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## Draft Minutes of the Fourth Meeting of the ER P28 Joint GCRP and DCRP Working Group

18<sup>th</sup> June 2015

Held at the EIC, 10<sup>th</sup> Floor, 89 Albert Embankment, London, SE1 7TP

### 1. Welcome, Introductions

GE welcomed everybody to the fourth meeting of the ER P28 Joint GCRP and DCRP Working Group (WG) to review the case and proposed scope of review of ENA Engineering Recommendation P28 Planning Limits for Voltage Fluctuations caused by Industrial, Commercial and Domestic Equipment in the UK (P28).

Attendance, apologies and absences were noted (see Appendix B for Attendance List).

Round the table introductions were made including Peter Twomey from ENW (replacement for Geraldine Bryson) and Peter Thomas from Nordex.

GE noted that Sridhar Sahukari has tendered his resignation from the WG. This has not been accepted and Energy UK have been asked to provide new representation.

### 2. Address by the Chair

GE thanked the WG members for their responses and contributions and presented the agenda (see Appendix C for Agenda). Moving forwards WG members were encouraged to provide contributions through sub-WGs.

[Document reference: P28 WG\_Paper\_4\_1\_Agenda\_P28 WG\_Meeting 4\_180615\_v1]

The WG is at the end of the review phase, with the deliverable expected to be issued to the DCRP at the end of July 2015.

The purpose of the meeting was outlined being to discuss issues, adequacy of current scope/requirements and proposed changes to ER P28 arising from:

- Allocation of rights 'First come, first-served' versus apportionment (Item 4.5 ToR)
- Other technical issues (Item 4.6 ToR)

System study aspects of P28 would be discussed in light of presentations from the invited consultants from Lightsource and Moeller Poeller.

The WG was reminded to:

- Disseminate the discussions to other groups they represent and report back
- Comply with the CACoP concerning meeting etiquette and transparency

### 3. Update/Actions from Last Meeting

It was agreed the draft minutes were a fair and accurate account of the previous meeting and could be published in the public area of the DCode website without amendment:

[Document Reference: P28 WG\_Paper\_4\_2\_ P28 Meeting Minutes and Actions\_23 04 15\_v1 Issued]

**ACTION 4.0: Publish the approved minutes from P28 meeting no. 3 23.04.15 on the DCode website (GE)**

GE presented an update on the actions from the last meeting.  
 [Document Reference: P28 WG\_Paper\_4\_3\_P28 Meeting Actions\_23 04 15\_v0.3\_Update]

**See Appendix A for the Summary of Actions - specifically Summary of Completed Actions in Current Meeting which references the relevant paper attached to the actions below.**

A summary of the decisions made from the completed actions is tabled below:

Action	Description	P28 WG Decision
3.2a	Report back on CIGRE WGs progress noting which documents are being reviewed <ul style="list-style-type: none"> <li>• DV provided update to WG</li> <li>• Meeting on 9/10 July in Brussels on PQ benchmarking</li> <li>• Amendment of IEC 61000 series documents not started yet (delayed from January 2015)</li> <li>• A new convenor is being sought for revision of IEC 61000-3-6</li> <li>• No meeting set-up yet for revision of IEC 61000-3-7</li> <li>• DV advised a CIGRE article on voltage dip was due to be published imminently</li> </ul>	DV to report back to P28 WG on CIGRE WGs  Review CIGRE article on voltage dips when published

**ACTION 4.1: Circulate DV's x2 emails to the WG regarding 9/10 July meeting in Brussels on PQ Benchmarking and an update on the IEC 61000 series of documents (GE)**

3.4	Review and comment on "P28 WG_Paper_3-14_Action 2.10_ Planning Limits for Rapid Voltage Changes rev1" and give feedback <ul style="list-style-type: none"> <li>• Agreed the paper would inform a significant part of P28 moving forwards</li> <li>• GE encouraged WG to study the contents and provide feedback</li> </ul>	Small sub-group to be set-up to review contents of paper moving forwards
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**ACTION 4.2: Add item to future agenda as point of discussion "P28 WG\_Paper\_3-14\_Action 2.10\_ Planning Limits for Rapid Voltage Changes rev1" written by Simon Scarbro (GE)**

