GOVERNMENT OF INDIA
CENTRAL ELECTRICITY AUTHORITY
(MINISTRY OF POWER)
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PUBLIC NOTICE

In accordance with the Section 177 of the Electricity Act, 2003, the Central Electricity Authority (CEA) had notified the Regulations *namely* **Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 on 21.02.2007 & amendment of these regulations notified on 15.10.2013.**

It is now proposed to further amend specific clauses in the said regulations. The proposed draft amendments in the above regulations are available on the CEA Website www.cea.nic.in. The Regulations can also be inspected in the office of Chief Engineer (Legal), Sewa Bhawan (North Wing), Room No. 622, 6th Floor, R. K. Puram, New Delhi-110066 on any working day from **15th November, 2016 to 31st December, 2016 between 1100 hrs to 1600 hrs.** Members of the public are requested to send their comments on the draft regulations to Chief Engineer (Legal), Sewa Bhawan (North Wing), Room No. 622, 6th Floor, R. K. Puram, New Delhi-110066 by post or through e-mail latest by **31st December, 2016.**

(P. D. Siwal)
Secretary, CEA

भारत सरकार
केंद्रीय विद्युत प्राधिकरण
(विद्युत मंत्रालय)
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सार्वजनिक नोटिस

विद्युत अधिनियम, 2003 की धारा 177 के अनुसरण में, केंद्रीय विद्युत प्राधिकरण (के.वि.प्रा.) द्वारा **केंद्रीय विद्युत प्राधिकरण (ग्रिड के संयोजन के लिए तकनीकी मानक) विनियम, 2007** को तारीख 21.02.2007 को अधिसूचित एवं संशोधन विनियम तारीख 15.10.2013 को अधिसूचित किये गये थे। अब उपर्युक्त विनियमों में विशिष्ट खंडों को पुन: संशोधित किए जाने का प्रस्ताव किया गया है। उक्त विनियमों में प्रस्तावित प्रारूप संशोधन के.वि.प्रा. की वेबसाइट www.cea.nic.in पर उपलब्ध हैं। विनियमों को **15 नवम्बर, 2016 , 2016 से 31 दिसम्बर, 2016 तक 11:00 बजे से 16:00 बजे तक** किसी भी कार्य दिवस को मुख्य अभियंता (विधि), कमरा नं. 622, सेवा भवन (उत्तरी खंड), छठा तल, आर.के.पुरम, नई दिल्ली-110066 के कार्यालय में भी देखा जा सकता है। जनता से प्रारूप विनियमों पर अपनी टिप्पणियां डाक अथवा ई-मेल के जरिए मुख्य अभियंता (विधि), कमरा नं. 622, सेवा भवन, (उत्तरी खंड), 6वां तल, आर.के.पुरम, नई दिल्ली-110066 को **31 दिसम्बर, 2016** तक भेजने का अनुरोध किया जाता है।

(पी. डी. सिवाल)
सचिव, के.वि.प्रा.

Central Electricity Authority

Grid Management Division

Subject: Draft second amendment in CEA (Technical Standards for connectivity to the Grid) Regulations, 2007 as amended.

A: BACKGROUND:

1.1. CEA (Technical Standards for connectivity to the Grid) Regulations, 2007 were notified on 21st February, 2007

1.2. These were further modified and first amendment of regulations was notified on 15th October, 2013.

1.3. This amendment seeks to introduce/review the following provisions in the existing regulations:

1. Introduction of Frequency range with provision to include frequency response by Wind & Solar power stations
2. Introduce applicability of LVRT to Solar Generating stations
3. Change applicability of LVRT to Wind generating units/stations at all voltage levels in place of 66 kV level & above.
4. Introduction of HVRT facility in Solar & Wind generating units/stations
5. Specifying Ramp Up & Ramp Down rates for Solar & Wind generating units/ stations
6. Introduction of Voltage Regulation services for Solar & Wind generating stations
7. Introduction of Short Circuit Ratio (SCR) for Renewable generating units/stations
8. Review of Reactive Power control capability of Renewable generating units/station
9. Review of limits of Harmonics
10. Power to relax in case of introduction of a new technology
11. Compliance Monitoring of CEA Regulations

B: PROPOSAL:

Following amendments in CEA (Technical Standards for connectivity to the Grid) Amendment Regulations, 2013 are proposed.

