units, require adding the documentation, if applicable, and answers th applicant in writing with copy to the respective DSO about th compliance of the technical documentation.

6.1.5.4. Within 20 calendar days from receipt the DSC reviews the documentation for power plants with installe capacity lower than 5 MW, requires adding it, if applicable, an can ask NPD for information on the compliance of the technica documentation on inverters or WTs.

6.1.6. Submitting the documents certifying preliminary worl has been executed for energising, and the request of energising during the test period.

6.1.6.1. In case of power plants with installed capacity highe than 10 MW the applicant submits to NPD the following documents, at least 10 week-days before the require energising date in the wind or photovoltaic power park:

a) Request of energising during the test period, according t annex 6;

b) Documents certifying the communication link has beer achieved (at least one of the two redundant paths) between the power plant and the TSO's optical fibre communication network

c) Documents certifying the power plant has been integrate in the TSO's EMS-SCADA system;

d) Documents certifying the power plant has been integrated in the TSO's forecast system;

e) The proposed commissioning schedule of the power plant, with the actuating sequence of WT, respectively inverters up to the capacity approved in the ATR corresponding to the stage specified in the ATR (if applicable); TSO is obliged to publish such schedule on its website;

f) The data required in annex 3, the name of the dispatching entity where the power plant will be assigned, and the responsible persons in operational terms after power plant energising;

g) In case of power plants connected in the TSO's transformer substations documents are needed to certify the power quality analyser was installed in the TSO's monitoring system for electricity quality;

6.1.6.2. In case of power plants with installed capacity higher than 5 MW and lower than 10 MW included, the applicant submits to the network operator, at least 10 week-days before the requested energising date of the wind or photovoltaic power park, the following documents:

a) Request of energising for the test period, according to annex 6;

b) Documents certifying the aggregation and integration solution has been implemented into the TSO's EMS-SCADA, as agreed with the latter one;

c) Documents certifying integration in the DMS-SCADA of DSO and in TSO's EMS-SCADA by one of the paths mentioned in letter b);

d) Documents certifying power plant's integration in the TSO's forecast system;

e) The proposed commissioning schedule of the power plant, with the actuating sequence of WT, respectively inverters up to the capacity approved in the ATR corresponding to the stage specified in the ATR (if applicable);

TSO is obliged to publish such schedule on its website;

f) The dispatching entity where the power plant will be assigned and the operational responsible persons after energising;

6.1.6.3. Within 5 week-days from receipt the DSO reviews whether the documentation received for power plants with installed capacity higher than 5 MW and lower than 10 MW included is full, according to the provisions of 6.1.6.2, he requires adding such documentation if applicable and transmits the complete documents to the TSO.

6.1.6.4. In case of power plants with installed capacity higher than 1 MW and lower than 5 MW included the applicant submits to the DSO, at least 10 week-days before the requested energising date for the wind or photovoltaic power plant, the following documents:

a) Request of energising for the test period, according to annex 6;

b) Documents certifying achieved communication link with the DMS-SCADA (one communication path);

c) Documents certifying integration into the DMS-SCADA systems; such integration refers to at least P (active power) and Q (reactive power) values;

d) The commissioning schedule of the power plant, for instance- generating units WT, invertors, as time sequence up to the capacity approved in the ATR corresponding to the stage specified in the ATR (if applicable);

6.1.7. The agreement to energise the wind or photovoltaic power park during test periods

6.1.7.1. Within 5 week-days from the receipt of full compliant technical documentation given in 6.1.4.1 (annexes 1 & 2) and of the documents specified in 6.1.6.1 and 6.1.6.2, NPD sends to the applicant and, if applicable, to the DSO its agreement to energise during the test period.

6.1.7.2. DSO transmits the energising agreement to the applicant for the test period within 5 week-days from its receipt of full technical documentation and of the documents specified in 6.1.6.4 and 6.1.3 letter d).

6.1.7.3. The agreement provided in 6.1.7.1 is issued only when the following requirements have been fully complied with:

a) The protections required in ATR are installed and the controls are set to the values required by NPD/DSO (article 13 of NT 51), as confirmed by test bulletins;

b) Proof is made the generating elements (WT, inverters, generating units etc.) to be commissioned comply with the requirements from applicable technical norms, by means of check-up certificates recognizeded in Europe;

c) The data requested in 6.1.6.1 and 6.1.6.2, as well as in 6.1.4.1 letter a) and 6.1.4.1 letter b) have been complied with and transmitted to NPD;

d) The commissioning period of the power plant, according to the transmitted schedule, including the preliminary test period, complies with the validity term of the establishment authorisation from ANRE;

6.1.7.4. NPD issues the Order investing the attributes of the dispatcher managerial authority for the respective installations, which will be transmitted to dispatchs responsible from dispatch structure, and generator's dispatcher.

6.1.7.5. In case NPD issues negative answer to the request to energise the WPP/PVPP with installed capacity higher than 5 MW, then NPD transmits a list of incompliances to the applicant and a copy to the DSO, within 5 week-days, as well as a postponed date to commission the wind or photovoltaic power park until such incompliances are removed.

6.1.7.6. If the answer of NPD to the energising request of power plant with installed capacity higher than 5 MW affirmative, the equipment is energised in accordance with th schedule elaborated by dispatch responsible strucuture applicable) together with the applicant.

6.1.7.7. NSO transmits the agreement to energise the WP and PVPP to the applicant within 5 week-days from its receipt complete documents specified in 6.1.6.4.

6.1.7.8. In case NSO issues negative answer to the reque to energise the WPP/PVPPwith installed capacity from 1 MW 5 MW included, NSO transmits a list of incompliances to th applicant, within 5 week-days, and the postpone commissioning date of the WPP or PVPP until such ar removed.

6.1.7.9. If the answer of NSO to the energising request fo WPP/PVPP with installed capacity from 1 MW to 5 MW included affirmative, the equipment is energised in accordance with th schedule elaborated by theritorial dispatch or zonal DSO applicable) together with the applicant.

6.1.7.10. The network operator energises th WPP/PVPPwithin 5 week-days from the issuance date of th energising agreement.

6.2. **Operation during test period**

6.2.1. Test period operation represents the time interval when generating equipment is energised, auxiliary equipment is completed (in order to cover the need of reactive power if applicable, of voltage control installations in the CP etc.) and component equipment is regulated in order to bring it to the level of technical performance specified in the connection requirements. The test period ends with the issuance of the technical compliance certificate and the connection certificate.

6.2.2. Test period operation provides the possible network operation and use where generating equipment inputs for a limited time interval, according to applicable regulations.

6.2.3. During the test period the power plant responds to dispatcher's orders according to what is provided in annex 3, by means of:

a) Disconnection / connection;

b) Changing the generated active power according to the value level asked by the dispatcher;

c) Changing the reactive power injected / taken out from the network to the value level required by the dispatcher.

6.2.4. Preliminary tests to check the technical compliance of wind and photovoltaic power parks

6.2.4.1. Preliminary tests are conducted according to the provisions from annexes 4 and 5.

6.2.4.2. Preliminary tests are carried out only when at least 90% of the installed capacity set in the ATR has been commissioned in each of the commissioning stages, if needed.

6.2.4.3. Preliminary tests are performed by a third party (type A licensed company), without the participation of the NPD/DSO representative (if applicable).

6.2.4.4. Complete documents with the preliminary test results for WPP and PVPP with capacity higher than 5 MW are sent to NPD.

6.2.4.5. In 15 calendar days NPD reviews the documents with test results and requires completion, if such is the case.

6.2.4.6. NPD transmits to the applicant in writing the possible incompliances and sets terms to remove them.

6.2.4.7. When incompliances have been eliminated the applicant requests approval for the final tests checking the compliance of the power plant.

6.2.5. Final tests to check the power plant's technical compliance with the connection requirements

6.2.5.1. In case of power plants with installed capacity above 10 MW, the applicant determines with NPD, also informing the DSO, a final tests period to check the compliance, while in case of power plants with installed capacity higher than 1 MW and lower or equal to 10 MW, the applicant determines together with NSO such final test period, which is conditioned by operational status at available capacity of minimum 60% from the installed capacity approved in the ATR for the respective commissioning stage (if applicable).

6.2.5.2. In case of power plants with installed capacity above 10 MW, the applicant transmits to NPD the invitation to participate to final tests, and in case of power plants with capacity lower or equal to 10 MW the applicant sends such attendance invitation to final final tests to the respective NSO.

6.2.5.3. The network operator and NPD are obliged to answer the applicant within 3 week-days from receipt of the invitaion specified in 6.2.5.2.

6.2.5.4. Final tests are conducted according to the provisions from annexes 4 and 5.

6.2.5.5. In case of power plants with ATR providing total installed capacity to be achieved in stages, preliminary and final tests will be conducted according to the installed capacity of each stage.

6.2.5.6. When final commissioning tests of the power plant have been done the applicant, the test contractor, NPD and NSO (if applicable) draw up minutes including- the incompliances ascertained during final tests, the additions to the existing controls of the power plant and the values of settable parameters from control loops, as well as the power plant's operation of the at the end of the test period.

6.2.5.7. The applicant transmits the full documents with the results of final tests to NPD and NSO (if applicable).

6.3. **Granting the technical compliance certificate to the WPP and PVPP**

6.3.1. In case of dispatchable power plants the applicant sends to NPD the request to issue the compliance certificate acoording to annex 7, accompanied by the following documents:

a) Confirming the setpoints of protections at the end of the commissioning stage for dispatchable power parks with capacities higher than 10 MW;

b) The results of final tests, including the minutes elaborated during these;

c) Minutes elaborated after the tests are also transmitted to the NSO;

d) Confirming the removal of incompliances and the achieved parameter setpoint of control loops mentioned in the minutes elaborated upon final tests;

e) An existing operational dispatch centre wherefrom active and reactive power setpoints can be transmitted to the dispatchable power plants with capacity ranging 5 ÷ 10 MW, including set values for active & reactive power and voltage, as well as a selection of control regimes of reactive power or voltage, namely operation as per the power - frequency curve in case of power plants with capacities higher than 10 MW connected to the DSO network;

f) Integrating the set values exchanged with the EMS-SCADA into the local setpoints of dispatchable power plants with capacity higher than 10 MW;

g) Putting in operation and integrating additional offset means into the control loops of reactive power and voltage for DWPP/DPVPP with capacity higher than 10 MW, namely into the control loop of reactive power for PVPP with capacity higher than 5 MW and lower than 10 MW included;

h) Listing and complying with the measures avoiding islan operation;

6.3.2. In case of NDWPP/NDPVPP the applicant transmits t NSO a request asking for the issuance of the complianc certificate according to annex 7, accompanied by the followin documents:

a) Registrations of the power quality as per standar SREN50160 (by temporary / permanent meters), which certif the standard limits are observed;

b) Observing the protection setpoints of the DSO;

c) Integrating into DMS-SCADA;

d) For NDWPP and NDPVPP- checking the technica compliance of generating units and of inverters based on th transmitted certificates (annex 1 and annex 2);

e) Writing down the measures applied in order to avoid th islanding operation;

f) The results of check-up tests performed according to thi procedure and, if applicable, the results of additional test required by the OR;

6.3.3. NPD issues CDC with the technical requirements fo connection public interest networks for a DWPP/DPVP connected to the TSO/DSO if the following are observed:

a) The results of final tests prove the compliance with th technical requirements;

b) The power quality monitored for at least 2 weeks durin tests stays within the limits of the quality standard;

c) According to each case, there are offset means fo reactive power and they have been integrated in control loops;

d) The set values sent by NPD through the EMS-SCAD system are received and integrated into the control systems o the DWPP/DPVPP with capacity higher than 10 MW;

e) Integration into the forecast system of NPD;

f) The quality analyser for the electricity generatedd by DWPP/DPVPP connected to the TSOis integrated into the TSO's system monitoring the electricity quality;

g) Two redundant communication pathsare provided with the TSO's optical fibre communication system for the power plants with capacity higher than 10 MW;

h) The compliance of component WT and inverters is proven by compliance certificates issued by European laboratories of worldwide acknowledgment;

6.3.4. In case all requirements of 6.3.3 are observed technical compliance certificates are granted for good.

6.3.5. In case of generating units with ATR providing total installed capacity to be achieved in stages, certification is granted for each development stage provided in the ATR.

6.3.6. The applicant is obliged to observe the Regulation of dispatch management of the National Power System and the General regulation of manoeuvres into medium and high voltage electricity installations, approved by order of ANRE president.

6.3.7. In case of DWPP/DPVPPwith installed capacity higher than 10 MW DEC (decision making dispatcher centre) issues the Order investing the attributes of the dispatcher managerial authority to the respective installations.

6.3.8. In case of DWPP/DPVPP with installed capacity ranging 5 MW ÷ 10 MW DET (decision making dispatcher centre) issues the Order investing the attributes of the dispatcher managerial authority to the respective installations.

6.3.9. In case of NDWPP/NDPVPP, DSO issues the Order investing the attributes of the dispatcher managerial authority to the respective installations.

6.3.10. The respective network operator issues the

compliance certificate conformitate for NDWPP/NDPVPP.

6.3.11. In exceptional circumstances CDC can ge granted in temporary terms for WPP and PVPP with installed capacity higher than 5 MW, but no more than 6 months and only in case of just one incompliance.

6.3.12. In case dispatcher orders are repeatedly trespassed, as well as the regulated limits of power quality parameters, the operational performance determined upon testing, and in the absence of metering data or failure to take over set values, the TSO/DSO notifies ANRE about the market applicant's trespassing of technical regulations issued by ANRE.

CHAPTER VII
Reports and registrations

7.1. The request for compliance certification and the attached technical documentation is kept by NPD.

7.2. All the technical documents, recods of preliminary and final tests as well as other required documents are kept within NPD. They can be placed at the DSO's disposal upon request.

7.3. The original compliance certificate (whose template is given in annex 8) is handed over to the applicant. A copy of such compliance certificate is sent to ANRE. The issuer is also keeping a copy of the certificate.

7.4. TSO provides transparency of data about the DWPP and DPVPP under tests (on the website http://www.transelectrica.ro/Transparenta/centraleprobe.php) and the situation of issued compliance certificates (according to the template from annex 8) on the website http://www.transelectrica.ro/Transparenta/functionare/Certificare a_conformitatii_cu_NT51 of the DWPP The document will include the date of preliminary tests, the date of final tests and the kind of technical compliance granted.

7.5. The synthesis of the certification process granting technical compliance to WPP and PVPP is provided in annex 9.

CHAPTER VIII
Final provisions

8.1. Economic operators that carry out compliance tests request certification from ANRE within 6 months from the enactement of this procedure. Until such date, in accordance with this procedure, tests can be conducted by economic operators agreed by the TSO, as per the procedure Acceptance of suppliers of products/service/work, TEL code - 04.08.