3.6	Seek clarity from the GCRP and DCRP as to what aspects of voltage fluctuation apply to either networks operators, users or both <ul style="list-style-type: none"> <li>• See "P28 WG_Paper_4_6"</li> <li>• DCRP intention is for DPC4.2.3.3 to treat network operators and users identically in terms of design of systems so that effects on end customers are minimised.</li> <li>• DCRP clarified DPC4.2.3.3 10% limit once per year for energising transformers is intended to apply to network operators and users alike</li> </ul>	P28 to be a user facing document that provides improved guidance on voltage fluctuation aspects of the DCode
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3.7	<p>Report back on the differences between ITIC Curve and Semi F47 Curve which looks at voltage sag immunity</p> <ul style="list-style-type: none"> <li>• See “P28 WG_Paper_4_6A”</li> <li>• ITIC Curve shows voltage sag immunity levels for electronic equipment generally</li> <li>• Semi F47 Curve specifies voltage sag immunity for semiconductor processing equipment; more onerous than ITIC curve at 50% sag depth (retained voltage)</li> <li>• ITIC curve specifies tolerances for voltage rise; Semi F47 doesn’t</li> </ul>	ITIC for voltage sag immunity will be followed
3.9	<p>Ask PQ&amp;EMC WG to comment on Mark Horrocks report “P28 WG_Paper_3_11a_Action 2.17_WPD Clarifications Rev 3_Comments Back From the Consultants” and report back to P28 WG</p> <ul style="list-style-type: none"> <li>• See “P28 WG_Paper_4_7”</li> <li>• Detailed response from Scottish Power Energy Networks</li> <li>• Further discussion/meeting of DNOs needed to reach consensus</li> </ul>	<p>DC to report back output of discussion/meeting of DNOs</p> <p>Agreed probability method would be suitable (see “P28 WG_Paper_4_8”</p>

**ACTION 4.3: Set up a sub-group of P28 WG members to further discuss Mark Horrocks report “P28 WG\_Paper\_3\_11a\_Action 2.17\_WPD Clarifications Rev 3\_Comments Back From The Consultants” xref Paper 4.7 SPENs response and Paper 4.8 TNEI response and report back to P28 WG (DC)**

**Note: Peter Thomas has volunteered to be part of sub-group**

No other comments were made on the completed actions.

#### 4. Terms of Reference (ToR)

GE presented the latest draft ToR

[Document Reference: P28 WG\_Paper\_4\_4\_ER P28 WG\_ToR\_v2.2\_Working]

The intention is for the revised P28 to be a standalone user facing document, which will attempt to align requirements in the DCode and GCode for rapid voltage changes and flicker severity limits. Where possible, P28 will be revised so detailed requirements in the DCode and GCode can be removed.

It was agreed that the revision of P28 would need to make the distinction between planning levels, emission levels and compatibility levels. Adequate guidance on limits will be provided to those wishing to connect to the network.

The WG did not have any objections to the amendments proposed.

**ACTION 4.4: Publish the approved Terms of Reference v2.2 on the DCode website (GE)**

#### 5. Proposed Changes to ER P28

GE tabled two areas for discussion:

- Allocation of rights 'First-come, first-served' versus apportionment (Item 4.5 of the ToR)
  - Is first-come, first-served still appropriate?
  - Alternative methods for allocating limits - i.e. approach in ER G5 (Harmonics)?
  - Applicability of PD IEC/TR 61000-3-7?
  - Site/background measurement tests?
- Other technical issues (Item 4.6 of the ToR)
  - New equipment/technology to be considered?
  - How to deal with situations where planning levels are exceeded?
  - Impact of flicker from DG in networks with a high source impedance and different planning limits?

There followed a discussion of issues, adequacy of current scope/requirements and proposed changes to ER P28 arising from the above - including availability of information/data to support proposed change and impact on stakeholders.

## 5.1 Allocation of Rights

GE gave a brief overview on:

- 'First-come, first-served' allocation
  - Relatively easy to administer and has served the industry well
  - Not fair or equitable for Users
  - Inconsistent with modern approaches in PD IEC/TR 61000-3-7 and revision of ER G5 (Harmonics)
- Alternative methods
  - Approach in PD/IEC/TR 61000-3-7 apportions flicker based on proportion of user demand to system capacity
  - Proposal in Paper 4\_9 (substituting system capacity for system fault level)
  - Are any other methods known?
- What is the experience of other countries?

The WG agreed that the current 'first-come, first-served' approach, although easy to administer and has not resulted in major problems with lack of 'flicker headroom', is not fair or equitable to users.