B(i). **In Regulation 2, the following new definitions are proposed to be included:**

(a) **Wind farm Developer**: The entity which has developed or will develop, and is carrying out or will carry out the operation and maintenance of the wind generating station/farm comprising more than one wind generating unit owned by the developer and/or other entities. This entity being an applicant to seek connectivity of the wind generation station/farm with the grid, shall be responsible for compliance of these regulations.

(b) **Solar park Developer**: The entity which has developed or will develop, and is carrying out or will carry out the operation and maintenance of the the solar park / generating station comprising more than one solar generating unit/module owned by the developer and/or other entities. This entity being an applicant to seek connectivity of the solar park / generating station with the grid, shall be responsible for compliance of these regulations.

B(ii). Heading of clause B2 is proposed to be modified as follows so as to apply the regulations thereunder to the generating units or station as a whole, as specified Further, these regulations are also proposed to be applied to solar generating units/stations as well in addition to wind generating units/stations.

Existing:

For generating stations getting connected on or after completion of 6 months from date of publication of these Regulations in Official Gazette

Proposed:

For generating units/stations getting connected on or after completion of 6 months from date of publication of these Regulations in Official Gazette.

B(iii). Sub clause (2) of clause B2 in Part–II of the Schedule of regulations is proposed to be amended as follows to introduce the frequency response feature in the renewable generating units:

Existing

The generating unit shall be capable of operating in the frequency range of 47.5 to 52 Hz and shall be able to deliver rated output in the frequency range of 49.5 Hz to 50.5 Hz.

Provided that above performance shall be achieved with voltage variation of up to ±5% subject to availability of commensurate wind speed in case of wind generating stations and solar insolation in case of solar generating stations.

Proposed:

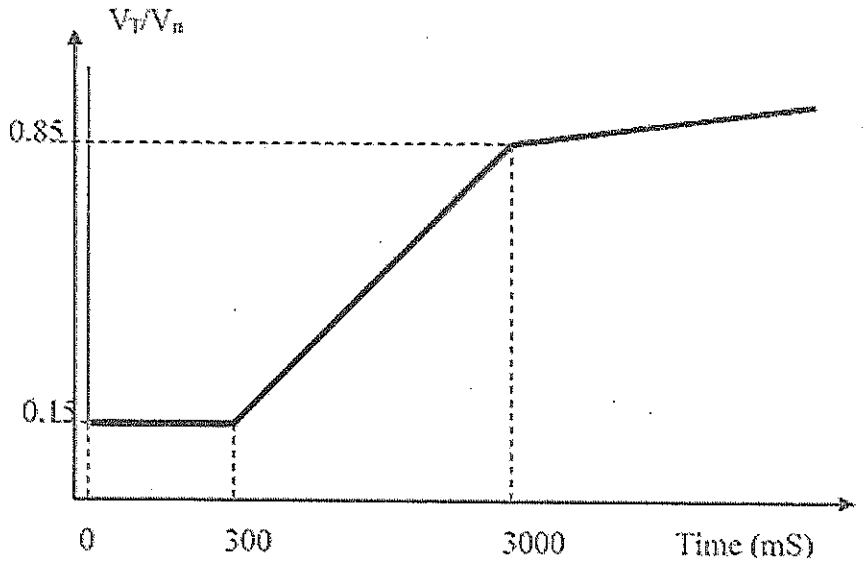
The generating unit shall be capable of operating in the frequency range 47.5 to 52 Hz and shall be able to deliver rated output in the frequency range of 49.5 Hz to 50.5 Hz.

Provided that in the frequency range below 49.90 Hz and above 50.05 Hz, or, as prescribed by the Central Commission from time to time, the output shall be as per frequency response requirement mentioned in sub-clause 4 below.