8.2. Annexes 1÷12 are integrant parts of this procedure.

ANNEX 1
to the procedure

TECHNICAL DATA
that need to be transmitted by wind power parks (WPP)

CHAPTER I
Technical data that need to be transmitted for dispatchable WPP with installed capacity over 10 MW

The applicants submit to the TSO, 6 months befor energising, the following documentation:

1. Copy of the ATR and of the connection contract;
2. Establishment authorisation from ANRE;
3. Technical project of the WPP, showing the length an technical characteristics of the cables and of the link to the DS or TSO substation/bay, the connection mode of the WT an auxiliary installations, and the single line electric diagram of th substation and of the power plant (according to annex 1.1);
4. Control diagrams (detailed) for active & reactive powe and voltage in the WPP, in order to point out how:

— it is taken in consideration the frequency measure t implement the P-f curve;

— The frequency — active power relation is implemente according to article 10 of NT 51;

— The set values of P (active power), Q (reactive power U (voltage), including the selection of operational regimes fc DWPP reactive power / voltage, are taken over from the DEC dispatcher centre;

— it is taken in consideration the voltage measure in th voltage control of theCP;

— it is taken in consideration de reactive power measure i the voltage control of the CP;

— The U/Q control diagrams provide:

• Continuous voltage control in the voltage fluctuation limit of the CP fully using the WPP's P-Q diagram in the CP, a auxiliary means and all on-load tap changers of transformers;

• Continuous reactive power control is provided in the CP i the limits of WPP's P-Q diagram in the CP (as equivaler generator), by fully using the reactive power possibly supplied b the WT with its P-Q diagrams and auxiliary control means;

5. The mathematic model of the WT, of the entire plant, c the reactive power offset means in the connection point at 0.9 inductive ÷ 0.95 capacitive and exchanging null reactive powe with the system in case WPP gives null active power;

6. Network study to calculate the need of reactive power in the connection point to observe the requirements of article 16 from NT 51 (0.95 inductive ÷ 0.95 capacitive) in all the active power range, while providing null reactive exchange with the system in case the active power generated is null. The P-Q diagram of the WPP will be attached in the connection point (including the input of all WT and of auxiliary means);

7. The dynamic regime study of the WPP and of the area in order to determine the measures avoiding the island operation (according to article 18 from NT 51);

8. Techniceal data necessary for calculations of steady-state and dynamic regimes (as per annexes 1.1 and 1.3);

9. Technical data of primary equipment- the 110 kV/MV, and MV/LV transformers, technical-electric data of WT, including the electric parameters, control diagrams and proper protections (according to annex 1.2);

10. For each type of WT to be installed- copies of the check-up documents and certificates, the records with test measured parameters by specific international companies licensed in Europe, which should certify:

— The P—Q capability curve has been verified;

— Ride through;

— WT operation in the frequency range (47.5÷52) Hz at 1 Hz/sec frequency variation rates, upon (0.9 ÷ 1.1) x Un voltage fluctuations;

— Disturbances introduced in terms of power quality (harmonics and flicker);

— The response to variations in the set values of P and Q;

Certificates will be accompanied by records made during such tests (for LVRT, as well as P and Q control);

11. Technical data necessary for calculations of protection controls (according to annexes 1.2 and 1.3);

12. Telecommunication projects mentioning the main communication path between DWPP and the connecting substation to TSO's EMS-SCADA; the main communication path is made by optical fibre with back-up path provided. Telecommunication projects should be endorsed by TSO's CTES; the main communication path used for DMS-SCADA integration means transmitting the disconnection data from the settlement group, respectively the settlement meter; telecom-munication projects should be endorsed in the CTES meeting of the distribution operator;

13. Providing WPP integration in EMS-SCADA. The WPP commissioning agreement is conditioned by the document certifying DWPP integration in EMS-SCADA. Proof will be submitted that the signal exchange was checked for DWPP integration into EMS-SCADA;

14. The staged commissioning schedule of the WPP, from he commissioning of the substation, link, WT; the schedule will be detailed by installed capacity stages;

15. Technical characteristics of power quality analyser to be installed in the connection point if the WPP is connected to a TSO substation; the analyser should be of class A, PSL certified and able to send SQL, PQDIF, .txt or xls files in the structure required by the TSO's power quality monitoring system; it will be integrated in the TSO's power quality monitoring system;

16. Minutes certifying integration in TSO's forecast system;

17. Equipment supplier's procedure of WT commissioning;

18. Data necessary to issue the investment order, according to the provisions from annex 3 to the procedure;

The data required in 8, 9, 11 & 18 are sent at least 60 calendar days before commissioning.

CHAPTER II

Technical data that need to be transmitted by DWPP with installed capacity above 5 MW and lower or equal to 10 MW

Applicants submit to the DSO, 3 months before energising, the following documents:

1. Copy of the ATR and of the connection contract;

2. Establishment authorisation from ANRE;

3. Technical project of the WPP, showing cable lengths and technical characteristics, and of the link to the DSO's or TSO's substation/bay, the connection of the WT and auxiliary installations, and the electric diagram of the substation and of the power plant (according to annex 1.1);

4. (Detailed) control diagrams of active power in the WPP;

5. Mathematical model of the WT;

6. WPP's dynamic regime study and of the area to determine the measures preventing island operation (according to the requirement of article18 in NT 51);

7. Technical data necessary for calculations of steady-state and dynamic regimes (as per annex 1.1 and the requirement of article 18 in NT 51);

8. Technical data of primary equipment- 110 kV/MV and MV/LV transformers of the WT, with electrical parameters control diagrams and proper protections (as per annex 1.2);

9. Each type of WT to be installed will be accompanied by copies of the check-up documents and certificates, and the records of parameters measured upon tests conducted by specific international companies recognised in Europe, which should certify:

— Verification of the P-Q capability curve;

— Fault ride through;

— WT operation in the (47.5 ÷ 52) Hz frequency range, at Hz/sec frequency variation rates and (0.9 ÷ 1.1) x Un voltage fluctuations;

— Disturbances introduced in terms of power quality (harmonics and flicker);

— The response to variations in the P and Q set values;

Certificatele vor fi însoțite de înregistrările efectuate în cadru acestor teste (pentru LVRT, precum și reglajul P și Q);

10. datele tehnice necesare calculelor aferente reglajelo protecțiilor (conform anexelor nr. 1.2 și 1.3);

11. Telecommunication project specifying- the main communication path and integration into the DSO's DMS-SCADA; the main communication path used for DMS-SCADA integration is also transmitting settlement data taken from the settlement unit, namely meter; telecom projects should be endorsed in the DSO's CTES; in case there is DSO link between the DSO's DMS-SCADA and TSO's EMS-SCADA (for an intermediate time until 2016) the P,Q, U data and the circuit breaker position are sent either directly in an interface point with the TSO's communication system of the dispatcher centre it is assigned to, or in an intermediate data gathering entity agreed with the DSO;

12. Document stating WPP integration in the EMS-SCADA; the agreement on the WPP first commissioning is conditioned by the document certifying WPP's EMS-SCADA integration through the DMS-SCADA or, for a time period until 2016, by the technical solution agreed with the TSO as per NT 51;

13. WPP's staged commissioning schedule beginning with the substation, the connector, the WT;

14. Minutes certifying integration in TSO's forecast system;

15. Data necessary to issue the investment order, according to the provisions from annex 3 to the procedure;

The data required in 8, 9, 11 and 15 are sent at least 60 calendar days before commissioning.

CHAPTER III

Technical data to be transmitted by non-dispatchable WPP with installed capacity above 1 MW and lower or equal to 5 MW

Applicants submit to the NSO they are connected to, 3 months before energising, the following documents:

1. Copy of the ATR and of the connection contract;

2. Technical project of the WPP showing cable length and technical characteristics and of the link to the DSO or TSO substation / bay, the WT and auxiliary installations connection, and the electric diagram of the substation and of the power plant (according to annex 1.1);

3. Aggregated integration into EMS-SCADA according to article 32 in NT 51;

4. WT's simplified mathematical model from the manufacturer;

5. Upon NPD's request (in specific circumstances),

techniceal data necessary for calculations of steady-state and dynamic regimes (according to annex 1.1);

6. Upon NPD's request (in specific circumstances), the technical data of primary equipment- the 110 kV/MV & MV/LV tranformers of the WT, with electrical parameters, control diagrams and proper protections (as per annexes 1. 2 & 1.3);

7. Each type of WT to be installed will be accompanied by copies of check-up documents and certificates, and the records of parameters measured upon testing made by specific international companies recognised in Europe, certifying:

— Verification of the P-Q capability curve;

— Fault ride through;

— WT operation in the (47.5 ÷ 52) Hz frequency range, at 1 Hz/sec frequency variation rates and (0.9 ÷ 1.1) x Un voltage fluctuations;

— Disturbances introduced in terms of power quality (harmonics and flicker);

— The response to variations in the P and Q set values;

Certificates will be accompanied by records made during such tests (for LVRT, as well as P and Q control);

8. Telecommunication project specifying the main communication path used for DMS-SCADA integration, which transmits the settlement data taken from the settlement unit, namely meter; telecommunication projects should be endorsed by DSO's CTES.

ANNEX 1.1
to annex 1 of the procedure

Data necessary for calculations of steady-state regimes, short-circuit currents and dynamic data for WPP

CHAPTER I
DWPP data necessary for calculations of steady-state regimes and short-circuit currents

DWPP data necessary for calculations of steady-state regimes and short-circuit currents are as follows:

a) Electrical diagram of the entire wind power park and of the system-connecting substation;

b) Length of all DWPP cables and OHL length or of underground cables between DWPP and the connecting substation;

c) Electric parameters specific to all cables and lines;

Lines and/or cable parameters		
Type (material)		
R_+	[Ω/km] at 20°C	
X_+	[Ω/km]	
C_+	[μFarad/km]	
R_0	[Ω/km]	
X_0	[Ω/km]	
S	[mm²]	
U_n	[kV]	

d) Data of the WT constituting the wind power park- number, nominal active power, P-Q diagram of each WT type, and the fluctuation rate of active power;

e) In case of MV/110 kV, MV/LV kV transformers- nominal capacity of windings, nominal voltage, idle run losses, copper losses, short-circuit voltage, idle run current, connection group, voltage control (control type & range, with the number of the nominal tap, maximum number of taps), neutral treatment;

f) Data on the reactive power offset system (e.g. condenser batteries- number of steps, installed capacity of each step) and indicating where such system is installed in the electrical diatram requested;

CHAPTER II
Dynamic data of the DWPP and NDWPP

Dynamic data of the DWPP and NDWPP are as follows:

a) Type of wind turbine-generator uni (e.g. double feed, full conversion);

b) Nominal capacity;

c) Logic operational diagram of the WT;

d) WT mathematical model and model parameters;

e) Electrical control system- control diagrams and parameters (Q control for NDWPP; P, Q control for DWPP with capacity ranging 5 ÷ 10 MW, included and P, Q, U for DWPP with capacity above 10 MW);

f) WT modelling parameters; diagram and parameters for current limits to the converter;

g) Control systems of the power plant- control diagrams and parameters of the DWPP;

h) Fault ride through measures- dynamic model, parameters of the NDWPP;

i) LVRT or ZVRT protections against voltage fluctuations for both the DWPP and the NDWPP;

j) Other special functions- low voltage power logic, participation to voltage control etc., for DWPP and NDWPP;

k) Dynamic equivalent of the wind power park;

l) WT model and control systems modelled as diagrams in the power plant (with all mathematical functions), and the proper set of parameters; a specified alternative can be by assimilation with a generic model from one application of the PSSE v32 software simulating steady-state and dynamic regimes of electrical systems (with compulsory provision of .dll files) or of Eurostag v4.5 software simulating dynamic regimes of electrical systems, parameters included; if the model includes additional control functions or specific characteristics, they will be specified and graphs will be added;

ANNEX 1.2
to annex 1 of the procedure

Data necessary for protection calculations

1. Data necessary for protection calculations are sent to NPD at least 30 days before the requested commissioning date for the test period.

2. Data necessary for protection calculations are as follows:

A. In case of dispatchable power parks DWPP, with capacity above 10 MW, DWPP with capcity ranging 5 MW ÷ 10 MW, and NDWPP connected at 110 kV:

1. Full technical project (primary and secondary electric circuits) of the wind power park;

2. Electric characteristics of installed WT and associated transformers, operational regimes with the three-phase short-circuit currents to the terminals of the converter + transformer assembly (in the MV part);

3. WT's protections against internal and external defects, controls and driving times;

4. Contribution to the short-circuit in the MV bus-bar of the connecting substation of each WT connected by same cable;

5. Electric characteristics, protections with associated controls and connection / disconnection automations of the elements compensating reactive power;

B. The TSO/DSO connecting substations of DWPP with capacity above 10 MW, DWPP ranging 5 MW ÷ 10 MW, and NDWPP connected to 110 kV:

1. Full technical project (primary and secondary electric circuits) of the substation connecting the WPP to TSO/DSO;

2. Electric characteristics of 110 kV/MV transformers, the documents, software and controls of their protection terminals;

3. Full documentation and software of protection terminals of the connecting line(s);

4. Electric and geometric characteristics of the FO-OPGW in each line segment [specific electrical resistance at 20°C (Ω/km), nominal cross-section [mmp], conductor radius (cm)], if the FO-OPGW was installed when WPP was commissioned;

C. Stations adjacent to the WPP connecting substation (if necessary):

1. Full technical project docuemnts (electrical part-primary and secondary circuits, block diagram of protections and the tripping matrix) if primary equipment replacement and/or additions were necessary in the protection diagran of the respective lines;

2. Full documentation and software of protectior terminals to be installed in the 110 kV part of adjacen stations to the DWPP connecting substation;

ANNEX 1.3
to annex 1 of the procedure

Data of WPP equipment necessary for protection calculations

1. Model of generator data (synchronous machine*)
Generator:
Manufacture:
Type:

S_{nom}:	[MVA]	P_{nom}:	[MW]	U_{nom}:	[V]	I_{nom}:	[A]
N_{nom}:	[rot/min]	cosφ nom:					
X_d:	[%]	X_{dprim}:	[%]	X_{dsec}	[%]		
X_q:	[%]	X_{qprim}:	[%]	X_{qsec}:	[%]		
X_{hom}:	[%]	X_{invers}:	[%]	T_{launch}:	[s]		

Excitation:
Manufacture:
Type:

U_{excit}: [V] I_{excit}: [A] $I_{forcing}$: [A] $T_{forcing}$: [s]

2. Model of double feed asynchronous generator* data
Generator:
Manufacture:
Type:

	S_{nom}:	[MVA]	P_{nom}:	[MW]
	U_{nom}:	[V]	I_{nom}:	[A]
	N_{nom}:	[rot/min]	cosFi nom	
	X_d:	[%]	X_d':	[%]
	X_d'':	[%]	X_q:	[%]
	X_q':	[%]	X_q'':	[%]
	X_{invers} (X2):	[%]		

* The short-circuit value of currents I_3 (three-phase short-circuit current) and I_1 (one-phase short-circuit current) against the transformer's MV winding voltage for the generator + LV/MV transformer + converter assembly.

3. Model of three windings transformer data
Transformer:
Manufacture:
Type:
Tank:

Core: columns No. of windings: Connection:

S_{nom1}:	[MVA]	U_{nom1}:	[kV]	$*U_{sc.\ IM}$:	[%]	Psc. IM:	[kW]
S_{nom2}:	[MVA]	U_{nom2}:	[kV]	$*U_{sc.\ IJ}$:	[%]	Psc. IJ:	[kW]
S_{nom3}:	[MVA]	U_{nom3}:	[kV]	$*U_{sc.\ MJ}$:	[%]	Psc. MJ:	[kW]

* The measurement capacity should be specified.