The proposal in Paper\_4\_9, where flicker is apportioned based on the proportion of user demand to system fault level not system capacity was discussed. The following discussion points were noted:

- The paper addresses two fundamental issues in PD/IEC/TR 61000-3-7 being practical difficulties determining system capacity and measurement of background levels
- The approach needs to take account of generation as well as demand. Demand needs to be defined in this context (AH)
- There were reservations whether using fault level for apportionment was appropriate:
  - Current assumption about treating the network as purely reactive may need to be reviewed in light of typical power factors - particularly at distribution voltage levels (DV)
  - What fault level would be used?
  - Is fault level directly proportional to system capacity?
- Broad agreement with the need to take into account existing background levels
- Can typical background levels be used or are actual measurements required?

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- How is the addition of generation, and hence system capacity, addressed in the apportionment multiplier?

The non-linearity of the apportionment multiplier  $M$  to the connection demand and source capacity was discussed. Although at low demand to short-circuit level the function tends towards linearity, the discrepancy at high demand was seen as a potential issue and requires further discussion.

**Action 4.5: Liaise with FG about an alternative proposal to his paper 4.9 “P28 WG\_Paper\_4\_9\_P28 WG Report-Stage 3-v04” (DV)**

The equations for  $M_T$  in the paper were reviewed. Some attendees reported problems with these showing correctly in the MS PowerPoint version.

**Action 4.6 PDF paper 4.9 P28 WG\_Paper\_4\_9\_P28 WG Report-Stage 3-v04 and reissue to WG (some members found word version was corrupted) (GE)**

There was general agreement that transfer coefficients and background measurements at remote nodes need to be taken into account. The Working Group discussed that it may be possible to recommend typical values, where actual values are not known.

Discussion about current P28 Stage 3 assessments suggested these were small in number for DNOs. This prompted debate about whether the Stage 3 assessment should be simplified, possibly generic guidelines, given there does not appear to be an issue currently. If necessary, the apportionment method could be integrated into a software tool to simplify studies.

**Action 4.7: Summarise an alternative method of scaling a user’s flicker emission to the available headroom (xref paper 4.9) (PJ)**

The WG broadly agreed that a simpler approach to apportionment (as intended in Paper\_4\_9) than that advocated in PD IEC/TR 61000-3-7 is required. However, it was agreed that using network capacity as the basis for apportionment should not be ruled out. There was agreement that the apportionment method proposed should be tested further by carrying out more distribution network examples, which could be validated by actual measurements. Sensitivity analysis should be carried out to understand the impact on apportionment for variations in the various parameters.

The following discussion points were noted regarding the adequacy of the current P28 Stage 2 assessment.

- Is the Stage 2 assessment still valid given the increasing number of DG connections (e.g. large number of heat pumps on same LV network) (AH)?
- Background flicker levels on distribution networks are typically less than  $P_{st} \leq 0.2$  (KL)
- The current Stage 2 limits in P28 appear to have worked well given there are only a small number of voltage complaints reported for equipment connected under Stage 2. This suggests limits may be over conservative at certain voltage levels
- Flicker problems that have been reported for equipment connected following Stage 2 assessment have typically been HV connections (AH)
- Anecdotal evidence suggests that providing the  $P_{st}$  of individual equipment is small then a large number of connections does not appear to cause a problem. Equipment that has a  $P_{st} < 0.7$  does not generally cause a problem in LV networks. Equipment with a  $P_{st} \geq 0.8$  can lead to voltage complaints (KL)

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- There may be a need to review the source impedance for Stage 2 assessment in line with IEC 61000-3-1

It was noted that the assumptions for the Stage 2 assessment and the basis of the  $P_{st}$  limit  $\leq 0.5$  need to be carefully reviewed in light of greater number of DG connections. It is understood the current limits are based on 8 connections. Reference should be made to IEC 61000-3-11, where requirements for conditional connections are relevant (e.g. fault level).

**Action 4.8: Review Stage 2 assessment methodology in P28 to see if it is still applicable to the revision in its current form (All)**

The WG believed further work would be required to evaluate whether different  $P_{st}$  limits should apply at different voltage levels.

Translation of the apportionment method in ENA ER G5 was discussed. There was a belief among some WG members that although the principles for flicker are similar the apportionment methodology in ENA ER G5 is not appropriate to flicker (DV).

**Action 4.9: Circulate ENA ER G5 current draft to WG (DC)**

**Action 4.10: Write a paper highlighting the principles behind flicker allocation in ER G5 latest draft on whether these translate to P28 (DV)**

DV advised that Australia had moved to apportionment of flicker based on PD IEC/TR 61000-3-7, which takes account of background levels. However, not sure how successful this has been or what other countries have adopted this approach.