B(iv). **Sub**–Clause (3) of Clause (B2) in Part II of the schedule is proposed to be modified as under to change applicability of the regulation regarding LVRT to both Wind and the Solar generating units/ stations at all voltage levels as against applicability to only Wind generating stations at 66 kV and above in the existing Regulation:

Existing:

Wind generating stations connected at voltage level of 66 kV and above shall remain connected to the grid when voltage at the interconnection point on any or all phases dips up to the levels depicted by the thick lines in the following curve:



Provided that during the voltage dip, the individual wind generating units in the generating station shall generate active power in proportion to the rated voltage.

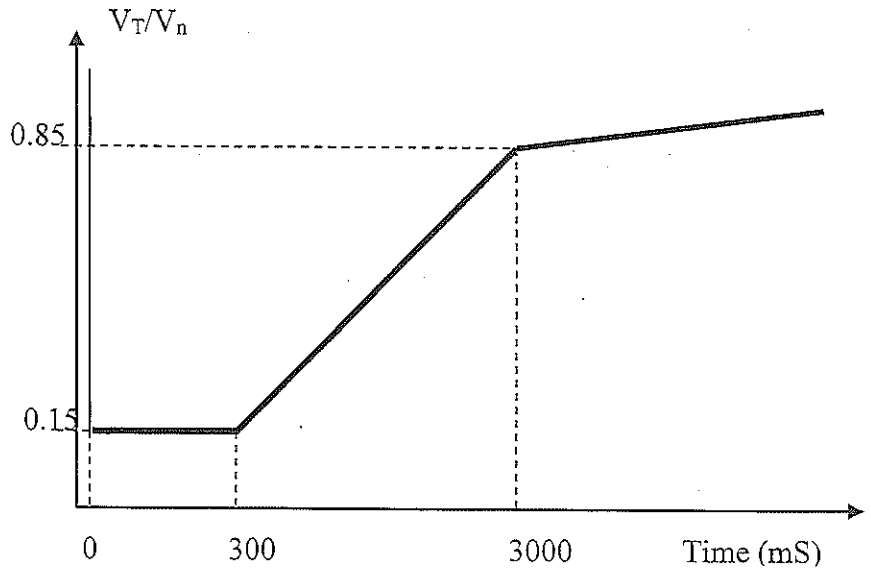
Provided further that during the voltage dip, the generating units shall maximise supply of reactive current till the time voltage starts recovering or for 300 ms, which ever time is lower.

Proposed:

(a). Wind and **Solar generating units/stations** connected ***to the grid,*** shall remain connected to the grid when voltage at the interconnection point (measured on HV side of interconnection) on any or all phases dips up to the levels depicted by the thick lines in the following curve:

VT : Actual Voltage

Vn: Nominal Voltage



Provided that during the voltage dip, the Wind **and Solar** generating units/station shall generate active power in proportion to the rated voltage.

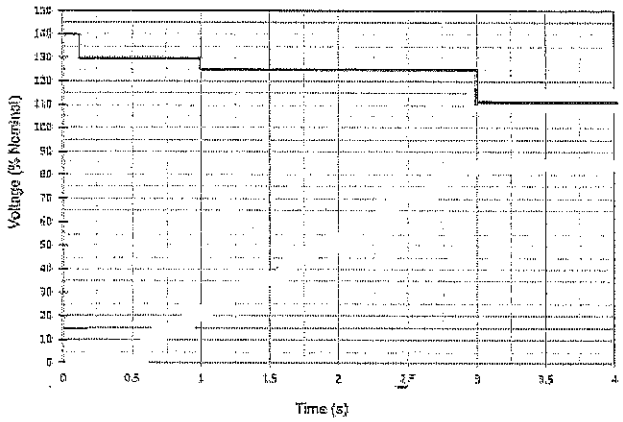
Provided further that during the voltage dip, the generating units/stations shall maximise supply of reactive current till the time voltage starts recovering or for 300 ms, which ever is lower.