I_{idle}: [%] P_{gol}: [kW]
Control winding:
Voltage control: U_{pmax}: [kV] U_{pmin}: [kV] U_{tap}: [kV]
U_{scpmax}: [%] U_{scpmin}: [%] U_{scpmed}: [%]
Neutral insulation level: Neutral treatment: #

Note: In case the transformer star neutral is grounded by some impedance, resistance will be specified and the reactance of the grounding impedance.

4. Model of two windings transformator data

Manufacture:

Type:

No of WT:		Insulation level	neutral			Connex:
S_{nom}:	[MVA]	$U_{nom\ I}$:	[kV]	$U_{nom\ J}$:	[kV]	$U_{scc.\ IJ}$: [%]
$I_{gol\ I}$:	[%]	$I_{gol\ J}$:	[%]			
P_{agol}:	[kW]	$P_{ascc.\ IJ}$:	[kW]			
U_{pmax}	[kV]		[kV]	U_{plot}:	[kV]	Voltage ratio. IJ:
$U_{scc.max}$:	[%]	$U_{scc.min}$:	[%]	$U_{scc.\ Nom.}$:	[%]	
Neutral treatm: #						

Note: In case the transformer star neutral is grounded by some impedance, resistance will be specified and the reactance of the grounding impedance.

5. Model of cable data

Cable: (Cu or Al)

Manufacture:

Type: Cross-section:

U_n:

Direct and earth-fault sequence parameters (measuring V will be specified)

R_+ = [Ω/m]	X_+ = [Ω/m]	C_+ = [μFarad/m]
R_0 = [Ω/m]	X_0 = [Ω/m]	C_0 = [μFarad/m]

Mutual coupling parameters (where needed)

Coupling length:

R_{m0} = [Ω/m] X_{m0} = [Ω/m]

Technical data to be transmitted by photovoltaic power parks (PVPP)

CHAPTER I

Technical data to be transmitted by dispatchable PVPP with installed capacity higher than 10 MW

Applicants submit to the DSO, 6 months before energising, the following documents:

1. Copy of the ATR and of the connection contract;
2. Establishment authorisation from ANRE;
3. Technical project of the PVPP, showing the length and technical characteristics of the cables and of the link to the DSO or TSO substation/bay, the connection mode of the inverters and auxiliary installations, and the electric diagram of the substation and of the power plant (according to annex 2.1);
4. Detailed control diagrams for active & reactive power and voltage in the PVPP, in order to point out the following:

— it is taken in consideration the frequency measure to implement the P-f curve;

— The frequency - active power relation is implemented according to article 9 in NT 30;

— The P, Q, U set values, including selection of DPVPP operation regimes / reactive power/voltage are taken from the DEC / dispatcher centre;

— it is taken in consideration the voltage measure in the CP voltage control;

5. it is taken in consideration the reactive power measure in the CP voltage control; Mathematical model of inverters, of the entire power plant and reactive power offset means at 0.90 inductive ÷ 0.90 capacitive in the connection point, while providing exchange of null reactive power with the system upon null active power generated by PVPP (requirement from article 17 in Tehnical Norm 30);
6. Network study to calculate the reactive power need in the connection point (0.90 inductive ÷ 0.90 capacitive) in all the active power range, while providing null reactive exchange with the system upon null active power generated by the power plant [requirements of article 13 par (1) & (3) in NT 30]; the P-Q diagram of PVPP in the connection point is attached;
7. Dynamic regime study of the PVPP and of the area to determine measures preventing its island operation (requirement from article 15 in NT 30);
8. Technical data necessary for calculations of steady-state and dynamic regimes (according to annex 2.2);
9. Technical data of primary equipment- inverters, 110 kV / MV & MV/LV transformers with electric parameters, control diagrams and proper protections (as per annex 2.2);
10. Each type of inverter to be installed will be accompanied by check-up documents and certificates (requirement of article 16 in NT 30) and by records of parameters measured upon tests made by international specific companies recognised in Europe, certifying:

— Verification of the P-Q capability curve;

— Fault ride through;

— Invertor operation in the (47.5 ÷ 52) Hz frequency range, at 1 Hz/sec frequency variation rates and (0.9 ÷ 1.1) x Un voltage fluctuations;

— Disturbances introduced in terms of power quality (harmonics and flicker);

— The response to variations in the P and Q set values;

Certificates will be accompanied by records made upon suc tests (LVRT and P & Q control);

11. All technical data necessary for calculations c protection controls (according to annexes 2.2 and 2.3);
12. Telecommunication project specifying- the main com munication path between DPVPP and the connection substatio to TSO's EMS-SCADA; the main communication path will b made of optical fibre, with back-up path provided; telecon projects should be endorsed by TSO's CTES; the main com munication path used for DMS-SCADA is also transmittin settlement data taken from the settlement unit, namely mete telecom projects should be endorsed in DSO's CTES;
13. Providing DPVPP integration in EMS-SCADA agreement on DPVPP's first commissioning is conditioned b the document certifying DPVPP's integration in EMS-SCADA and by the document certifying signal transmission from th metering unit and its reception in the central point; proof will b provided that the exchange of signals was verified for DPVPP integration in EMS-SCADA;
14. Staged DPVPP commissioning schedule beginning wit the substation, connector and inverters; the schedule is detailed by steps of installed capacity and internal tests performed;
15. Technical characteristics of the power quality analyse to be installed in the connection point if PVPP is connected in a TSO substation; such analyser will be class A, PSL certified and able to send SQL, PQDIF, .txt or .xls files in the structure required by the TSO's power quality monitoring system; it wil be integrated in the TSO's power quality monitoring system;
16. Equipment supplier's procedure of inverte commissioning;
17. Data for issuance of the investment order as per annex to the procedure;

The data asked for in 4, 8, 9, 11 and 17 are transmitted a least 60 calendar days before commissioning.

CHAPTER II

Technical data to be transmitted by dispatchable PVPP with installed capacity above 5 MW and lower or equal to 10 MW

Applicants submit to the DSO, 3 months before energising the following documents:

1. Copy of the ATR and of the connection contract;
2. Establishment authorisation from ANRE;
3. PVPP's technical project showing the length and technica characteristics of the cables and of the link to the DSO or TSO substation/bay, the connection of inverters and of auxiliary installations, and the electric diagram for the substation and the power plant (according to annex 2.1);
4. (Detailed) control diagrams of active & reactive power in the PVPP, in order to point out how:

— P and Q set values are taken and modified;

— It is take in consideration the measuremets from CP of the PVPP;

5. Mathematical models for inverters, the entire power plant and reactive power compensation means in the connection point (if applicable) at 0.90 inductive ÷ 0.90 capacitive and providing exchange of null reactive power with the system upon null active power generated by PVPP (requirement from article 17 in NT 30);

6. Network study to calculate the reactive power needed in the connection point to comply with the provisions of article 13 in NT 30 (0.90 inductive ÷ 0.90 capacitive) in the entire active power range, while providing null reactive exchange with the system in case the generated active power is null; the P-Q diagram of PVPP in the connection point;

7. Dynamic regime study of the PVPP and of the area to determine its possible island operation (requirement from article 15 of NT 30);

8. Technical data necessary for calculations of steady-state and dynamic regimes (according to annex 2.2);

9. Technical data of primary equipment- inverters, 110 kV / MV & MV/LV transformers with electric parameters, control diagrams and proper protections (as per annex 2.2);

10. Each type of inverter to be installed will be accompanied by copies of the check-up documents and certificates (requirement of article 16 in NT 30) and by records of parameters measured upon tests made by international companies recognised in Europe, specifying:

— Verification of the P-Q capability curve;

— Fault ride through;

— Inverter operation in the (47.5 ÷ 52) Hz frequency range, at 1 Hz/sec frequency variation rates and (0.9 ÷ 1.1) x Un voltage fluctuations;

— Disturbances introduced in terms of power quality (harmonics and flicker);

— The response to variations in the P and Q set values;

Certificates will be accompanied by records made during such tests (for LVRT, as well as P and Q control);

11. Technical data necessary for calculations of protection controls (according to annex 2.2 and annex 2.3);

12. Telecommunication project specifying- the main communication path and integration into the DSO's DMS-SCADA; the main communication path used for DMS-SCADA integration is also transmitting settlement data taken from the settlement unit, namely meter; telecom projects should be endorsed in the DSO's CTES; in case there is no link between the DSO's DMS-SCADA and TSO's EMS-SCADA (for an intermediate time until 2016) the P,Q, U data and the circuit breaker positions are transmitted either directly in an interface point with the TSO's communication system from the dispatcher centre it is assigned to or in an intermediate data gathering centre agreed with the OR;

13. Providing DPVPP integration in EMS-SCADA; agreement on DPVPP's first commissioning is conditioned by the document certifying DPVPP's integration in DMS-SCADA or EMS-SCADA;

14. DPVPP staged commissioning schedule beginning with the substation, the connector and the inverters;

15. Technical characteristics of the power quality analyser to be installed in the connection point in case PVPP is connected in a TSO substation; such analyser will be class A, PSL certified and able to transmit SQL, PQDIF, .txt or .xls files into the structure required by the TSO's power quality monitoring system; it will be integrated in the TSO's power quality monitoring system;

16. Equipment supplier's procedure of inverter commissioning;

17. Data necessary to issue the investment order according to annex 3 to the procedure; The data asked for in 4, 8, 9, 11 and 17 are transmitted at least 60 calendar days before commissioning.

CHAPTER III

Technical data to be transmitted by non-dispatchable PVPP with installed capacity below 5 MW

Applicants submit to the NSO they will be connected to, months before energising, the following documents:

1. Copy of the ATR and of the connection contract;

2. Technical project of the NDPVPP showing- the length and technical characteristics of cables and of the connector t the DSO or TSO substation/bay, the connection of inverters an of auxiliary installations, as well as the electrical diagram of th substation and of the power plant (as per annex 2.1);

3. Simplified mathematical model of inverters from th manufacturer;

4. Calculations of the active power need in the connection point to comply with the requirements of article 13 in NT 30 (0.90 inductive ÷ 0.90 capacitive) in all the active power range, while providing null reactive exchange with the system upon null active power generated by the power plant, as well as the P-Q diagram of inverters; NDPVPP's technical data necessary for calculations of steady-state and dynamic regimes (as per annex 2.1);

5. Upon NPD's request (in specific circumstances), the technical data of NDPVPP primary equipment- inverters and 110 kV/MV & MV/LV transformers, with electric parameters, control diagrams and proper protections (as per annexes 2.2. and 2.3.);

6. Each type of inverter to be installed will be accompanied by copies of the check-up documents and certificates (provision from article 16 of NT 30) and by records of parameters measured upon tests made by specific international companies recognised in Europe, certifying:

— Verification of the P-Q capability curve;

— Fault ride through;

— Inverter operation in the (47.5 ÷ 52) Hz frequency range, at 1 Hz/sec frequency variation rates and (0.9 ÷ 1.1) x Un voltage fluctuations;

— Disturbances introduced in terms of power quality (harmonics and flicker);

— The response to variations in the P and Q set values;

Certificates will be accompanied by records made during such tests (for LVRT, as well as P and Q control).

DSO transmits the documents specified in 1-7 to the NPD.

ANNEX 2.1
to annex 2 of the procedure

Data necessary for calculations of steady-state regimes, short-circuit currents and dynamic data of the PVPP

CHAPTER I

DPVPP data necessary to calculate steady-state regimes and short-circuit curents

DPVPP data necessary to calculate steady-state regimes and short-circuit currents are as follows:

a) Electrical diagram of the entire photovoltaic power park and of the system connecting substation;

b) Length of all DPVPP cables and OHL length between DPVPP and the system connecting substation;

c) Electrical parameters specific to all cables and lines;

Line and/or cable parameters		
Type (material)		
R_+	[Ω/km] at 20°C	
X_+	[Ω/km]	
C_+	[μFarad/km]	
R_0	[Ω/km]	
X_0	[Ω/km]	
S	[mm^2]	
U_n	[kV]	

d) Data on the inverters constituting the photovoltaic power plant- number, nominal active capacity, P-Q of each inverter and the variation rate of active power;

e) In case of MV/110 kV, MV/LV transformers- nominal capacity of windings, nominal voltage, idle run losses, copper losses, short-circuit currents, idle run current, connection group, voltage control (type & range, including the number of the nominal tap, maximum tap number), neutral treatment;

f) Data on the reactive compensation system (e.g. condenser batteries- number of steps, installed capacity of each step), also indicating the compensation system location in the requested electric diagram.CHAPTER II

Dynamic data of DPVPP and NDPVPP

Dynamic data of DPVPP and NDPVPP are as follows:

a) Inverter type;

b) Nominal capacity;

c) Inverter's operational logic;

d) Inverter's mathematical model and its parameters;

e) Electric control system- control diagrams & parameters (Q control for NDPVPP; P, Q control for DPVPP ranging 5 MW ÷ 10 MW, included, and P, Q, U control for DPVPP above 10 MW);

f) Parameters to model the inverter; diagram and parameters for the converter's current limits;

g) Mathematical model and control system- diagram and parameters, for DPVPP;

h) Control systems of the power plant- control diagrams, parameters, for DPVPP;

i) Fault ride through measures- dynamic models and parameters for NDPVPP;

j) Voltage fluctuation protections- low or zero voltage ride through (LVRT, ZVRT) for DPVPP and NDPVPP;

k) Other special functions- low voltage power logic (LVPL), participation to frequency control etc. for DPVPP and NDPVPP;

l) Inverter model and control system models in the power plant (DPVPP) as diagrams (with mathematical functions) with proper set of parameters; a specified alternative can be by assimilation with a generic model from one application of the PSSE v32 software simulating steady-state and dynamic regimes of electrical systems (with compulsory provision of .dll files) or of Eurostag v4.5 software simulating dynamic regimes of electrical systems, parameters included; if the model includes additional control functions or specific characteristics, they will be specified and graphs will be added;

Data necessary for protection calculations

1. Data needed for protection calculations are transmitted to NPD at least 30 days before the requested commissioning date for the test period.

2. Data needed for protection calculations are as follows:

A. In case of photovoltaic power park, DPVPP, with capacity above 10 MW, DPVPP ranging 5 MW ÷ 10 MW, and the NDPVPP connected to 110 kV:

1. Full technical project (primary and secondary electrical circuits) of the photovoltaic power plant;

2. Electric characteristics of installed inverters and associated transformers, operating regimes including the three-phase short-circuit currents to the terminals of the inverter + transformer assembly (in the MV part);

3. Inverters' protections to internal and external defects, control and driving times;

4. Contribution to the short-circuit in the MV bus-bar of the connecting substation of each inverter group connected by same cable;

5. Electric characteristics, protections and associated controls, connection / disconnection automations of the elements compensating reactive power;

B. The RED/RET connection substation for DPVPP with capacity above 10 MW, DPVPP ranging 5 MW ÷ 10 MW, and the NDPVPP connected to 110 kV:

1. Full technical project (primary and secondary electrica circuits) of the substation connecting PVPP to the RED/RET;

2. Electric characteristics of 110 kV/MV power transformers the documents, software and controls of protection terminals;

3. Full documentation and software associated to protection terminals of the connecting line(s);

4. Electrical and geometrical characteristics of the FO-OPGW in each line segment [specific electric resistance at 20°C (Ω/km), nominal cross-section (mmp), conductor radius (cm)], if the FO-OPGW was installed at PVPP commissioning;

C. Adjacent stations to the PVPP connecting substation (if necessary):

1. All documents of the technical project (electrical part with primary and secondary circuits, block diagram of protections and tripping matrix), if primary equipment replacement and/or additions were necessary in the protection diagram of the respective lines;

2. Full documentation and software associated to protection terminals of to be installed in the 110 kV part of stations adjacent to the DPVPP connection substation;

ANNEX 2.3
to annex 2 of the procedure

Data of PVPP equipment necessary for protection calculations

1. Model of photovoltaic panel data

Type of photovoltaic panel: Pnom = [kW]

2. Model of inverter data*

* The short-circuit value of currents I_3 (three-phase short-circuit current) and I_2 (two-phase short-circuit current) against the inverter's terminals.