**Action 4.11: Ask Cigre WG about their knowledge of how other countries allocate rights and headroom for flicker (DV)**

**Action 4.12: Ask Eurelectric PQ WG about their knowledge of how other countries allocate rights (DC)**

The issue of how apportionment exponents in Clause 7 of PD IEC/TR 61000-3-7 can be applied was raised.

A summary of the decisions/agreements of the WG from the allocation of rights discussion is listed below.

- Measured values of background levels are required for Stage 3 assessment - guidance on typical default values may be appropriate
- 'First-come, first-served' allocation is no longer appropriate
- The apportionment approach in PD IEC/TR 61000-3-7 is not wholly appropriate because it does not take into account background levels and determination of network capacity is complex
- Any apportionment method in the revised P28 needs to differentiate between generation and demand
- Apportionment based on network capacity was not ruled out

## **5.2 Other Technical Issues**

Exceedance of planning levels was discussed and it was believed this is not a particular issue for DNOs. Where exceedances have occurred the problem has been principally due to a single user (generally at 11 kV) resulting in noticeable flicker for other users.

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The solutions have generally involved providing a lower impedance connection by the DNO. This is not to say that problems caused by summation of voltage disturbances by multiple users may not be a problem in future. High background levels are not believed to be a problem at present.

Heat pumps are not believed to pose a problem providing they are provided with soft start technology as opposed to direct-on-line starting (KL).

The appropriateness of a 3% voltage step change limit was discussed and whether this should be relaxed for rural networks with a high source impedance. The subject of infrequent transformer energisation in these circumstances was discussed. It was believed that the proposals for Rapid Voltage Change (see P28 WG\_Paper\_3-14) would be applicable.

**Action 4.13: Review transformer energisation data from wind farm connections and feedback data to the WG for revision stage (PTh)**

Problems with flicker are known to have occurred with DG in networks with a high source impedance - namely where LV customers are connected to the same network as pumping stations. It was agreed that more information on the voltage fluctuation caused by small hydro generators would be beneficial.

**Action 4.14: Ask person who responded to Briefing Paper 1 regarding possible relaxation of planning limits for ‘weak’ networks with “hydro connections” to provide clarification of technical issue and more detail on flicker/RVC caused by these connections (GE)**

The WG agreed to review the  $P_{st}$  limits in the tables of IEC 61000-3-3 and IEC 61000 3-11 to see whether there was any basis for change in limits in P28.

**Action 4.15: Review table of permitted voltage fluctuations in IEC 61000-3-3 and 61000-3-11 and how it applies to exceedance of 3% limit in P28 (GE)**

P28 WG\_Paper\_4\_7A was reviewed, which summarised power quality measurements taken over a monitoring period following the connection of 112 small heat pumps to a LV network. The measurements showed that the connection of the heat pumps, which all complied with requirements in IEC 61000-3-3, did not significantly affect short-time flicker severity ( $P_{st}$ ).

Further consideration is required as to whether Stage 1 simplified assessment should apply to connection of HV users (particularly where demand is small compared to short-circuit level).

**Summary of Proposals and Actions**

It was agreed that any proposed modifications arising from discussions in item 5 would be summarised in these meeting minutes. The summary is provided below.

<b>Item</b>	<b>Proposed Modification</b>	<b>Information to Support Change</b>
1	P28 should consider generation as well as demand for allocation of rights	A new area not previously considered in P28
2	P28 should take into account transfer coefficients and background measurements at remote nodes for apportionment of flicker headroom	A new area not previously considered in P28

3	'First-come, first-served' allocation is no longer appropriate for flicker and will be replaced with a fairer more equitable solution	Existing allocation method is inconsistent with IEC and intent of DCODE
4	P28 should consider guidance for simplified assessment of HV connections under Stage 1 assessment	Not previously considered in P28 and needed to align with IEC Standards

## 6. System Study Aspects of P28

The WG received presentations from two invited consultants based on their experiences/issues from a system studies perspective working with the current revision of ER P28. The intention was to give a balanced view on what type of changes to P28 may need to be considered by the Working Group to reflect good practice in this area from a consultant perspective with first-hand knowledge of these matters.

The presentations were as follows.

- Jose Ribbecca representing Lightsource (see P28 Modelling and Simulations.pdf)
- Jonathan Horne representing M.P.E. (see MPE P28 meeting presentation 18 June 2015.pdf)

A brief summary of the key aspects/discussions were as follows.