B(v). New provision regarding High Voltage Ride Through (HVRT) facility in Wind as well as Solar generating units / stations is proposed to be inserted after above sub-clause:

(b). Wind and Solar generating units/stations connected at all voltage levels to the grid, shall remain connected to the grid when voltage at the interconnection point, measured on HV side, on any or all phases (Symmetrical or asymmetrical overvoltage conditions) rise above the specified value given below for specified time:

Over voltage (pu)	**Minimum time to remain connected (Seconds)**
1.3<V≤1.4	**1**
1.1<V≤1.3	**3**
1.1 or below	**Indefinitely**

The requirement is shown graphically as below:



High Voltage Ride Through]

B(vi). **Sub** –Clause (4) of Clause B2 in Part II of the Schedule B2(4) requires the Wind generating stations to provide frequency response / regulation. This provision is proposed to be amended to include the following additional features:

1) Wind and solar generating stations with installed capacity of more than **10 MW** should provide an immediate real power primary frequency response, proportional to frequency deviations from scheduled frequency, similar to governor response. The rate of real power response to frequency deviations should be similar to or more responsive than the droop characteristic of 3 to 6 % used by conventional generators. Wind and solar generating station should have controls that provide both for down-regulation and up-regulation. For this purpose, Wind and Solar generating station in combination with energy storage systems such as, but not limited to BESS (Battery Energy Storage System), flywheels and hybrid systems, are acceptable options.

2) For small frequency deviations e.g. less than 0.3 Hz, the Wind and Solar generating station response should be proportional to the frequency deviation, based on the specified droop characteristic. The frequency response dead band should not exceed +/- 0.03%. For large frequency

deviation e.g. in excess of 0.3 Hz, the Wind and Solar generating station should provide an immediate real power primary frequency response of at least 10% of the maximum AC active power capacity. The time response should be less than 1 second.

3) If energy storage systems are utilized to comply with the frequency regulation requirements, and during a disturbance, the system frequency falls suddenly and stays below 49.7 Hz, the wind/solar generating station frequency response should act immediately(within one sec) and should be maintained for at least 10 minutes. After the 10th minute, the real power primary frequency response should not decrease at a ramp rate higher than 10% of the maximum AC active power capacity per minute.

4) The operational range of the frequency response and regulation system should be from 10% to 100% of the maximum AC active power capacity

Accordingly, Clause B2(4) is proposed to be amended as follows.

Existing:

Wind generating station connected at voltage level of 66 kV and above shall have facility to control active power injection in accordance with a set point, which shall be capable of being revised based on direction of the appropriate Load Dispatch Centre.

Proposed:

(a). Wind **and Solar** generating stations with installed capacity of more than 10 MW connected at voltage level of **33** kV and above shall have facility to control active power injection in accordance with a set point, which shall be capable of being revised based on direction of the appropriate Load Dispatch Centre. **Governors of the units shall have a droop of 3 to 6% and a dead band not exceeding ±0.03 Hz.**

Provided that for large frequency deviation e.g. in excess of 0.3 Hz, the Wind and Solar Generating Station should provide an immediate (within

1 second) real power primary frequency response of at least 10% of the maximum AC active power capacity.

Provided that wind generating station and inverter based generating stations having capacity 50 MW or more shall have storage capacity of at least 10% of installed capacity as common facility irrespective of generation capacity owned/ developed by different owners/developers.

Provided further that if energy storage systems are utilized to comply with the frequency regulation requirements, and during a disturbance, the system frequency falls suddenly and stays below 49.7 Hz, the wind/solar generating station shall provide an immediate frequency response. The time response shall be less than 1 second and should be maintained for at least 10 minutes. After the 10^{th} minute, the real power primary frequency response should not decrease at a ramp rate higher than 10% of the maximum AC active power capacity per minute.

(b) The operating range of the frequency response and regulation system shall be from 10% to 100% of the maximum AC active power capacity.