Inverter name:

Manufacture:

Type:

S_{nom}:	[VA]	P_{nom}:	[W]	U_{nom}:	[V]	$I_{nom\ ac}$:	[A]
$\cos\varphi_{nom}$:		P max:	[W]				
Input - voltage		(Vcc):	[V]				

Protection to minimum and maximum voltage: [X]/[-]

3. Model of three windings transformer data

Transformer name:							
Manufacture:			Type:				
Tank:		Core:	columns	no. of		Connex:	
S_{nom1}:	[MVA]	U_{nom1}:	[kV]	*$U_{sc.\ IM}$:	[%]	Psc. IM:	[kW]
S_{nom2}:	[MVA]	U_{nom2}:	[kV]	*$U_{sc.\ IJ}$:	[%]	Psc. IJ:	[kW]
S_{nom3}:	[MVA]	U_{nom3}:	[kV]	*$U_{sc.\ MJ}$:	[%]	Psc. MJ:	[kW]

* Measuring capacity should be specified.

I_{idle}: Cntrl wind	[%]	P_{idle}:	[kW]				
Volt cntrl		U_{pmax}:	[kV]	U_{pmin}:	[kV]	U_{plot}:	[kV]
		U_{scpmax}:	[%]	U_{scpmin}:	[%]	U_{scpmed}:	[%]

Neutral insulation level: Neutral treatment: #

Note: In case the transformer star neutral is grounded by some impedance, resistance will be specified and the reactance of the grounding impedance.

4. Model of two windings transformer data

Manufacture: No.	Type: Neutral insulation level:			Connex:		
S_{nom} : I_{idle} I:	[MVA] [%] [kW]	$U_{nom\ I}$: $I_{gol\ J}$: $P_{ascc.}$	[kV] [%] [kW]	$U_{nom\ J}$:	[kV]	$U_{scc.\ IJ}$: [%]
U_{pmax}:	[kV]	U_{pmin}:	[kV]	U_{plot}:	[kV]	Voltage ratio IJ:
$U_{scc.max}$: Neutral treatm: #	[%]	$U_{scc.min}$:	[%]	$U_{scc.\ Nom.}$:	[%]	

Note: In case the transformer star neutral is grounded by some impedance, resistance will be specified and the reactance of the grounding impedance.

5. Model of cable data

Cable: (Cu or Al) Manufacture: Type: Cross-section:

U_n:

Direct and earth-fault sequence parameters (specifying the measurement V)

R_+ = [Ω/m]	X_+ = [Ω/m]	C_+ = [μFarad/m]
R_0 = [Ω/m]	X_0 = [Ω/m]	C_0 = [μFarad/m]

Mutual coupling parameters (if applicable)

Coupling length:

R_{m0} = [Ω/m] X_{m0} = [Ω/m]

ANNEX 3
to the procedure

Requirements in view of issuing the investment order for WPP/PVPP

In accordance with the provisions of articles 19 and 181 ÷ 185 of the TSO Code, part III- Regulation of dispatcher management of the SEN, the operational management of the WPP/PVPP requires the decision-making dispatcher centre with control authority over the respective installation (NPD for all DWPP/DPVPP and DSO for NDWPP/NDPVPP) to issue the following documents:

— Assignment of the new power objective (WPP/PVPP) to NPS;

— Investment order of dispatcher managerial authority;

In this respect the applicant sends to NPD/DSO either:

— The (single line) NPS connecting diagram specifying the main parameters of the new equipment;

— Data on the dispatcher centre providing WPP/PVPP operation; it should provide permanent location (address), control room, direct phone connection between it and the dispatcher entity of direct control over the power plant and the substation; back-up telephone connection (in all networks); fax machine; permanent operational personnel that operate the power plant 24 h / 24 h;

— Proposed normal diagram;

The dispatcher's entity operational personnel running the DWPP/DPVPP have at least the following attributions of operational control beginning with the test period, after commissioning minimum 60% of the installed capacity:

— Monitoring the installations they operate and efficiently notifying to higher-up dispatch centres any abnormal operation and deviations of parameters from limit values set in norms / normative acts / technical codes / guidelines / procedures;

— Efficiently notifying in real time the incompliances and/or unavailability in the power plant;

— Receiving and executing dispatcher orders sent by higher-up centres;

— Making manoeuvres in the managed installations, both scheduled and accidental;

— Transmitting signals of incidents/failures to higher-up dispatcher centres;

— Receiving and executing dispatcher orders for active power loading / unloading;

— Receiving and executing dispatcher orders of reactive power loading/unloading (WPP/PVPP), voltage and power control (DWPP/DPVPP);

— Transmitting operational disconnection requests (output downsize) for work and/or commissioning; requests are made according to the provisiosn of articles 124 ÷ 141 of the Grid Code, part III- Regulation of dispatcher management of the NPS;

— Operatively confirming the disconnection and re-connection of equipment under decision authority of higher-up dispatcher centres;

— Knowing the data introduced for the DWPP/DPVPP into the Balancing market platform;

— Knowing the DWPP's electricity forecast;

— Transmitting P [MW] and Q [MVAr] hourly data at s- times;

— Transmitting the active energy generated within 24 h at the end of each day (D day);

— Sending other data about WPP/PVPP operation asked by higher-up dispatcher centres;

— WPP/PVPP should transmit the monthly generated active electricity to the dispatch centre in maximum 5 days after the end of the calendar month;

ANNEX 4
to the procedure

Checking the WPP's technical performance in terms of its compliance with the requirements of the technical norm for connection to public interest networks

CHAPTER I
Purpose

The purpose of this procedure is to establish:

a) Tests, verifications and records necessary to prove the compliance of wind power parks with the provisions of NT 51;

b) Check-up and test mode of the DWPP;

The procedure is applied according to article 29 par (2) and to article 30 in NT 51:

— Article 29: "(2) WT/WPP are commissioned and set operational only after testing, integration into the network operator's SCADA and transmitting him the test results set in tables 1-5, determined according to the procedure provided in article 30 par (5)".

— Article 30: "(1) The network operator checks whether WPP connection and operation leads to trespassing the terms of frequency and voltage ranges, ride through capability and power quality set in this technical norm".

(2) In case of DWPP the TSO checks whether it complies with the terms of this norm. If DWPP is connected to a distribution network the respective DSO will cooperate with the TSO, under the latter's coordination, to make the check-up.

(3) In case of NDWPP the network operator the WPP will be connected checks whether it complies with the terms in this norm. In all cases the DSO cooperates with the TSO to make the check-up.

(4) The WPP's compliance with connection terms, including those of this norm, is confirmed by issuing a compliance certificate by the network operator responsiable of verification, according to the provisions of par (1) ÷ (3).

(5) The WPP's compliance with connection and operation terms is verified and the compliance certificate is issued according to a procedure elaborated by the TSO, with DSO consultation and ANRE approval. The procedure should comprise provisions of the commissioning stages, test period and acceptance for long-term operation".

CHAPTER II
Application domain

This procedure is applied to WPP with installed capacity above 1 MW, regardless of their voltage in the connection point after commissioning, and it supervises the control on on compliance with the technical terms from NT 51 and the RET Code.

The procedure is applied:

2.1. When a new, refurbished WPP is commissioned or at the end of each WPP development stage specified in the ATR;

2.2. During operation in order to determine the WPP performance (in case its operation was found not to comply with the requirements of NT 51 and of the Grid Code);

2.3. After capital repair, replacements, upgrade to the SCADA or to the control systems of the entire DWPP;

2.4. Upon the OTS's request according to the provisions of chap. 6.4 of the RET Code; in such case the OTS can request verification by proof of any test from this procedure;

2.5. In case of WPP with capacity ranging 1 MW ÷ 5 MW tests are verified and assessed by the DSO, using this procedure;

2.6. In case of WPP with capacity higher than 10 MW tests are verified and assessed by the OTS;.

2.7. In case of WPP with capacity ranging 5 MW ÷ 10 MW tests are performed and assessed according to this procedure by the DSO that participates to the tests and transmits their results to the OTS.

CHAPTER III
Responsibilities

3.1. **TSO's responsibilities**

3.1.1. Verifying all the documentation on the achievement of active & reactive power and voltage control loops, and asks for additional documents where the requirements to be confirmed are not proven by the already submitted documentation.

3.1.2. Participating to the tests and trials from this procedure.

3.1.3. Initiating the check-up on DWPP operation in the situations provided in the Grid Code, in case one of the NT51 requirements is repeatedly trespassed. The provisions of chapter 6.4 from the Grid Code are applied in such case.

3.1.4. Approving the test schedule sent by the applicant.

3.1.5. It is entitled to ask the test supervisor to do again one or several tests.

3.1.6. In case of deviations from this procedure resulting from objective causes, submitted by the test supervisor before making the tests, NPD is responsible to construe the application of this procedure.

3.2. **Responsibilities of the generator managing the WPP**

3.2.1. Initiating the tests for the situations from items 2.1 and 2.3.

3.2.2. Elaborating the test schedule together with the company admitted for tests, and the documentation (records).

3.2.3. At least 10 week-days before beginning the tests transmitting to NPD the test schedule and the demand to attend them, thus agreeing with it a date for preliminary tests.

3.2.4. Informing the respective DSO about the time periods when tests are made and requires the agreement in terms of network conditions.

3.2.5. Transmitting the test schedule to the involved DSO, when verifying WPP-s with capacity ranging 5 MW ÷ 10 MW, at least 10 week-days before beginning the test, while also requesting the attendance of (DSO) representatives and possibly of OTS representatives.

3.2.6. WPP with capacity lower or equal to 5 MW transmits the test schedule to the involved DSO, at least 10 week-days before beginning the tests, while also requesting the attendance of DSO representatives to such tests.

3.2.7. Providing the technical conditions for tests.

3.2.8. Providing the safe operation of the WPP during tests, being responsible for the integrity of the entire installation during tests.

3.2.9. Designating a test supervisor by mutual agreemtn with the test contractor.

3.2.10. When tests have been completed- transmitting the final full documentation according to this procedure- to the NPD for WPP with installed capacity above 10 MW, to the DSO and NPD for WPP with installed capacity above 5 MW and below 10 MW and to the DSO for WPP with installed capacity above 1 MW and below 5 MW.

3.3. **Responsibilities of the DSO**

3.3.1. Elaborating own verification procedures for the WPP with capacity below or equal to 5 MW, which comprise at least the tests and the mode of operation from this procedure.

3.3.2. Collaborating with the OTS in order to provide the test conditions, making the tests and studying the test results included in this procedure in terms of network conditions for the dispatchable WPP connected to its own distribution network.

CHAPTER IV
Mode of operation

4.1. **General conditions for tests**

4.1.1. The tests synthetised in annex 4.1 are fully executed within preliminary (house) tests and they are partially / fully resumed in the final tests performed before NPD representatives for WPP with installed capacity above 10 MW and/or before the DSO in the other cases.

4.1.2. The final tests executed before NPD specialists will verify also the application of P, Q, U set values sent by DEC.

4.1.3. The applicant submits to NPD a full file with the records made during preliminary (house) and final tests. In case of preliminary test results NPD studies the documentation, requires other documents or additional tests, and if applicable initiates a meeting between the applicant, DSO representatives and the test contractor.

4.1.4. DWPP check-ups can begin only if the number of wind generator modules commissioned by the supplier, according to its own procedures, represents minimum 90% of the total number of DWPP modules provided in the ATR, according to the staged period of the installed capacity.

4.1.5. Tests will be carried out during time intervals when wind speed provides minimum 60% output of the DWPP installed capacity.

4.2. **Requirements for metering instrumentation, simulation and registration equipment**

4.2.1. Frequency transducers of ≤ 0.005 Hz accuracy, response time < 100 ms, range (45÷55) Hz

4.2.2. P, Q, U transducers, minimum 0.3 accuracy class

4.2.3. Gathering system, minimum 0.5 s for each value collected with possible registration by .xls files. Registration rates of minimum 40 ms will be provided for the requirements in items 4.7 and 4.8.

4.2.4. Frequency simulation- < 0.005 Hz accuracy, range (45÷55) Hz in steps with 0.5 Hz/sec slope;

4.2.5. GPS (global positioning system) for the time stamp

4.2.6. Available power and wind speed from DWPP equipment

4.2.7. Class A power quality analysers with GPS and possible calculation of disturbances in different time intervals, pre-set or determined post-registration. For instance getting the disturbance of a time when each test was made, but also for 1 week (standardised). Electricity quality will be recorded during all tests, but also minimum 2 weeks of DWPP running.

4.2.8. Tests for WPP-s with installed capacity above 5 MW should be made by a class A certifyed company.

4.3. **Checking the WPP operational requirements in case of frequency variation**

Tests are meant for DWPP with installed capacity above 1(MW and aim at checking the complaince with requirements fron article 10 from NT 51:

— Article 10 — (1): " DWPP will be provided with automated control system of active power depending on frequency (automatic f/P control). It will operate according to a frequency/power response curve shown in figure 2, where P_d is the available active power. The coordinates of points A, B. C D and E depend on frequency, the active power that the powe

ɔark can generate and on the the set value where active power s limited within the following ranges: A (50—47 Hz), B (50—47 Hz), C (50—52 Hz), DE (50—52 Hz). The position of these ɔoints should be set as per the network operator's 'equirements, with maximum ±10 mHz error. The frequency netering error should not exceed ±10 mHz.

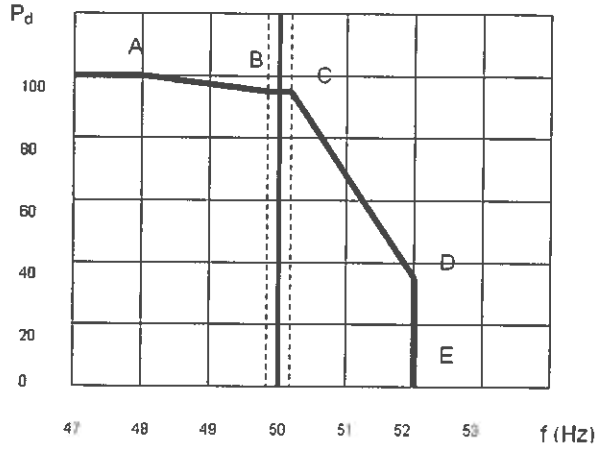


Figure 2: Variation of DWPP power depending on frequency

(2) The active power genered because of frequency variations will be modified, as much as possible, by proportionally changing the active power generated by each DWPP module, and not by turning modules on and off. The response rate of each operational GGE should be at least 60% of the nominal power per minute (MW/min).

(3) If frequency reaches to a value higher than what corresponds to segment D—E on the characteristic curve shown in figure 2 the DWPP is disconnected. The TSO determines the re-connecting conditions.