### Lightsource

- P28 compliance studies comprise of steady state and transient studies
- Steady state studies investigate voltage step changes and voltage flicker emissions at the PCC
- Transient studies investigate RVC
- Transformer manufacturers do not tend to provide zero sequence impedances or saturation curves for purposes of detailed modelling. The quality of transformer models varies and the saturation curve models used for modelling transformer energisation may give different results
- Data for modelling overhead lines and cables is derived from DNO Long Term Development Statements (LTDS) - is this sufficient
- Transformer energisation is modelled for different scenarios including max. and min. short-circuit at the PCC, sequential energisation and point-on-wave switching
- Flicker calculations for solar installations are based on IEC 61400-21 (wind turbine generators), where changes in wind speed concept are applied to PV installations. How inverter manufacturers derive variables may be an issue
- Voltage step changes are analysed for 0% to 100% generation output under different power factor conditions

### M.P.E.

- Flicker considered as continuous (operation of wind farms/PV farms) and following switching actions (energisation of transformers)
- Continuous flicker from wind turbines caused by turbulence, tower shadow and oscillation (not an issue for modern DFIG/full converter wind turbines)
- Inappropriate inverter control can cause flicker - not a system problem
- Switching actions that cause flicker include connection of fixed speed wind turbine generators (mitigated by soft start) and energisation of wind farm step-up transformers



- Issues for transformer energisation include sympathetic inrush, worst case grid fault level - pessimistic conditions. Would a probabilistic approach be more appropriate?
- Rapid voltage change typically due to capacitor switching, tripping generation/load, loss of system
- Considerations for revised P28
  - Scope of P28 to include flicker, voltage dips and rapid voltage change
  - Definite sections to address different aspects required
  - What DCODE requirements should be within P28?
  - Requires updating to include DG and transformer energisation
  - Opportunity to align Grid and Distribution Codes
  - Improved definition of outage conditions
  - Consistency of fault level calculation process (e.g. normal conditions, outage conditions etc.)
  - Examples of flicker assessment need updating for DG applications
  - Standards should apply to TSOs/DNOs as well as users
  - Minimise chain of references and update for wind turbine generators
  - How are Stage 3 assessments to be carried out - can background levels be provided and if not what is assumed?
  - Should P28 provide recommendations on different methods for mitigating flicker?
  - Are voltage complaints or damage caused by flicker from wind and PV farms a common problem?
  - Limits for transformer energisation should be considered
  - Should larger limits apply during daylight hours?
  - Is remanence of 80% appropriate - any better information?
  - Requirements for rapid voltage changes should be clearly defined

The WG discussed the issues and limitations of different software packages. Any assumptions for modelling need to be addressed in the revised P28 but would not address any particular software.

The WG agreed both presentations had been informative and helpful and GE, on behalf of the WG, thanked the consultants for their attendance.

The following actions resulted from the presentations given.

**Action 4.16: Review presentation by Jose Ribeca Lightsource and summarise the important parameters for modelling (as per the brief) (MH)**

## 7. Project Plan

GE confirmed there were no changes to the project plan.  
[Document reference: ENA\_EREC\_P28\_Ph1\_PID\_v1\_Issued]

## 8. General Management/Administration

Arrangements for general management and administration have not changed since the previous meeting and given the time constraints this section was omitted from the meeting except to note the WG secure access area on the ENA website is still under development. It will not use https:// which will assist those members of the WG who are unable to access Dropbox. GE will issue the link and login details when it is operational.

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## 8.1 On-line Repository Requirements

- Public access
  - Now set-up and hosted by ENA on the DCRP website
  - Being administered on behalf of the WG by the ENA Secretariat
  - Provides access to all approved outputs from WG (see <http://www.dcode.org.uk/areas-of-work/>)
- Working Group secure access
  - It is proposed to use the ENA projects portal (under development but expect shortly)
  - Interim step is to use the secure password protected file sharing area now being hosted on Dropbox, where files are encrypted and password protected

## 8.2 Consultation Process

The following governance processes that need to be complied with are summarised below.

- Current References
  - DCRP Constitution and Rules - Standard Procedure 1
  - Electricity Networks and Futures Group (ENFG) Document Review/Approval Process (v3 Revision November 2013)
- Proposed Processes
  - Interfaces with Working Group now incorporated into revised ENFG Document Review/Approval Process
  - No initial public consultation proposed for development of ER P28 revision
  - Regulatory authorities, trade associations and IET will be given early opportunity to comment of draft P28 revision
  - Working Group will draft consultation paper for agreement by the GCRP and DCRP
  - Public consultation will only take place following acceptance of the modifications by the ENFG and joint agreement by the GCRP and DCRP

## 8.3 Support Requirements

The following support requirements are being provided.