(c). **The Wind and Solar generating stations shall be able to control the rate of change of power output at a rate not more than ± 10% per minute, independent of meteorological conditions. The ramp rate control tolerance shall be ±10%.**

B(vii). Following **new clause B2(5)** is proposed to be added **to incorporate feature of Voltage Regulation in Wind and Solar generating stations:**

a). Wind generating stations / Solar generating stations shall have a continuously-variable, continuously-acting, closed loop control Voltage Regulation System (VRS) i.e. an equivalent to the Automatic Voltage Regulator (AVR) in conventional machines.

b). The VRS set-point shall be adjustable in the range prescribed by the appropriate Commission and it shall also be adjustable by Load Dispatch Center via SCADA.

c). **The VRS controller regulation strategy shall be based on proportional plus integral (PI) control actions with parallel reactive droop compensation. The VRS Droop shall be adjustable from 0 to 10%.**

d). **The VRS shall be calibrated such that a change in reactive power will achieve 95% of its final value no later than 1 second following a step change in voltage. The change in reactive power shall not cause excessive voltage excursions or overshoot.**

e). **The VRS shall be in service as long as the Wind / Solar generating unit is electrically connected to the grid, regardless of MW output including nil generation from the unit.**

f). **The VRS dead band shall not exceed ± 0.1%.**

B(viii). Following **new clause B2(6) regarding short circuit ratio in respect of Wind / Solar generators** is proposed to be added as has been laid down in respect of conventional generators in Clause A1 in Part-II of the Schedule.

The short circuit ratio for the generating station shall not be less than 5.

B(ix). Existing **sub-clause (5) may be re-numbered as sub-clause (7).**

B(x). Regulation B3 is proposed to be modified **to incorporate LVRT feature in all existing generating units /stations also.**

Existing:

For Generating units which are commissioned before and up to 6 months after the date of publication of Regulations in the Official Gazette.

The generating company and the licensee of the electricity system to which the generating stations are connected shall mutually discuss and agree on the measures which can be taken to meet the standards specified in (B1) and (B2) subject to technical feasibility

Proposed:

(a) **For Generating units /stations which are commissioned before and up to 6 months (i.e. up to 15.4.2014) of the date of publication (15.10.2013) of CEA (Technical standards for connectivity to the Grid) Amendment Regulations, 2013 in the Official Gazette.**

The generating company and the licensee of the electricity system to which the generating stations are connected shall mutually discuss and agree on the measures which can be taken to meet the standards specified in (B1) and (B2) in Part II of the Schedule of the CEA (Technical standards for connectivity to the Grid) Amendment Regulations, 2013 *subject to technical feasibility*

Provided that sub clause 3(a) under (B2) above shall be complied with by the generating unit/station within a period of one year from the date of publication of these Regulations in the official Gazette subject to technical feasibility.

(b) **For Generating units/stations which are commissioned after 6 months (i.e. from 16.4.2014 and onward) of the date of publication (15.10.2013) of CEA (Technical standards for connectivity to the Grid) Amendment Regulations, 2013 in the Official Gazette and upto publication of these regulations in the Official Gazette.**

Generating unit/station shall comply with sub-clauses 1, 2, 4 and 5 under (B2) in Part-II of the Schedule of CEA (Technical standards for connectivity to the Grid) Amendment Regulations, 2013.

Provided that sub-clause 3(a) under (B2) above shall be complied with by the generating unit/station within a period of one year from the date of publication of these regulations in the official Gazette subject to technical feasibility.

(c) Exemption from the above due to technical infeasibility may be allowed by the Authority.

B(xi). Clause No.3 regarding **Limits of Harmonics** in Part-IV of the Schedule to the principal Regulations is proposed **to be modified** as follows:

Existing:

Voltage and Current Harmonics

1. *The total harmonic distortion for voltage at the connection point shall not exceed 5% with no individual harmonic higher than 3%.*
2. *The total harmonic distortion for current drawn from the transmission system at the connection point shall not exceed 8%.The limits prescribed in (1) and (2) shall be implemented in a phased manner so as to achieve complete compliance not later than five years from the date of publication of these regulations in the official Gazette.*

Proposed:

Voltage and Current Harmonics

1) **The limits of voltage harmonics by the distribution licensee in its electricity system, the limits of injection of current harmonics by bulk consumers, point of harmonic measurement i.e Point of Common Coupling (PCC), method of harmonic measurement and other matters, shall be in accordance with the IEEE 519-2014 standards, as modified from time to time.,**

   Provided that Distribution licensee, to ensure compliance at grid connection points, may make provision in respective supply code made by respective SERC to limit harmonic injection by consumers other than bulk consumers, in its own system.