(4) Upon frequency variations in the NPS the DWPP should have the capability:

a) To reduce active power at least 40% of the available (or set) capacity / Hz when frequency exceeds 50,2 Hz;

b) To provide active power increase up to the maximum limit of available active power when frequency drops below 49.8 Hz".

Mode of operation: The test is performed for two ɔperational cases- operation at available capacity given by nomentary meteorological conditions, and a set value of active ɔower, lower than available capacity. The frequency metered in he active power loop will be replaced with a simulated value nput either by the soft or by a signal generator. Different requency values will be simulated: 47.5; 48; 48.5; 49; 49.8; 50.2; 50.5; 51; 51.5; 52; 52.1 Hz. The test will be under active ɔower control with the reactive power value set to zero.

Records: Records will be made in time for- available power Pd, set active power Pcons, simulated frequenby value fsimulated and the metered values in the substation (CP), and in the power park (P, Q, U, f). The P-f graph will be also made in comparison with the requirement from figure 2 of NT 51.

Evaluation: The change degree of active power by frequenc variations will be determined, including WPP turning off wher frequency values exceed the 47.5÷52 Hz range. One shoulc verify the WPP follows the P-f graph when frequency fluctuates from 52 to 50.2 Hz and the WPP is capable to be network connected at any frequency value in the required range. The number of WT modules turned off to decrease frequency will be also written down. .

4.4. **Verification of requirements to comply with the se active power**

Tests refer to verifying the compliance with the requirements from articles 11 & 12 of NT 51, providing the behaviour o dispatchable wind power parks above 10 MW upon variations in the set active power.

4.4.1. Article 11 — (1): „The active power generated by a DWPP should be limited to a set value".

Mode of operation: In case environmental conditions are good for operation to at least 60% of the commissionec installed capacity, a locat set value of active power will be set lower than the available power. The new set value will be maintained at least 5 minutes, then a set value equal to the installed capacity will be set. The test will be repeated for 3 different set valued of active power, for instance: 20% Pi, 40% Pi, 60% Pi. The test will be performed with actuated reactive power control, the reactive power being set to zero.

Records: In time records will be made for: available power, set active power and the metered values, both in the substation (CP) and in the power park (P, Q, U, f), wind speed.

Evaluation: The set active power should be reached in the given time of the set variation speed and at the requested low power step, while maintained within ± 5% Pi range. The same requirements are valid in case the initial set value is resumed (meaning power increase).

4.4.2. Article 11 — (2): „The set value of active power should be automatically taken from a remote distance [1]".

This verification is applied to all WPP with insalled capacity above 10 MW where the set active power is transmitted from the EMS-SCADA.

Mode of operation is provided in 4.4.1, with the difference that in case of WPP above 10 MW, the set value is set by the DEC/DET by means of EMS-SCADA.

Records: In time records are made for: available power, set active power and the values metered in the CP: active power generated, voltage, reactive power and wind speed.

Evaluation: The set value of active power received and executed by the DWPP is that set by EMS-SCADA.

4.4.3. Article 11 — (3): „ DWPP provides active power control in the common point of coupling within the ± 5% range from installed capacity (as average power in 10 minutes)".

Mode of operation, records and evaluation are as shown in item 4.4.1.

4.4.4. Article 12 — (1): „Upon normal operation the DWPP should have the capacity:

a) To set the linear increase/decrease of generated active power to the value required by the network operator (MW/ minute);

b) To reduce, upon network operator's demand, the generated active power to the required value (shut-down included), complying with the set (loading/unloading) variation speed. Power variation rate should be observed both in case of natural power variation (higher wind speed) and when set values vary. The above provisions do not refer to intempestive stops.

(2) Power variation rate should be set in a band ranging 10% of the installed capacity per minute and the maximum admissible rate, given by the manufacturer" - such verification targets all WPP-s with installed capacity above 10 MW.

Mode of operation, records and evaluation are those provided in item 4.4.1. Two variation slopes of active power will be set, one being 10% Pi/minute. The slope is verified both when reducing the set active power and when increasing it within the limits of admissible power.

4.4.5. In case of wind power parks with installed capacity lower or equal to 10 MW and higher than 5 MW, active power is controlled to the dispatcher set values by disconnecting / connecting WT.

4.5. **Verification of requirements for the capacity to deliver reactive power in the CP**

Such tests are for DWPP of installed capacity above 10 MW and aim at verifying the compliance with the requirements from article 16 of NT 51 and at verifying the P-Q diagram determined by study in the CP with the real P-Q diagram in the CP, with the voltage value during tests.

4.5.1. **Verification of the power factor in the CP**

This test verifies the compliance with the requirements from article 16 par (1) of NT 51 and of Grid Code about the behaviour of wind power parks to set voltage variations.

Article 16 — (1) „Voltage values of the admissible voltage range in the connection point require reactive power produced / absorbed by a DWPP to be continuously controlled with a power factor in the 0.95 capacitive - 0.95 inductive range at least"

Mode of operation: In the admissible voltage range specified in the RET and RED Codes at value as close as possible to the installed active power the WPP passes to reactive power control applying maximum set value of reactive power both in inductive and in capacitive regime. Obtained values are recorded.

Records: Metered values are recorded, bot in the substation (CP) and in the power park (P, Q, U, f).

Evaluation: The power factor is calculated for the maximum active power of the tests. The exchange of reactive power is measured in the CP for null active power.

4.5.2. **Verification of reactive power control requirements**

This test verifies the compliance with the requirements of article 16 par (2) letter b) and par (4) of NT 51 and of Grid Code with respect to the wind power parks' behaviour upon variations in the set value of reactive power.This test is applie to all WPP above 10 MW.

Article 16 — (2): „ DWPP should provide automatic voltage – reactive power control in the CP by one mode: [...]

b) Reactive power control exchanged with the NPS. [...]

(4) The response rate of the voltage control system should be minimum 95% of 30 seconds' available reactive power".

Mode of operation: When the admissible voltage limits are observed in the CP, WPP passes to reactive power control upon the generated active power according to environmental conditions. Various set values of reactive power are applied. Tests are done again for local and remote setpoints of reactive power (DEC/DET or the dispatcher centre of the DWPP). In case of WPP above 10 MW tests are resumed for at least two different variation values of reactive power, one for 95% of the available reactive power in 30 seconds.

Records: P, Q, U and f metered in the substation and in the power park are recorded and the set value of reactive power.

Evaluation: Observing the set value of reactive power and maintaining a constant value of maximum ± 2 MVAr in the insensitivity range. The MVAr/kV values in the CP will be determined for at least two active power values generated by the WPP. Variation rates of reactive power will be determined.

4.5.3. **Verifying the P-Q theoretical diagram of WPP in the CP**

Mode of operation: Within the admissible voltage range specified in the RET and RED Codes, upon a value as close as possible to the installed active capacity WPP passes to reactive power control applying a maximum set value of reactive both in inductive and in capacitive regime. The values obtained are recorded. The P-Q diagram of the WPP is drawn up for at least 5 active power points. When the set value of active power is zero, the reactive power injected in the CP is also measured, supervising to be null.

Records: The metered P, Q și U values metered in the substation and in the CP and the set values of reactive power Qc and of active power Pc.

Evaluation: The P-Q diagram made after reactive studies in the CP is compared with the real one. The exchange of reactive power in the CP at null active power is metered.

4.6. **Verification of voltage control requirements**

This test verifies the compliance with the requirements of article 16 par (2) letter a) and of article 16 par (3) of NT 51 and of Grid Code about the behaviour of wind power parks upon voltage fluctuations.

This test is applied to all WPP above 10 MW.

Article 16 — (2): „DWPP should provide automatic voltage-reactive power control in the CP in any of the modes:

a) voltage control;".

Mode of operation: When the admissible voltage limits are observed in the CP WPP passes to voltage control upon available active power and upon existent network voltage at that moment, by applying different set voltages: at ≥ 110 kV by ± 2÷3 kV to the network voltage, and at <110 kV by ± 2÷3% Un to the network voltage. Tests are resumed for local and remote set voltage values (DEC/DET/WPP dispatcher centre) and for at least two different values of voltage fluctuation rate.

Records: P, Q, U and f values metered both in the power park and in the CP as well as the set voltage value.

Evaluation: Achieving the set voltage value and maintaining it constant within the insensivilty range of maximum ±0.5 kV. The MVAr/kV values in the CP will be determined for at least two active power values generated by the WPP. The voltage fluctuation rate is determined, which needs to be as close as possible to the set value.

4.7. **Verification of shock-free switching between the reactive power and voltage control regimes in the CP**

Tests are applied only for WPP above 10 MW and refer to demonstrating the passage (switch) between the operational regimes under voltage and under reactive power regimes without generating shocks in the active / reactive power or in the voltage. Such verification of regime switching is done locally and remotely (DEC/DET/Dispatcher centre).

4.8. **Verifying the normal regime operational requirements**

Tests are applied to all WPP above 1 MW and verify the compliance with the requirements of article 17 of NT 51 thus:

Article 17: „Under normal network operation a DWPP should not produce in the CP fast voltage fluctuations greater than ±4% of the nominal value for medium and high voltage and than ±5% of the nominal low voltage".

Check-ups consist in recording long operation at various values of generated active power and when the WPP is turned on, namely when the WT starts running. Verification means turning on/of the WPP breaker. P, Q, U records in the CP/ WPP should last from minimum 2 to 24 hours.

4.9. **Verification of requirements for operation under special circumstances**

Tests are applied for all WPP above 5 MW and verify the compliance with requirements of article 14 par (1) of NT 51:

Article 14: „(1) The generator is responsible to protect the WT and their auxiliary installations against damages which might be produced by defects of its own installations or by the grid impact over them when DWPP disconnecting protections trip or upon netwrok incidents (short-circuits with or without grounding, grid protections tripping, transient surges etc.), as well as upon exceptional/abnormal operational conditions"

Mode of operation: Disconnection followed by fast re-connection (automatic fast re-closure is simulated) of the WPP breaker from the connecting substation (CP). Under special circumstances in WPP above 10 MW three phase fast automatic re-closures will be simulated in the CP or in other network point indicated by the TSO.

Records: P, Q și U measured in the CP with maximum 40 ms acquisition rate.

Evaluare: the WPP behaviour

4.10. **Verification of the WPP - EMS-SCADA data exchange**

Tests are applied to all WPP above 1 MW and verify:

a) for DWPP above 10 MW:

1. Reception / emission and correct execution of exchanged information / orders: metered values (P, Q, U), se values (P, Q, U) and regime selectors (P-f, Q/U);

2. Reception of values by means of optical fibre communication path with back-up on a differen communication support;

3. DWPP integration in EMS-SCADA;

4. Correct treatment of metered values and set values o the DWPP in all protocols;

5. Checking the analogue values displayed with the analogue values read from other DWPP calibrate (P, Q, U, f);

b) In case of WPP above 1 MW but lower or equal to 10 MW, integration of P and Q values metered in the CP and received in the TSO's EMS-SCADA either from the WPP dispatcher centre or from the distribution operator's DMS-SCADA.

TSO proceeds with such verification. The above mentioned signals should be received correctly, while set values should be functional and accurately executed by the DWPP.

4.11. **Verification of power quality in the WPP connection point**

Tests are applied to all WPP above 1 MW and refer to maintain the THD, harmonics, negative non-symmetry factor and flicker within limits in the connection point.

Quality analysers mentioned further are class A, PSL certified and belong to the contractor, namely the applicant.

In case of WPP above 10 MW the records made during tests and two weeks afterwards will be sent to NPD.

In case the DWPP operation during test period provide records that prove deterioration of electricity quality, the generator should take measures and endow with necessary compensation means, which should lead to compliance with the power quality parameters in the connection point in the limits set in the RET/RED Code. WPP operation is not admitted without complying with the power quality requirements in the connection point.

CHAPTER V
Reports and records

Records contain the full file of test results according to annex 4.1, accompanied by the contractor's conclusions (the company making the tests), as well as by the documents specified in this procedure.

The list of tests that need to be carried out is provided in annex 4.1.

ANNEX 4.1
to annex 4 of the procedure

Test no.	Article of the NT51	Paragraph in the procedure	Test name/ description	Operational conditions	Simulations	Metered values	Testing time	Special requirements / Evaluation conditions
1	article 10 par (1) and art. 10 par (4)	annex 4 item 4.3	Verifying the implementation of the frequency-power dependence curve	When Pd > 60% Pi the following values are selected P_1 = 80% Pd P_2 = Pd	Applying the simulated frequency steps 47,5; 48; 48,5;49; 49,7; 49,9;50; 50,1; 50,3;51; 51,5;51,9; 52,1 Hz	P, Q, U, f both in the substation (CP) and in the power park, simulated f, available power Pd, set value of power Pc	1 ÷ 3 minutes for each step depending on the steady-state recovery time	**Evaluation: DWPP** should respond as per required power-frequency dependence **records:** time development of Pc, Pd and the simulated frequency in CP; the P-f graph simulated as per figure 2 of NT51 using the averages of generated P and Pd
	article 10 par (2)	annex 4 item 4.3	Verifying the proportional change of modules P with no WT turn off					**Evaluation: DWPP** should respond as per required power-frequency dependence with no WT turning on/off **records:** no. of operational WT
	article 10 par (3)	annex 4 item 4.3	Verify the turn on/off as per frequency criteria					**Evaluation:** when DWPP is off the turning on/off cause is supervised and recorded **records:** turn on/off times
2	article 11	annex 4 items 4.4.1, 4.4.2, 4.4.3	Check the active power control at set value lower than available power	At 10%Pi/min and 20%Pi/min variation rates P reductions of minimum 20%Pi are applied, followed by return to Pd	No frequency simulation	P, Q, U, f in the substation (CP), and in the power plant, also the wind speed		**Evaluation: DWPP** should keep the new set power in the ±5%Pi range **records:** the time development of Pd, Pc, P, Q, U in CP, with operational voltage control
	article 12	annex 4 item 4.4.4	Checking the active power control at set value lower than available power					**Evaluation: DWPP** should provide variation rate of the set power **înregistrări:** time development of Pd, Pc, P, Q, U in CP, with operational voltage control
3	article 16	annex 4	Provide power factor- 0.95 inductive/capaciti ve in connection point	2 steps (20% ÷ 100%) Pi P_1 = Pd P_2 = 5%Pi	Setting φ at 0.95; 0.7 inductive/capaciti ve and „1"	P, Q, U, f in substation (CP) and in power park	5 minutes/test verifying the 0.95; 0.7 inductive/capaciti ve and „1"	**Evaluation: DWPP** should provide the set FP **records:** time development of P, Q, U in CP and PdR, and of cosφ in CP with cosφ control operational setpoint

	par (1)	item 4.5.1	Provide exchange of zero reactive with system in case of P null	All WT will stop or test made at v < v cut on	Test can be made inside tests 2 or 3	P, Q, U, f in substation (CP) and in power park	5 minutes	**Evaluation: DWPP** should make zero exchange of Q with NPS **records:** time development of P, Q, U in CP
4	Article 16 par (2) letter a)	annex 4 item 4.6	Providing voltage control in the CP	P in (10% ÷ 100%) Pi range Uc = ±3 kV to U (for U < 110 kV) in CP. For U < 110 kV Uc =± 2—3% Un	Setting U to the mentioned values	P, Q, U, f both in substation (CP) and in the power park, Uc, Pc in CP	Uc is kept for minimum 5 minutes, two different U variation rates will be selected	**Evaluation: DWPP** should provide voltage control in connection point within admissible range using the entire Q capacity **records:** time development of P, Q, U, Uc, Pc
5	Article 16 par (2) let b) art. 16 -par (4)	annex 4 item 4.5.2	Providing reactive power control in the CP	P in the (10%÷100%) Pi range minimum 3 set values are taken for Q, ±5 MVAr steps	Setting Q to the selected values	P, Q, U, f both in substation (CP) and in power park, Qc, Pc in CP	Q set value is kept for minimum 5 minutes, two different Q variation rates will be selected	**Evaluation: DWPP** should provide Q control in connection point **records:** time development of P, Q, U, Uc, Pc
6		annex 4 item 4.7	Shock-free switch between Q, U or cosφ control regimes	This test can be made inside the previous tests		P, Q, U in CP	Q→U, U→Q, Q→cosφ, cosφ→Q, U→cosφ, cosφ→U switching	**Evaluation: DWPP** should provide shock-free switching **records:** time development of P, Q, U in CP
7	Article 17	annex 4 item 4.8	Records during normal operation	none		P, Q, U in CP	Minimum 2h	**Evaluation:** power and wind speed variations are supervised which led to automatic GGE turn on/off **records:** time development of P, Q, U in CP & the no. of operational WT and the P & Q generated
8	Article 14 par (1)	annex 4 item 4.9	Check operation upon DWPP connection / disconnection	By disconnecting IO CP at P= (20%÷100) Pi		P, Q, U in CP	5 minutes	**Evaluation:** Q & U variations are supervised in connection points, U fluctuation should be < 5% Un **records:** time development of P, Q, U in CP
9		annex 4 item 4.10	Check the DWPP - EMS-SCADA data	Pd >60%Pi	none	P, Q, U, f in CP	1 hour	**Evaluation**: in NPD by sending P, Q, U set values and swithing P/f & Q/U regimes **records**: mode of DWPP response

