To

The present consultation note is relevant for market players and electricity producers within the photovoltaic sector, grid companies, transformer associations and Danish Energy Association.

Tonne Kjærsvej 65
7000 Fredericia
Tel. +45 70 10 22 44
Fax +45 76 24 51 80

info@energinet.dk
www.energinet.dk
cvr-nr. 28 98 06 71

Public consultation note – Technical regulation 3.2.2

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KDJ/XLOC

The present consultation note is valid for the public consultation conducted during the time period from 2 July 2014 to 18 August 2014 regarding the "Public Consultation document – TR 3.2.2, revision 5.0" including appendices and guidelines.

The completed public consultation gave rise to 39 unique comments in total, which have subsequently been processed by the working group with respect to TR 3.2.2.

The working group consisted of the following representatives from the photovoltaic sector:

Company	**Representatives**
Dansk Energi	Jan Rasmussen
Dansk Energi	Morten Erlang
EnergiMidt A/S	Frits Krejberg
TEKNIQ	Søren Rise
Solarpanels ApS	Poul Schack
SEAS-NVE	Niels Andersen
Danfoss Solar Inverters	Søren Bækhøj Kjær
AURA Energi	Hugo T. Sørensen
Energinet.dk	Bo Normann Amdi
Energinet.dk	Knud Johansen

The comments of the public consultation and the responses of the working group have been incorporated in the chart below.

memo

Nr.	Section/ sub-section / line no.	Section Page/Figure/Table	Type of comment (General/Technical/ Editorial)	Comment	Proposal for amendments	Conclusion
1	231	Figure 2	T	In case of directly connected plants, PGC and POC coincide. In the Appendix, the generator terminals can be defined. Should be amended throughout the document.	Update figure and definition. Partly accepted - PGC should be the generator terminals otherwise the logic falls apart in my opinion. When we use the term ”directly” connected, then there must also be something which is ”indirectly” connected – has this been ”installation connected” – if yes, then ought we not write this?	Partly acceptable - PGC should be generator terminals otherwise the logic falls apart. When the term ”directly” connected is used there must also be something that is ”indirectly” connected – is it then "connected to the installation” – if yes we ought to write that?
2	645	Table 1, Page 18	E	This may be deleted as requirements for U has been described in other technical regulations.		Unaccepted – knowledge of this table is essential, i.e. the individual reader must be acquainted with the standard referred to in order to know the design limits.
4	674	Page 19		It must be the transmission system operator which defines the frequency limits and not the electricity supply undertaking.		Accepted – text is amended.
5	804	Page 24		What is to be obtained by this sentence? What is the purpose? (We find that the sentence is broad and confusing as references to other standards are made and not only to TF 3.2.2).		Accepted – text is amended and clarified.
3	854	Page 25	T	There is no example on how to calculate the currents. No reference is made to this.	Tilføjes til et regneeksempel. Og så en reference til det afsnit i teksten.	Partly acceptable – an example is missing – discussed in the working group and examples are added in the guidelines.
6	859	Page 25	E	Section B3.4	Corrected to section B3.3.	Accepted – text is amended.
7	894	Page 26	E	”0”	Corrected to section B3.2.	Accepted – text is amended.

8	902	Page 26		What is to be obtained by this sentence? What is the purpose? (We find that the sentence is broad and confusing as references to other standards are made and not only to TF 3.2.2).		Accepted – ought to be discussed in the working group.
9	4.3.2.1	Page 27	E	No reference is made to examples for limit values.	Reference to B3.1.1.	Accepted – text is amended
10	911	Page 28	E	Formula in the same line as text.	New line after the formula.	Accepted – text is amended
11	999		E	Specification of the unit size is missing.	'category B, C and D' is to be added Not accepted – requirements to the unit size are specified in 4.4.2.1 and 4.4.2.2.	Accepted – text is amended
12	4.4.2.1	Table 4 and 5	T	Incorrect indication of intervals < 250 and ≥ 350	New tables. See note 1.	Accepted – tables are corrected
13	4.4.2.2	Page 29	E	No reference to B3.2.	Reference is added to B3.2.	Accepted – text is amended
14	1067	Page 30	T	"0"	Supply with calculation examples with respect to harmonic – only examples given for flicker (B3.1).	Accepted - reference is added.
15	1088	Page 30	E	Section B3.4.	Corrected to section B3.3.	Accepted - text added.
16	1091	Page 30	E	Section B3.3.	Corrected to section B3.2.	Accepted - text added.
17	1105	Table 7	T	Incorrect indication of intervals < 250 and ≥ 350.	New tables. See note 2.	Accepted - table amended as proposed.
18	1116		E	Specification of unit size is missing.	'category B, C and D' is added.	Not accepted - requirements to unit size are indicated in 4.5.2.1 and 4.5.2.2.
19	1157		E	Specification of unit size is missing.	'category B, C and D' is added.	Not accepted – requirements for unit size are mentioned in 4.6.2.1 and 4.6.2.2.