- Provided by ENA Secretariat
  - Organisation and facilitation of WG meetings
  - Preparation of meeting agendas
  - Taking and distributing meeting minutes/actions
  - Preparation of briefing papers and documents
  - Preparation and distribution of WG reports and documentation
  - Collation of incoming data and responses
- Provided by Working Group Members
  - Preparation of papers
  - Response to papers
  - Specialist technical support
  - Incoming/field data

There were no other support requirements identified.

## 9. AOB

- Due to time limitations it was agreed that the findings and results from Trench Farm would be circulated to the WG for comments at the next meeting

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- Consultation on GC0076 is complete and is in the progress of being submitted to the Authority for approval
  - Sridhar Sahukari, who represents Energy UK, has tendered his resignation. GE advised this has not been accepted until Energy UK are able to nominate another representative
  - GE advised that a draft report to summarise the decisions and proposed changes to P28 arising from the last 3 meetings would be submitted to the WG before the next meeting for comments
  - PTh advised that ENSPEC, a supplier of Power Quality equipment, supply Visimax point-on-wave control equipment that can be retrofitted to control closing of circuit-breakers. This can be used for single-phase and three-phase closing. ENSPEC are looking for trial sites in the UK and may be able to provide results, which could be useful for the WG

**Action 4.17: Circulate the questionnaire completed by JD's colleagues at RES who deal with several UK DNOs for connection of wind farms and other generator connections (xref 2.16) (GE)**

**Action 4.18: Circulate paper 4.11 "P28 WG\_Paper\_4\_11\_Trench Farm pre mag tests 1" to the WG for comments (GE)**

## **10. Date for Future Meetings**

The following dates have previously been agreed for future meetings:

- 3<sup>rd</sup> September 2015
- 4<sup>th</sup> November 2015

## **NOTES**

1. The current membership, ToR, agenda, papers and previous minutes with this meeting can be found on the DCode website (see <http://www.dcode.org.uk/dcrp-er-p28-working-group.html>).

## Appendix A

### ER P28 Joint GCRP & DCRP Working Group Meeting No.4

#### Summary of Actions from Current Meeting

Item	Action	Who	Due by
4.0	Publish the approved minutes from P28 meeting no. 3 23.04.15 on the DCode website	GE	
4.1	Circulate DV's x2 emails to the WG regarding 9/10 July meeting in Brussels on PQ Benchmarking and an update on the IEC 61000 series of documents	GE	
4.2	Add item to future agenda as point of discussion "P28 WG_Paper_3-14_Action 2.10_ Planning Limits for Rapid Voltage Changes rev1" written by Simon Scarbro	GE	
4.3	Set up a sub-group of P28 WG members to further discuss Mark Horrocks report "P28 WG_Paper_3_11a_Action 2.17_WPD Clarifications Rev 3_Comments Back From The Consultants" xref Paper 4.7 SPENs response and Paper 4.8 TNEI response and report back to P28 WG Note: Peter Thomas has volunteered to be part of sub-group	DC	
4.4	Publish the approved Terms of Reference v2.2 on the DCode website	GE	
4.5	Liaise with FG about an alternative proposal to his paper 4.9 "P28 WG_Paper_4_9_P28 WG Report-Stage 3-v04"	DV	
4.6	PDF paper 4.9 P28 WG_Paper_4_9_P28 WG Report-Stage 3-v04 and reissue to WG (some members found word version was corrupted)	GE	
4.7	Summarise an alternative method of scaling a user's flicker emission to the available headroom (xref paper 4.9)	PJ	
4.8	Review Stage 2 assessment methodology in P28 to see if it is still applicable to the revision in its current form	All	
4.9	Circulate ENA ER G5 current draft to WG	DC	
4.10	Write a paper highlighting the principles behind flicker allocation in ER G5 latest draft on whether these translate to P28	DV	
4.11	Ask Cigre WG about their knowledge of how other countries allocate rights and headroom for flicker	DV	
4.12	Ask Eurelectric PQ WG about their knowledge of how other countries allocate rights	DC	
4.13	Review transformer energisation data from wind farm connections and feedback data to the WG for revision stage	PTh	
4.14	Ask person who responded to Briefing Paper 1 regarding possible relaxation of planning limits for 'weak' networks with "hydro connections" to provide clarification of technical issue and more detail on flicker/RVC caused by these connections	GE	
4.15	Review table of permitted voltage fluctuations in IEC 61000-3-3 and 61000-3-11 and how it applies to exceedance of 3% limit in P28	GE	
4.16	Review presentation by Jose Ribeca Lightsource and summarise the important parameters for modelling (as per the brief)	MH	
4.17	Circulate the questionnaire completed by JD's colleagues at RES who deal several UK DNOs for connection of wind farms and other generator connections (xref 2.16)	GE	