10		annex 4 item 4.11	Check power quality in WPP connection point	none	none	According to standard EN 50160	Minimum 2 weeks	**Evaluation**: by comparison with standard EN 50160 **records**: class A power quality analysers

Verification of PVPP technical performance in terms of compliance with the requirements from the technical norm to connect them to public interest networks

CHAPTER I
Purpose

The purpose of this procedure is to establish:

a) Tests, verifications and records necessary to make in order to prove the compliance of photovoltaic power parks with NT 30;

b) The mode of PVPP verification and testing.

The procedure is applied as per article 19 of NT 30:

Article 19: „(1) DSO and TSO, if applicable, verifies and makes sure the DPVPP connection and operation do not lead to trespassing applicable norms on operation in the frequency, voltage, ride-through and power quality regimes in the CP.

(2) Compliance is checked as per the TSO-elaborated procedure in consultation with DSO and endorsed by ANRE. Procedure refers to commissioning stages, test period and acceptance for long term operation".

CHAPTER II
Application

This procedure is applied to all photovoltaic power parks, regardless of voltage level in the connection point upon commissioning, and aims at checking the compliance with the design technical conditions, the technical requirements of ATR and those mentioned in NT 30 and in the RET Code.

The procedure is applied:

2.1. When commissioning a new or refurbished photovoltaic power park;

2.2. During operation to determine the performance of photovoltaic power parks in case of complaints about non-observed requirements from NT 30 or the RET Code;

2.3. After capital repairs, replacements, SCADA and control systems in the power park, or total or partial replacement of associated inverters;

2.4. Upon TSO's request as per chapter 6.4 of the RET Code; in such case the TSO can aks trial verification of any test in this procedure;

2.5. In case of PVPP with capacity ranging 1 MW ÷ 5 MW tests are checked and assessed by DSO, using this procedure;

2.6. In case of PVPP above 10 MW tests are checked and assessed by the TSO;

2.7. In case of PVPP with capacity ranging 5 ÷ 10 MW tests are made and assessed according to this procedure by DSO that participates to tests and sends the results to TSO.

CHAPTER III
Responsibilities

3.1. **Responsibilities of the TSO**

3.1.1. Checking all the documents about achieving the control loops for active & reactive power and voltage, and asking additional documents and tests in case the performance that need to be acknowledged is not proved by the tests made and/or submitted documentation.

3.1.2. Participating to the trials and tests of this procedure.

3.1.3. Initiating the check-up on DPVPP operation in the cases provided in TSO Grid Code when one or severa requirements are repeatedly trespassed, according to items 2.2 and 2.4. In this case the provisions of chapter 6.4 of the Gird Code are applied.

3.1.4. Approving the test schedule sent by the applicant.

3.1.5. It is entitled to ask the test supervisor to repeat one or several tests, or additional tests to point out the performance of PVPP or of component inverters.

3.1.6. In case of deviations from this procedure resulting from objective reasons provided by the test supervisor before making the tests DEN is responsible to construe the application of the procedure.

3.2. **Responsibilities of generator managing the PVPP**

3.2.1. In case of procedures requiring verifications/tests – initiating tests for the situations provided in 2.1 and 2.3.

3.2.2. Elaborating the test schedule together with the accepted company (provider) in order to make the tests and elaborate the documents (records) and submitting it for approval to TSO, respectively DSO.

3.2.3. Informing the respective DSO on the time intervals of tests and asking the agreement in terms of network conditions.

3.2.4. Transmitting to NPD, at least 10 week-days before tests, the test schedule together with the request for test participation, while also agreeing a date for preliminary tests.

3.2.5. To check the PVPP ranging 5 MW ÷ 10 MW- transmitting to involved DSO, at least 10 week-days before tests, the test schedule and the requeste for the (DSO) representatives and possibly the TSO representatives.

3.2.6. To check the PVPP lower or equal to 5 MW- transmitting to the involved DSO, at least 10 week-days before tests, the test schedule and the request for the DSO representatives to the tests.

3.2.7. Providing the technical conditions for tests.

3.2.8. Providing the PVPP safe operation during all tests, being responsible for the integrity of all installations throughout the tests.

3.2.9. Designating a test supervisor together with the provider.

3.2.10. When tests are done- sending the full final documentation according to this procedure: to NPD for PVPP above 10 MW, to DSO and NPD for PVPP above 5 MW and below 10 MW, to DSO for PVPP above 1 MW and below 5 MW.

3.3. **Responsibilities of the DSO**

3.3.1. Elaborating own verification procedures containing at least the tests and the mode of operation of this procedure for PVPP below or equal to 5 MW.

3.3.2. Cooperating with the TSO in providing the test conditions, and reviewing the test results of this procedure in terms of network conditions, for dispatchable PVPP connected in their distribution network.

CHAPTER IV

Mode of operation

4.1. General conditions for tests

4.1.1. Tests synthetised in annex 5.1 are fully performed inside the preliminary (house) tests and are partially/fully resumed in the final tests made before NPD representatives for PVPP above 10 MW and/or DSO for the other capacities.

4.1.2. In the final tests executed before NPD specialists the achievement of P, Q, U set values from DEC is verified.

4.1.3. The applicant submits to NPD a full file with records made during preliminary (house) and final tests. When analysing the results of preliminary tests NPD reviews the documents, asks for others or for additional tests, and if applicable initiates a meeting of the applicant, DSO and test provider.

4.1.4. PVPP verifications can begin only when minimum 90% of PVPP installed capacity was commissioned, as per the manufacturers' procedures.

4.1.5. Tests will be made when environmental conditions provide PVPP output of minimum 60% from Pi.

4.2. Requirements for the metering instrumentation and the simulation & registration equipment

421. Frequency transducers- ≤ 0.005 Hz accuracy class, response time < 100 ms, range 45÷55 Hz

422. P, Q, U transducers, minimum 0.3 accuracy class

423. Acquisition system- minimum 0.5 s for each value collected, possible registration in .xls files. Minimum 40 ms registration rates will be provided for the requirements of 6.10

424. Frequency simulation- < 0.005 Hz accuracy, range 45÷ 55 Hz, providing frequency modification of 5 mHz accuracy and 1 Hz/sec slope.

425. GPS for the time stamp

426. Metering the available power, value for which PVPP equipment can be also used.

427. Electricity quality analysers- class A, by GPS, by possible calculation of disturbances in different time intervals- pre-set or determined after the registration.

For instance: determining the disturbance in the time interval of each test, but also during 1 week (standardised).

428. In case of verifications made for PVPP above 5 MW, the test-making company (provider) should be audited and agreed by the TSO, as per the Operational procedure 'Acceptance of product/service/work supliers', code: Tel 04.08.

4.3. Verification of PVPP operational requirements upon frequency variation

Tests are meant for DPVPP above 10 MW and verify the compliance with the requirements of article 9 of NT 30:

Article 9: "(1) DPVPP will be provided with automatic active power control system depending on frequency (automatic frequency/power control). It will operate according to a frequency/active power response curve shown in figure 2, where P_m represents the active power available at that moment. The coordinates of points A, B, C, D and E depend on frequency, on the active power that the power park can generate and the set value limiting the active power, in the ranges: A (50—47 Hz), B (50—47 Hz), C (50—52 Hz), DE (50—52 Hz). The position of such points should be set according to the network operator's requirements with maximum ±10mHz error. The frequency metering error should not exceed ± 10 mHz.

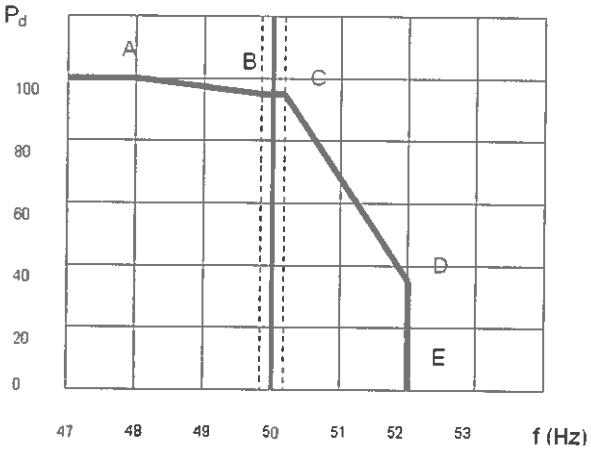


Figure 2- Active power variation in DPVPP depending on frequency

(2) The generated active power modified according to frequency variations will occur as much as possible under momentary sun radiation by proportionally modifying the active power generated by DPVPP inverters.

(3) In case frequency reaches a value higher than that of segment D-E of the characteristic curve shown in figure 2, it is admitted to disconnect the DPVPP".

Mode of operation: This test is made for two operational cases- operation at available power given by the momentary meteorological conditions, and at a set value of active power, lower than the available power. The frequency metered inside the active power loop will be replaced with some simulated value introduced either by the software or by a signal generator. Different frequency values will be simulated: 47.5; 48; 48.5; 49; 49.8; 50.2; 50.5; 51; 51.5; 52; 52.1 Hz. The test se will be carried out with operational reactive power control, the set value of reactive power being zero.

Records: Records will be made in time for- available power Pd, set active power Pcons, simulated frequency value fsimulate and the values metered in the substation (CP) and in the power park: P, Q, U, f. The P-f graph will be also made in comparison with that requested in figure 2 of NT 30.

Evaluare: The modification degree of active power upon frequency variations will be determined, including PVPP shut-down when frequency values exceed the 47.5÷52 Hz range. Checks will be made to have the PVPP power following the P-f graph when frequency varies from 52 to 50.2 Hz and PVPP can be connected to the grad at any frequency value in this range.

4.4. Verification of compliance requirements for active power set values

Tests refer to verifications on the compliance with requirements from article 10 of NT 30 about the behaviour of dispatchable photovoltaic power parks above 5 MW upon variations in the setpoint active power.

Tests are applied to all PVPP above 5 MW.

Tests refer to demonstrating such compliance with:

4.4.1. Article 10 - (1): "The active power generated by a DPVPP should be limited to a set value"

Verification applies to all PVPP above 5 MW.

Mode of operation: Under good environmental conditions for operation to at least 60% of the commissioned installed capacity, a set value of active power will be locally set, below the available power. The new power setpoint will be maintained at least 5 minutes, then a new setpoint will follow

equal to the installed capacity. This test will be repeated for 3 different setpoints of active power, for instance- 20% Pi, 40% Pi, 60% Pi. The test will be performed with operational reactive power control set to zero.

Records: Records will be made in time for- available power Pd, active power setpoint Pcons, values metered in the substation (CP) and in the power park: P, Q, U, f.

Evaluation: The active power setpoint should be reached during the time given by the set variation rate and the reduced power step required within ±5% Pi. The same requirements are applied in case of restoration (meaning power growth) to the initial power setpoint.

4.4.2. Article 10 — (2): „The active power setpoint should be taken automatically from distance (remotely)".

Verification is applied to all PVPP above 10 MW which receive their active power setpoint from the EMS-SCADA, and in case of PVPP above 5 MW but below 10 MW their active power setpoint will be transmitted by the PVPP power park dispathcer centre.

Mode of operation: The same as in item 4.4.1, except for PVPP above 10 MW with setpoints from DEC/DET by means of EMS-SCADA, while PVPP above 5 MW and lower or equal to 10 MW receive such setpoints from their own dispatcher centre through the communication path the latter decided on. The power park dispatcher centre should verify whether power setpoints are transmitted from power park dispatcher centres to DPVPP above 10 MW.

Records: Records will be made in time for- available power Pd, active power setpoint Pcons and the values metered in the substation (CP) and in the power park: P, Q, U, f.

Evaluare: The active power setpoint received and applied in the DPVPP has been set by EMS-SCADA.

4.4.3. Article 10. — (3): „ DPVPP should provide active power control within ±5% range from the PVPP installed capacity against the setpoint"

Verification will target all PVPP above 5 MW.

Mode of operation, records and evaluation are as shown in item 4.4.1.

4.4.4. Article 10. — (4): „ DPVPP should provide the possibility to set the variation rate of generated active power to the TSO-required value (MW/min) of minimum 10% Pi/minut."

Verification will target all PVPP above 10 MW.

Mode of operation, records and evaluation are as shown in item 4.4.1. Two variation slopes of active power will be set, one of 10% Pi/minute. Slope is checked both when the active power setpoint decreases and it increases.

4.5. **Verification of requirements on the capacity to deliver reactive power in the CP**

Tests are meant for PVPP and intend verifying the compliance with the requirements specified in article 13 and article 21 par (3) of NT 30.

4.5.1. Verification of the power factor in the CP

This test verifies PVPP's compliance with Pi>1 MW from the requirements provided in article 13 par (1), respectively article 21 par (3) of NT 30, referring to PVPP behaviour when the voltage setpoint fluctuates.

Article 13 — (1): „When voltage values in the coupling point are within the addmissible range the reactive power generated / taken by an operational DPVPP should be controlled continuously according to a power factor of absolute value of maximum 0.90 capacitive and 0.90 inductive".

Article 21 — (3): „In addition to the requirements of par (1), NDPVPP with installed capacity above 1 MW and lower or equal to 5 MW should comply with the requirements from articles 6, 7, 8, 11, article 12 par (2), article 13 par (1), par (2) letter b) and par (3), articles 14, 16, 18 and 19".