   Provided further that at a particular PCC where in addition to bulk consumers, other consumers are also connected, the allocation of harmonic limits shall be in accordance with the maximum demand recorded during last one year .

2) **The measurement of harmonics shall be done at PCC and not at consumer premises.**

3) **At PCC, metering of harmonics will be done to ensure that Voltage harmonics are within prescribed limits on utility side and current harmonics are within prescribed limits for each user.**
4) **Utility shall install Power Quality meters in a phased manner within next three years of publication of this regulation covering at least 33% of the identified measuring points each year.**
5) **PCC position shall be decided by utility based on network configuration i.e dedicated user (HV side) or mixed user (LV side).**
6) **Measuring and metering of harmonics shall be a continuous process with permanent meters *complying* to IEC 61000-4-30 Class A and capable of detecting direction of Harmonics (whether it is upstream or downstream) and data in regard to harmonics shall be available with utility and it is to be shared with consumer. This is to ensure continuous compliance as distortion limits are to be calculated based on daily and weekly percentile values.**
7) **In addition to harmonics, periodic measurement of other power quality parameters like voltage sag, swell and disruptions shall be done on monthly basis and reports shall be shared with consumer/utility.**
8) **In addition to the meters for monitoring of quality to be installed by utility as per (4) above, the provision with regard to continuous measurement of quality parameters shall also be applicable for consumers having load more than threshold limit as decided by appropriate Commission. These consumers shall install meters at their own expenses and share data as and when required by utility.**

B(xii). Clause 2 regarding "Reactive Power" in Part-IV of the Schedule to Principal Regulations is proposed to be amended as under (Suggested by RA division):

Existing:

The distribution licensee shall provide adequate reactive compensation to compensate inductive reactive power requirement in their system so that they do not depend upon the grid for reactive power support. The power factor for distribution system and bulk consumer shall not be less than 0.95.

Proposed:

The distribution licensee **and bulk consumer** shall provide adequate reactive compensation to compensate ~~inductive~~ reactive power requirement in their system so that they do not depend upon the grid for reactive power support. The power factor for distribution system and bulk consumer shall not be less than 0.95.

B(xiii). The following **new Regulation 10** is proposed to be added **regarding 'Power to Relax' in case of introduction of new technology** at the end of the principal regulations.

The Authority may relax any of the conditions of these Regulations in case of introduction of new technology, in the instance that the Authority finds that the new technology may improve efficiency or has any additional benefits for the country, without any adverse impact on electricity system. For this, the requester shall submit an application to the Authority and reply to all queries sought by it. The Authority may allow the same by giving reasons in writing.

B(xiv). The following new Regulation 11 is proposed to be added regarding compliance Monitoring at the end of the principal regulations.

It shall be the responsibility of concerned Central/ State Transmission utility to ensure that before connectivity to grid is permitted, all general connectivity conditions stipulated in the CEA Regulations are complied with. Except for the provisions laid down under sub-clause (2), (3) and (5) of Regulation 6, which need to be specifically verified by the appropriate transmission utility before allowing connectivity , it shall be in the form of self-declaration in the proforma of connection agreement which can be sample checked/ verified by CTU/STU. Non-compliance shall be reported immediately to appropriate commission.

It is clarified that only provisions with regard to LVRT as mentioned in point No. B(iv) above shall be applicable to all existing as well as new Wind & Solar generating units/stations. All other provisions shall be applicable to generating units commissioned on or after six months of publication of these Regulations.

(Secretary)

CEA