Item	Action	Who	Due by
4.18	Circulate paper 4.11 "P28 WG_Paper_4_11_Trench Farm pre mag tests 1" to the WG for comments	GE All	Next Meeting

### Summary of Outstanding Actions from Previous Meetings

Item	Action	Who	Due by
2.18	Refer any technical issues involving distributed generation that cannot be resolved to the DG Steering Group	(GE)	Ongoing
2.22	Prepare a paper of published literature research on modern lighting and flicker	(JH)	28.05.15
2.23	Email the paper on flicker and modern lighting written by professor from Finland to GE <i>Update: RB has emailed twice with no response</i>	(RB)	28.05.15
2.28	Obtain approval to share information from National Grid to support whether measured values of Pst are regularly exceeding Pst = 1 whether Pst levels at MV and HV should be increased	(FG)	28.05.15
1.8	Include in the draft Agenda, issued 1 month ahead of the meetings, any invitation to include a technical guest	(GE)	Ongoing
1.17	Email relevant documentation and circulation list to the Secretariat (GE cc MJC) who will act as coordinator to disseminate information to WG members	(All)	Ongoing

### Summary of Completed Actions in Current Meeting

Item	Action	Who
2.8	Review the stakeholders and comment whether members believe all key stakeholders are represented	(All)
2.16	Document aspects of P28 that are inconsistent when carrying out P28 assessments across different networks operators	(JD)
2.20	Produce a paper reporting on WPD's position and whether a consensus of opinion can be reached in the PQ & EMC Group across the DNOs on how to address voltage	(DC)
3.0	Update 10 February 2015 Minutes page 4 bullet point 6 from "Vnominal - 30% x Vnominal" to "Vnominal - 30%" as per KL	GE
3.1	Invite/follow up on consumer bodies becoming P28 corresponding members - AMDEA, NFU, CLA, WI, CAB <b>NOTE: Citizen Advice Bureau to be Corresponding Member</b>	GE
3.1a	Check whether the Electricity Consumers Council is represented by one of the other stakeholders <b>NOTE: Citizen Advice Bureau will represent the Electricity Consumers Council</b>	GE
3.2	Report back on which consumer organisations OFGEM consults with <b>NOTE: OFGEM have confirmed this is the Citizens Advice Bureau (CAB)</b>	MB
3.2a	Report back on CIGRE WGs progress noting which documents are being reviewed	DV

Item	Action	Who
3.3	Circulate FG's and SSc's comments on "P28 WG_Paper_3-14_Action 2.10_Planning Limits for Rapid Voltage Changes rev1" <b>NOTE: Circulated on the 22/05/15 - See Paper_4_5 and Paper 4_5A</b>	GE
3.4	Review and comment on "P28 WG_Paper_3-14_Action 2.10_Planning Limits for Rapid Voltage Changes rev1" and give feedback <b>NOTE: No response received from Members. To be discussed as a separate topic at a future meeting</b>	All
3.5	Add an agenda item for June meeting to discuss how GC0076 aligns with the Distribution Code and the Grid Code	GE
3.6	Seek clarity from the GCRP and DCRP as to what aspects of voltage fluctuation apply to either networks operators, users or both <b>NOTE: Email sent to the Secretary of the DCRP on the 22/05/15 - See Paper_4_6</b>	GE
3.7	Report back on the differences between ITIC Curve and Semi F47 Curve which looks at voltage sag immunity <b>NOTE: See Paper 4_6A</b>	GE/KL
3.8	Identify CIGRE brochure on Remanence <b>NOTE: FG has confirmed brochure is "Transformer energisation in power systems: A study guide" Technical Brochure 568. CIGRE WG C4.307. Published in February 2014</b>	FG
3.9	Ask PQ&EMC WG to comment on Mark Horrocks report "P28 WG_Paper_3_11a_Action 2.17_WPD Clarifications Rev 3_Comments Back From The Consultants" and report back to P28 WG <b>See Paper_4_7 and TNEI Response See Paper_4_8</b>	DC
3.10	Review and comment on "P28 WG_Paper_3-20_Action 2.21_Conditions in P28_v0.1_Working"	All
3.11	Review and comment on "P28 WG_Paper_3-13_RE P28 Meeting Actions - Allocation of Rights"	All
3.12	Email P28 WG the revised Terms of Reference "ER P28 WG_ToR_v2.2_Working"	GE
3.13	Review and comment on the revised Terms of Reference "ER P28 WG_ToR_v2.2_Working"	All
3.14	Send out Lightsource plan for energising a no. of sites for monitoring purposes during June 2015. P28 WG to consider whether it would be useful for this WG to collect data	MH All
3.14a	Circulate the CIGRE WG paper on remanence <b>See Dropbox\ER P28 WG Working Files\CIGRE Publications</b>	FG
3.15	Report back on how P28 Review fits in with the work being done in LCT (Low Carbon Technologies) WG with reference to voltage disturbance of multiple equipment, where individual items of equipment can be connected unconditionally and the impact caused by the whole system	KL
3.16	Look at compliance with BS EN 61000-3-3 and whether there are wider issues from an aggregation point of view for individual appliances	AH