Mode of operation: In the admissible voltage range specified in the Grid Code when the value is as close as possible to the installed active power PVPP passes to reactive power control and maximum reactive power setpoint is applied both in inductive and in capacitive regime. Resulting values are recorded.

Records: P, Q, U, f values metered in the substation (CP) and in the power park are recorded:

Evaluation: The power factor is calculated for the maximum active power of the tests.

4.5.2. Verifying the requirements on the reactive power control- this test verifies the compliance with the specified requirements in article 13 par (2) letter b) of NT 30 and of the Grid Code, regarding the behaviour of photovoltaic power parks upon variations in the reactive power setpoint.

This test is applied to all PVPP above 5 MW.

Article 13 — (2): „ DPVPP should provide automatic voltage - reactive power control in the CP in any of the modes (fully using the reactive power resources of the PVPP):

b) Control of the reactive power exchanged with NPS in the CP".

Mode of operation: When admissible voltage limits are observed in the CP PVPP passes to reactive power control at active power generated according to environmental conditions. Various reactive power setpoints are applied. Tests are resumed with local reactive power setpoints or remotely set (by DEC/DET or PVPP's dispatcher centre in case of PVPP below or equal to 10 MW). In case of PVPP above 10 MW tests are also re-made for at least two different values of reactive power.

Records: Values metered in the substation (CP) and in the power park- P, Q, U, f and the reactive power setpoint- are recorded.

Evaluation: Achieving the reactive power setpoint and maintaining a constant value of maximum ±2 MVAr in the insensivity range. The MVAr/kV of the CP will be determined for at least two active power values generated by PVPP.

4.5.3. Verifying the P-Q theoretical diagram of PVPP in CP

This test verifies the compliance with the requirements specified in article 13 par (3) of NT 30.

Article 13 — (3): „It should provide in the CP null reactive power exchange with the system in case the DPVPP does not produce active power (when generated active power is null)"

Mode of operation: When operating within the admissible voltage range specified in the RET & RED Codes and the value is as close as possible to the installed active power PVPP passes to reactive power control and a maximum reactive power setpoint is applied both in inductive and in capacitive regime. Resulting values are recorded. The P-Q diagram of PVPP is drawn for at least 5 active power points. When the active power setpoint is zero the reactive power injected in the CP is also metered, supervising it to be null.

Records: Values metered in the substation (CP) and in the power park are recorded- P, Q, U, f as well as the reactive power Qc and active power Pc setpoints.

Evaluation: The P-Q diagram made after reactive studies in the CP will be compared to the real one. The reactive power exchange in the CP is metered upon null active power.

4.6. **Verification of voltage control requirements**

This test verifies the compliance with t he requirements provided in article 13 par (2) letter a of NT 30 and of Grid Code with respect to the behaviour of photovoltaic power parks upon voltage setpoint fluctuations.

The test is applied to all PVPP above 10 MW.

Article 13 — (2): „DPVPP should provide automatic voltage - reactive power control in the CP in any of the modes (fully using the reactive power resources of the PVPP):

a) Voltage control in the CP".

Mode of operation: When the admissible voltage limits are observed in the CP PVPP passes to voltage control upon active power generated as per environmental conditions and upon the existing system voltage at that moment, with different voltage setpoints applied- for ≥ 110 kV values: ±2÷3 kV against the network voltage and for < 110 kV values: ±2÷3% Un to the grid voltage. Tests are resumed for local voltage setpoints and remote ones (by DEC/DET/PVPP dispatcher centre) and at least two different voltage fluctuation values.

Records: Values metered in the substation (CP) and in the power park: P, Q, U, f and voltage setpoint- Uconsemn.

Evaluation: The voltage setpoint should be achieved and a constant value of maximum ± 0.5 kV should be maintained in the insensivity range. The MVAr/kV values of the CP will be determined for at least two active power values from PVPP.

4.7. **Verifying the shock-free switching between reactive power and voltage control regimes in the CP**

Tests are applied only to PVPP above 10 MW and will prove the passage (switch) between the voltage control and reactive power control operational regimes with no shocks of active / reactive power or voltage. Checks are made both for local regime switching and for the remotely operated ones (DEC/DET/dispatcher centre).

4.8. **Verification of normal operational regime requirements**

Tests are applied to all PVPP above 1 MW and verify the compliance with the requirements of article 14 of NT 30:

Article 14: „Under network normal operational regime DPVPP should not generate fast voltage fluctuations higher than ±5% of the nominal value [...]."

Verifications consist in records of long operation at different values of generated active power. Records should point out the circumstance when PVPP was in operation one or several inverters stopped or automatically turned on because environmental and ambiental conditions varied. Records should be made for minimum 2 up to 24 hours.

4.9. **Verification of operational requrirements in special circumstances**

Tests apply to all PVPP above 1 MW and verify how they comply with the requirements of article 12 par (1) of NT 30:

Article 12 — (1): „The DPVPP owner is obliged to provide protection of photovoltaic panels, of DPVPP component inverters and of auxiliary installations against damages that can be caused by defects in their own installations or by the grid impact over them when DPVPP trip protections operate accurately or upon network incidents (short-circuits with or without grounding, tripping of network protections, transient surges etc.), as well as when exceptional/abnormal technical operational contidions occur".

Mode of operation: PVPP breaker in the connecting substation (CP) is disconnected, and then rapidly re-connected. In special circumstances three phase fast automatic re-closure simulations in the CP for PVPP above 10 MW or in another TSO-indicated network point.

Records: Values metered in the substation (CP) and in the power park: P, Q, U, f with maximum 40 ms procurement rate.

Evaluation: PVPP behaviour

4.10. **Verification of PVPP - EMS-SCADA data exchange**

Tests apply to all PVPP above 1 MW and they verify:

a) For DPVPP above 10 MW:

1. Reception/emission and correct execution of exchanged information/orders- (P, Q, U) metered values, (P, Q, U) setpoints and (P-f, Q/U) regim selectors;

2. Reception of values by means of optical fibre communication path and back-up on another communication support;

3. DPVPP integration in EMS-SCADA;

4. Correct treatment of metered values and setpoints from DPVPP in all the protocols;

5. Checking up the analogue values displayed with the analogue values read from other DPVPP (P, Q, U, f);

b) In case of PVPP with installed capacity above 1 MW and lower or equal to 10 MW the P & Q values metered in the CP and received in TSO's EMS-SCADA should be integrated either from the PVPP dispatcher centre or from the distribution operator's DMS-SCADA.

The TSO makes such verification and the above signals should be received accurately, while setpoints should be functional and accurately executed by DPVPP.

4.11. **Verifying power quality in PVPP's connection point**

Tests are applied to all PVPP above 1 MW and supervise the compliance with set limits of THD, harmonics, negative non-symmetry factor and flicker in the connection point.

Quality analysers mentioned further are class A, PSL certified and belong to the provider, namely to the applicant.

Article 18: "DPVPP is monitored in terms of power quality in the CP during tests. DPVPP connected to the Grid will permanently monitory power quality by being integrated into the TSO's power quality monitoring system".

In case of PVPP above 10 MW the records made during tests and for two more weeks will be transmitted to NPD.

In case of DPVPP operation even during test period and records prove deterioration of electricity quality, the generator should take measures and get endowed with necessary compensation means, which should achieve compliance with the power quality parameters in the connection point, maintaining them within the limits specified in the RET/RED Codes. PVPP operation is not admitted without observing the power quality requirements in the connection point.

CAPITOLUL V
Reports and registrations

Records contain the full file of test results according to annex 5.1, accompanied by the provider's conclusions (the one that performed the tests), as well as the documents provided in this procedure.

The list of tests that need to be carried out is provided in annex 5.1.

Test number	Article of the NT30	Paragraph in the procedure	PVPP under verification			Test name/ description	Operational conditions	Simulations	Metered values	Test duration	Special requirements /Evaluation conditions
			Pi > 10 MW	10 MW ≤ Pi < 5 MW	5 MW ≤ Pi < 1 MW						
1	Article 9 par (1) art. 9 par (2)	annex 5 item 4.3	YES	NO	NO	Verifying the implementation of the frequency-power dependence curve	When Pd > 60% Pi the following values are seclected P_1 = 70% Pd P_2 available power (no P setpoint)	Applying the simulated frequency steps 47.5; 48; 48.5; 49; 49.8; 50.2; 50.5; 51; 51.5; 52; 52.1 Hz	P, Q, U, f both in the substation (CP) and in the power park, Pc, Pd, fsimulate	1 ÷ 3 minutes for each step depending on the steadying time	**Records:** time development of Pc, P & frequency; P-f graph simulated as per figurei 2 **evaluation:** DPVPP should respond as per required power - frequency
	Article 9 par (3)	annex 5 item 4.3	YES	NO	NO	Verifying the turn on/off by frequency criteria					**Records:** turn on/off times **evaluation:** when DPVPP stops the turn off/on time will be written and supervised and turn off/on procedures are assessed
	art. 10 par (1) art. 10 par (2) art. 10 par (3)	annex 5 item 4.4.1 item 4.4.2 item 4.4.3	YES	YES	NO	Checking the active power control at setpoint lower than available power	Pd > 60% Pi 3 paliere: P_1 = 60% Pd P_2 = 40% Pd P_3 = 20% Pd	none	P, Q, U, f both in substation (CP) and in power park, Pc & Pd	Test is done with return, 5 min for each step; different slope is taken for each test (2 slopes will be checked)	**Records:** time development of Pc, Pd, P, Q, U in CP, at operational reactive power control and Qconsemn = 0 **evaluation:** PVPPshould keep the new power setpoint within ±5% Pi

2	Article 10 par (4)	annex 5 item 4.4.4	YES	NO	NO	Checking the active power control at set value					**Records:** time development of Pc, P, Q, U in CP, with reactive power control in operation at Qconsemn = 0 **evaluation: DWPP** should provide variation rate of set power
3	article 13 par (1)	annex 5 item 4.5.1	YES	YES	YES	Provide 0.90 inductive/ capacitive power factor in CP at P = Pi	P = Pi	none	P, Q, U, f both in substation (CP) and in power park	5 minutes/test verifying the 0.90 inductive/ capacitive	**Records:** time development of P, Q, U in CP **evaluation: DWPP** should provide FP 0.9 inductive / capacitive
	Article 13 par (3)	annex 5 item 4.5.2	YES	YES	YES	Providing zero reactive exchange with the system when P = null	P = 0	none	P, Q, U, f both in substation (CP) and in power park	5 minutes	**Records:** time evolution of P, Q, U in CP **evaluation: DWPP** should make zero reactive exchange with NPS in CP
4	article 13 par (2) let a)	annex 5 item 4.6	YES	NO	NO	Providing voltage control in the CP	P in the (10%÷100%) Pi range	none	P, Q, U, f both in substation (CP) and in power park, and Ucons	Setting kept minim 10 min, when setpoint is reached 2 different variation rates are selected	**Records:** time development of P, Q, U, Pc and Uconsemn **evaluare: DWPP** should provide voltage control in connection point

5	Article 13 alin. (2) lit. b)	annex 5 item 4.5	YES	YES	NO	Providing reactiv power control in the CP	P in the (10%÷100%) Pi range, 3 setpoints are selected for Q	none	P, Q, U, f both in substation (CP) and in power park, and Qcons	Setting kept minim 10 min, when setpoint is reached for PVPP≥ 10 MW different variation rates are selected	**Records:** time development of P, Q, U, Qc in CP **evaluare: DWPP** should provide reactive power control in connection point within ±2 MVAr range
6		annex 5 item 4.7	YES	NO	NO	Shock-less switch between Q/U control regimes	This test can be made inside the previous ones		P, Q, U, f both in substation (CP) and in power park	Q→U, U→Q control switch	**Records:** time development of P, Q, U in CP **evaluation:** DPVPP should provide shock-less switch
7	Article 14	annex 5 item 4.8	YES	YES	YES	Records of normal operation	none	none	P, Q, U, f both in substation (CP) and in power park	minimum 24 hours	**Evaluation:** active power, voltage and reactive power variations will be noticed in CP și PVPP **records:** time development of P, Q, U in CP and no. of operational inverters
8	Article 12 par (1) și art. 15	annex 5 item 4.9	YES	YES	YES	Checking the operation upon PVPP disconnection / connection	By disconnectin g the PVPP breaker in the CP at P = (50%÷100%) Pi	none	P, Q, U, f both in substation (CP) and in power park	10 minutes	**Records:** time development of P, Q, U in CP and in PVPP **evaluare:** Q & U variations in CP will be supervised, U fluctuation should be <5%Un

9		annex 5 item 4.10	YES	YES	YES	Checking the PVPP - EMS-SCADA data exchange	Pd >60%Pi	none	P, Q, U, f in the CP	1 hour	**Evaluation:** by DET/DED by sending P, Q, Usetpoints and switching P/f & Q/U regimes **records:** the response manner of the PVPP
10	Article 18	annex 5 item 4.11	YES	YES	YES	Checking power quality in the PVPP connection point	none	none	According to standard EN50160	minimum 2 weeks	**Evaluation** by comparison with standard EN50160 **records:** power quality analysers class A

ANNEX 6
to the procedure

Model of request for issance of energising agreement for DWPP/DPVPP equipment

HEADER

To
NATIONAL POWER GRID COMPANY TRANSELECTRICA SA

Trading Company ....., registered with the Office of the Commercial Register of ..... under number ....., is kindly requesting you to energise the Dispatchable Wind / Photovoltaic Power Park ...., managed by it.

To support such request the documents provided in item 6.1. of the Procedure with respect to energising for test periods and certifying the technical compliance of wind and photovoltaic power parks, approved under Order 74/2013 of the National Regulatory for Energy, are hereby attached.

Director,
1. ..... 1.

Date: 1.....

ANNEX 7
to the procedure

Model of request for issuance of compliance certificate with the requirements of NT 51 and NT 30

HEADER

To
NATIONAL POWER GRID COMPANY TRANSELECTRICA SA

Trading Company ....., registered with the Office of the Commercial Register of ..... under number ....., is kindly requesting the certifcation of compliance with Order 51/2009 of the president of the National Regulatory for Energy approving the norm „Technical conditions to connect wind power parks to electricity networks of public interest", with later amendments and additions, and with Order 30/2013 of the president of the National Regulatory for Energy approving the norm „Technical conditions to connect photovoltaic power parks to electricity networks of public interest" for the Wind / Photovoltaic Power Park ....., managed by it.

To support such request the documents provided in item 6.3. of the Procedure with respect to energising for test periods and certifying the technical compliance of wind and photovoltaic power parks, approved under Order 74/2013 of the National Regulatory for Energy, are hereby attached.

Director,
11.....

Date: 1.....

Patterns of certificates issued by the TSO, namely the DSO, for compliance with the requirements of technical norms for WPP and PVPP

Compania Națională de Transport al Energiei Electrice

"Transelectrica" - S.A.

Ca urmare a solicitării adresate de .....,
cu sediul în ....., Nr. Reg. Comerțului .....,
reprezentată prin Administrator /Director General ....., înregistrată la numărul ..... din data de .....
în baza probelor de verificare și a documentației tehnice depuse la C.N.T.E.E. Transelectrica S.A.
se acordă

CERTIFICAT

de conformitate cu cerințele
Normei Tehnice *„Condiții tehnice de racordare la rețelele electrice de interes public pentru centralele electrice eoliene"*
Ordinul președintelui Autorității Naționale de Reglementare în Domeniul Energiei nr. 51/2009
cu modificările și completările ulterioare
Centrala electrică eoliană dispecerizabilă: .....