20	1208	Page 34		Requirements have been located under general requirements but does it apply to all plant sizes having an output 50kW. The requirement will result in increased construction costs. (Also compare the signal list, appendix 4, section B4.1).	Will the metered data required be applied? If not the requirement must be optional for the electricity supply undertaking.	Requirement has been clarified and agreed on by the working group.
21	1280	Page 36	E	”on”	To be aligned with text below.	Accepted – text is amended.
22	1288	Page 36	T/E	Fmin and Fmax.	Why not just describe the limits 47Hz and 52Hz.	Not accepted – limits may change for different reasons. Therefore, parameters are used in the specification. The actual parameters are specified in appendix 4.
23	5.3.3 and 5.3.4		T/E	Sequence of the two sections.	Possibly exchange the two sections; it makes more sense in section 5.3.3.	Accepted – text is amended.
24	1530	5.6.2	T	Requirement for category B should be identical to the ones mentioned in category A.	Text is replaced with text from section 5.6.1.	Not accepted – requirements for category A and B are defined in the working group.
25	1592	Figure 15, 17, 19	E	No minimum requirements.	Add minimum requirements.	Minimum requirement defined in cooperation with working group.
26	1779	Table 12	T	Over voltage (step 2) is defined as 2 sec., which implies that first protection step has tripped.	Overvoltage step 1 and overvoltage step 2 has to be exchanged.	Accepted – text is amended.

27	1958	Pkt. 3	G	The standard agreements of Danish Energy Association urge to that these must be signed prior to grid connection.	New text is written for item. 3 'When the documentation has been approved, the Distribution Network Operator issues the operating authorization.	Is this in line with the practice of the Distribution Network Operators? If this is the case there should be a new item designated "Together with an offer for grid connection, the DNO forwards a draft for an agreement for grid connection and an agreement for grid use. Unnecessary administration is foreseen. Text is modified as agreed on by the working group.
28	1977	Pkt. 6	G	The standard agreements of Danish Energy Association urge to that these must be signed prior to grid connection.	New text is written for item 6. When the documentation is approved, the DNO issues a final operating authorization.	Is this in line with the practice of the Distribution Network Operators? If this is the case there should be a new item designated "Together with an offer for grid connection, the DNO forwards a draft for an agreement for grid connection and an agreement for grid use. Unnecessary administration is foreseen. Text is modified as agreed on by the working group.
29	1993		G	When the inverter is added to the positive list, there is no documentation requirement or category A.	'Inclusion' is amended to 'possible inclusion' Lines 2012-2014 are deleted.	Partly accepted – text is modified. There are no protective setting requirements.
30	1994		G	When the inverter is added to the positive list, there is no documentation requirement or category A.	'There is no requirement for further documentation when the plants are added to the positive list. For inclusion on the positive list, see appendix 6' is to be incorporated. Lines 2064-2084 are deleted. Appendix 2 to TR 3.2.1 is updated with respect to protective settings.	Not accepted – we are discussing TR 3.2.2 and not TR 3.2.1, thus we cannot make amendments to an appendix relating to another TR. The only requirement for category A plants is relay settings – B1.1.1. Does the DNO wish to control the protective settings?