Dispecerul Energetic Național

DIRECTOR .....
.....

Seria: CE Nr.: ..... **Data eliberării: .....**

Sigla

Operatorului de distribuție

(Operatorul de distribuție)
.....

Ca urmare a solicitării adresate de .....,
cu sediul în ....., Nr. Reg. Comerțului .....,
reprezentată prin Administrator /Director General ....., înregistrată la numărul ..... din data de .....
în baza probelor de verificare și a documentației tehnice depuse la .....(Operatorul de distribuție)
se acordă

CERTIFICAT

de conformitate cu cerințele
Normei Tehnice *„Condiții tehnice de racordare la rețelele electrice de interes public pentru centralele electrice eoliene"*
Ordinul președintelui Autorității Naționale de Reglementare în Domeniul Energiei nr. 51/2009
cu modificările și completările ulterioare
Centrala electrică eoliană nedispecerizabilă: .....

(Operatorul de distribuție)
.....

DIRECTOR .....
.....

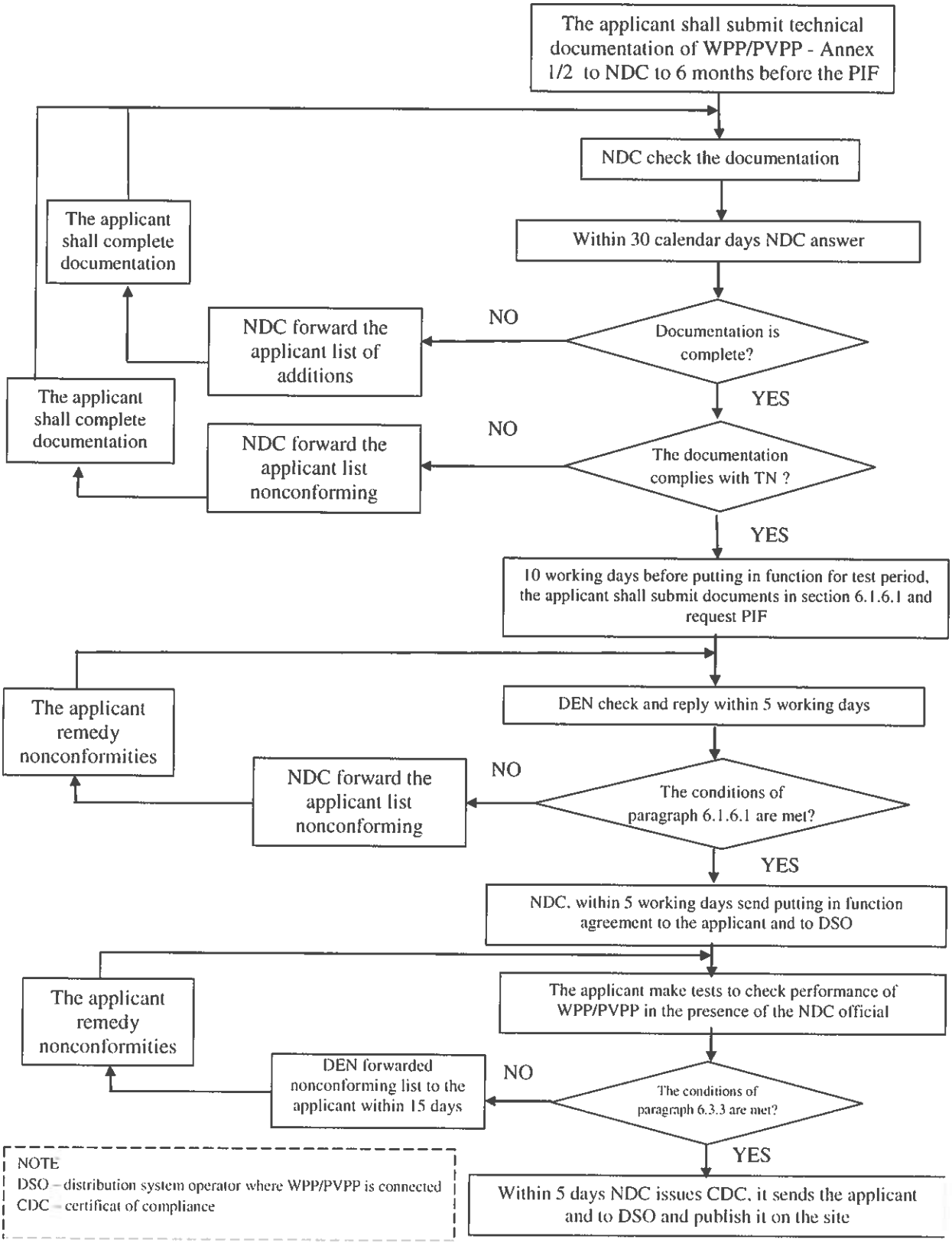
Seria: CE Nr.: ..... **Data eliberării: .....**

ANNEX 9
Ito the procedu

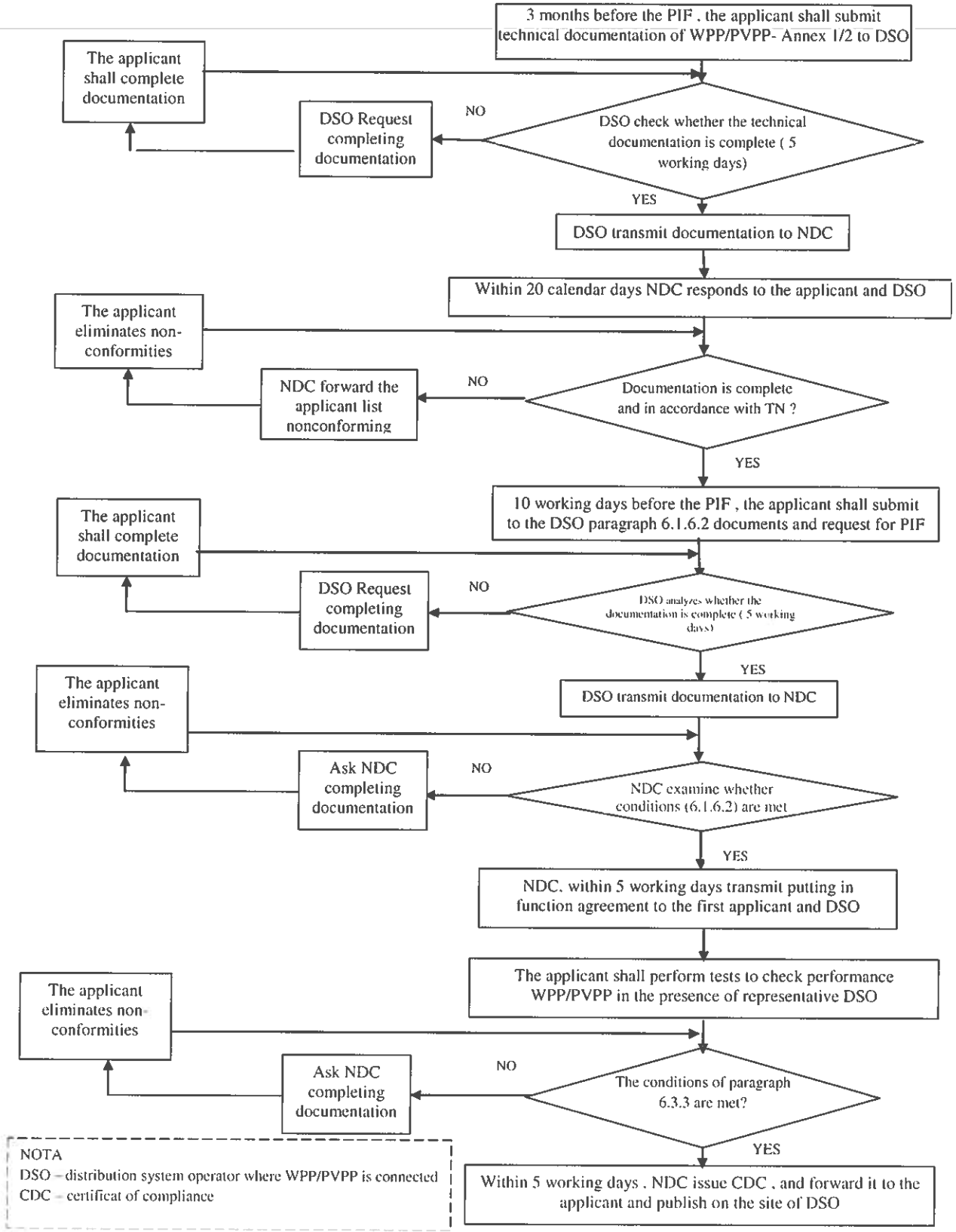
Synthesis of technical compliance granting to WPP and PVPP

	Installed capacity > 10 MW		Installed capacity higher than 5 MW and lower or equal to 10 MW		Installed capacity higher than 1 MW and lower or equal to 5 MW	
	WPP	PVPP	WPP	PVPP	WPP	PVPP
Technical documentation specified in annexes 1, 2 &3 to the procedure is submitted	NPD		NSO care, în termen de 5 zile o transmite la NPD		OR	
Integrating the metered and condition values in the TSO's EMS-SCADA	directly		in aggregated mode by link to EMS / DMS SCADA in the dispatcher / communication centre		in aggregated mode by link to EMS / DMS SCADA in the dispatcher / communication centre	
Integrating the metered and condition values in the DSO's DMS-SCADA	YES, except for those directly connected in TSO's substations		YES		YES	
Setting values are integrated in the	TSO's EMS-SCADA		Dispatcher centre of the WPP/PVPP		NO	
Integration in the forecast system	YES	YES	YES	YES	NO	
Reactive power control, at the dispatcher's disposal	YES continuously at the set value		YES by GGE disconnection / connection at set value	YES, continuously at set value	NO	
Q control at dispatcher's disposal	YES continuously at the set value		YES, in steps	YES continuously at set value	NO	
Compensation means are integrated in	Voltage and reactive power control loops			Control loop of reactive power		
U control at dispatcher's disposal	YES continuously at set value		NO		NO	
Implementing the power-frequency curve	YES		NO		NO	
Verification of inverter/GGE compliance (laboratory certificates and tests)	YES		YES		YES	
Studies to calculate reactive power in CP	YES		Calculation of reactive power in CP	YES	Calculation of reactive power in CP	
Studies to avoid islanding	YES		YES		Upon request of OR/ DEN	
Based on full documents certifying the compliance with technical requirements; the energising permit for commissioning is issued by	DEN		DEN		OR	
WPP &PVPP belong to a dispatcher centre	YES		YES		NO	
Investment order issued by	DEN		DEN		OR	
Publishing the commissioning schedule	TSO's website		—		—	
Tests are made to check the performance of the power park	YES		YES		Upon request of OR	
Final power park tests are performed before the representatives of	DEN		OD		OD	
Technical compliance certificate issued by	DEN		DEN		OR	
Publishing the situation of compliance certificate on Transelectrica website	TSO's website and OR's website		TSO's website and OR's website		—	
Enlisting on the balancing market	YES		YES		NO	

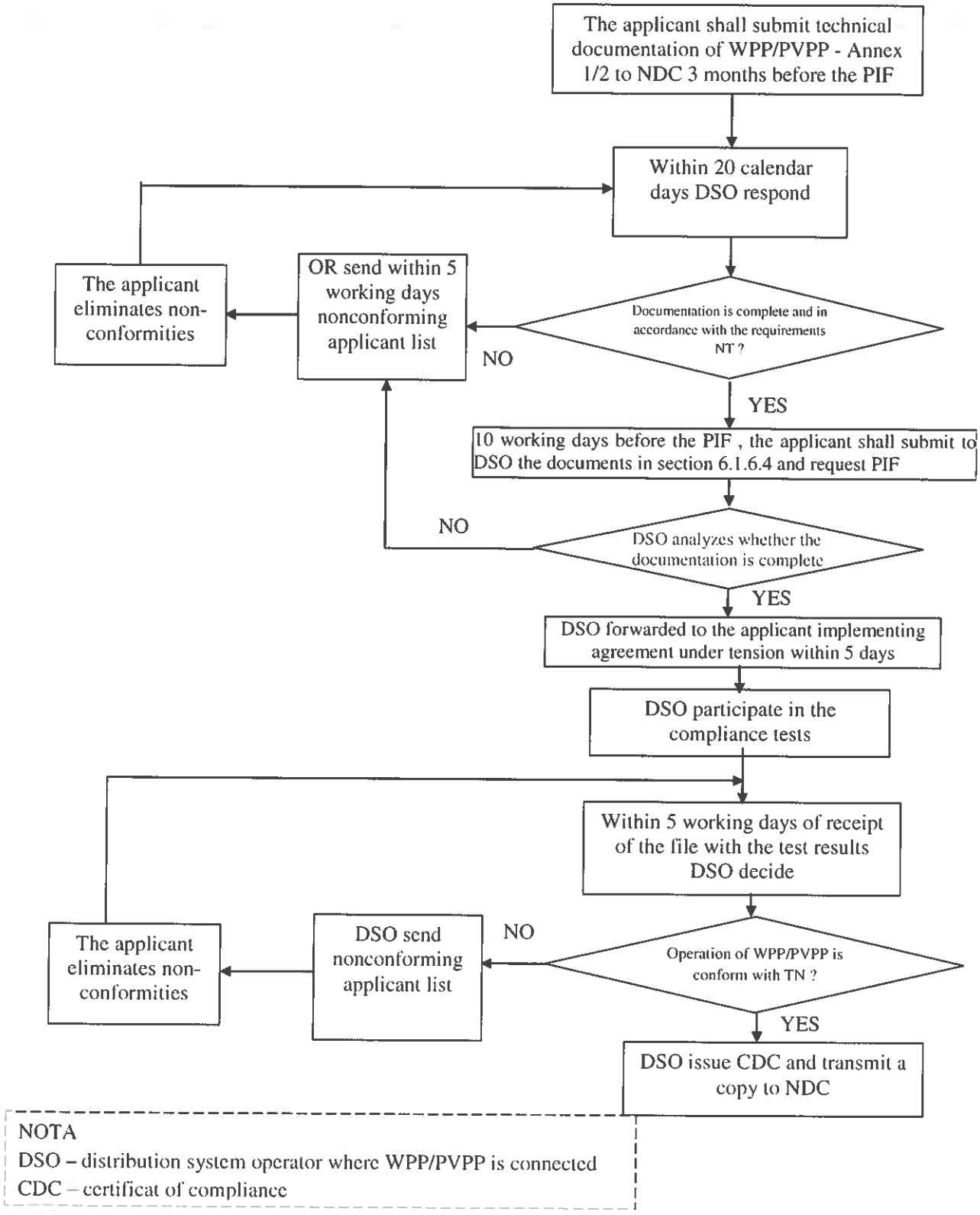
Logical diagram of energising process for test and certification periods of WPP & PVPP with Pi > 10 MW



Logical diagram of energising process for test and certification periods of WPP & PVPP with 5 MW < Pi ≤ 10 MW



Logical diagram of energising process for test and certification periods of WPP & PVPP with 1 MW < Pi ≤ 5 MW



NOTA
DSO – distribution system operator where WPP/PVPP is connected
CDC – certificat of compliance