31	2500		G	Data communication for category A is not a requirement.	'PV power plant' is replaced with 'In case data communication is applied, the PV power plant must'	Not accepted – Plant for category A must be able to receive a STOP signal – as a minimum in a terminal strip, but it might as well be a command IEC 60870-5-104 command or an IEC 61850 command.
32	2504		G	Data communication for category B is not a requirement.	'PV power plant' is replaced with 'In case data communication is applied, the PV power plant must'	Not accepted – category B plants must be able to receive a STOP signal as well as a "Released for start" – as a minimum in a terminal strip, but it could also be an IEC 60870-5-104 commands or an IEC 61850 command.
33	2241	Page 72	E	Hyperlink inactive.	To be corrected in order to activate the hyperlink.	Accepted – text is amended.
34	2559	Page 82	E	Hyperlink inactive.	To be corrected in order to activate the hyperlink.	Accepted – text is amended.
35	2626	Page 84	E	Hyperlink inactive.	To be corrected in order to activate the hyperlink.	Accepted – text is amended.
36	Appendix		G	The appendices are very unclear. Some of the appendices are only mentioned in the TR, e.g. appendix 3. Appendix 4.1 exists as a separate file. Does appendix 1 exist?	Extern files should not have any appendix designation.	Structure of the appendices to be reorganized as agreed on by the working group.
37	Appendix		G	There is conjunction between the information required in appendices 1 and 5.	Documentation is not necessary in both appendices. Requirement should be mentioned in appendix 1. Appendix 5 should be deleted alternatively describe where the template can be located.	Accepted – text is amended.
38	Appendix		G	Requirement about simulation model should appear from appendix 1 with reference to simulation model described in appendix 2.	Adapt the appendix.	Accepted – text is amended.

39	Appendix 4.1		T	The value is 49.88 Hz but ought to be 49.98 Hz in order to be consistent with the regulations for optional ancillary service (and symmetrical with f3). See note 3.		Accepted – text is amended.

Note 1.

New **harmonic** limit values for plants with an output above 50 kW and up to and including 1,5MW

Voltage level (AC)	**Rsce**	**Odd harmonic order h (not a multiple of 3)**				
		5	7	11	13	17≤h≤39
$U_n \leq 1$ kV	<33	3.6	2.5	1	0.7	-
	≥33	4.1	2.8	1.1	0.8	-
	≥66	5.3	3.5	1.7	1.2	-
	≥120	7.2	4.6	2.6	1.6	-
	≥250	11.7	7.5	4.4	3	-
	≥350	15.2	9.6	5.9	4.1	-
$U_n > 1$ kV	-	4	4	2	2	$\frac{400}{h^2}$ *

Interpolation between the table values is required for Rsce ≥33

Voltage level (AC)	**Rsce**	**THD_I**	**$PWHD_I$**
$U_n \leq 1$ kV	<33	4.5	7.9
	≥33	4.9	8.1
	≥66	6	9
	≥120	8.3	10.5
	≥250	13.9	14.3
	≥350	18	17.3

U_n > 1 kV		-	-

Interpolation between the table values is required for Rsce ≥33

Note 2.

New **interharmonic** limit values for plants with an output larger than 50 kW and up to and including 1,5 MW

Voltage level (AC)	**Rsce**	**Frequency (Hz)**		
		75 Hz	**122 Hz**	**>175 Hz**
$U_n \leq 1$ kV	<33	0.4	0.6	$\frac{75}{f_{*)}}$
	≥33	0.5	0.7	$\frac{83}{f_{*)}}$
	≥66	0.6	0.8	$\frac{104}{f_{*)}}$
	≥120	0.7	1.1	$\frac{139}{f_{*)}}$
	≥250	1.2	1.8	$\frac{224}{f_{*)}}$
	≥350	1.5	2.3	$\frac{289}{f_{*)}}$
U_n > 1 kV	-	0.44	0.66	$\frac{83}{f_{*)}}$

Interpolation between the table values is required for Rsce ≥33

Note 3

Frequency control - start frequency for regulation band - f1	Frequency control	49.50 – 50.00	49.80	Hz
Frequency control - start frequency for regulation band - f2	Frequency control	49.80 – 50.00	49.88	Hz
Frequency control - start frequency for regulation band - f3	Frequency control	50.00 – 50.20	50.02	Hz
Frequency control - start frequency for regulation band - f4	Frequency control	50.00 – 50.50	50.20	Hz