Item	Action	Who
3.17	Send feedback to GE's PowerPoint presentation on Proposed Changes to P28 (slides 27-29) <ul style="list-style-type: none"> <li>• Standards – Applicability of IEE Standards</li> <li>• Standards – Applicability of IEEE Standards</li> <li>• Evaluation of Background Levels</li> </ul> <b>NOTE: No response received from Members</b>	All
3.18	Liaise with MH, RB, JD and DV about inviting a Consultant with detailed knowledge of P28 studies to a WG meeting <b>NOTE: Invitations sent to Jose Ribecca at Lightsource and Jonathan Horne at Moeller Poeller</b>	GE
3.19	Update the P28 WG with the outcome of GCRP meeting mid-May on GC0076 progress	FG

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## Appendix B

### ER P28 Joint GCRP & DCRP Working Group Meeting No.4

#### Attendance List 18<sup>th</sup> June 2015 EIC Office, London

##### Attendees:

Name	Initials	Company
Peter Twomey	PT	ENW
Peter Johnston	PJ	NIE
Ken Lennon	KL	SP Energy Networks
Adrian Ellis	AE	SSE
Steve Mould	SM	UKPN
Andrew Hood	AH	WPD
Mark Horrocks	MH	Lightsource
Joe Duddy	JD	RES Group
Mark Kilcullen	MK	Department of Energy & Climate Change
Peter Thomas	PTTh	Nordex
Davor Vujatovic	DV	VandA Engineering Services
David Crawley	DC	ENA
Gary Eastwood	GE	Threepwood Consulting Ltd
Michelle Chambers	MJC	Threepwood Consulting Ltd

##### Third Party Attendees (Agenda Item 6 only):

Jose Ribecca	Lightsource
Jonathan Horne	Moeller Poeller
Kiran Munji	Moeller Poeller

##### Apologies:

Roshan Bhattarai	Northern Powergrid
Forooz Ghassemi	National Grid
Matthew Ball	OFGEM
Mark Thomas	TataSteel
Tony Headley	BEAMA
James Hoare	Renewable Energy Association
Sridhar Sahukari	Energy UK

##### Absences:

Gareth Evans	OFGEM
Sridhar Sahukari	Energy UK



## Appendix C

### ER P28 Joint GCRP & DCRP Working Group Meeting No.4

Thursday 18<sup>th</sup> June 2015, 10:30 – 15:30

#### Agenda

<b>1.</b>	Welcome, introductions	<b>DC/GJE</b>	<b>10:30</b>
<b>2.</b>	Address by the Chair	<b>GJE</b>	
<b>3.</b>	Update/actions from last meeting <ul style="list-style-type: none"> <li>• Review/approval of meeting notes</li> <li>• Update on actions</li> </ul>	<b>GJE/ALL</b>	
<b>4.</b>	Terms of Reference (ToR) <ul style="list-style-type: none"> <li>• Approval of proposed changes</li> </ul>	<b>GJE/ALL</b>	
<b>5.</b>	Proposed changes to ER P28 <ul style="list-style-type: none"> <li>• Allocation of rights 'First-come, first-served' versus apportionment (Item 4.5 ToR) <ul style="list-style-type: none"> <li>➢ Is first-come, first-served still appropriate?</li> <li>➢ Alternative methods for allocating limits - i.e. approach in ER G5 (Harmonics)?</li> <li>➢ Applicability of PD IEC/TR 61000-3-7?</li> <li>➢ Site/background measurement tests?</li> </ul> </li> <li>• Other technical issues (Item 4.6 ToR) <ul style="list-style-type: none"> <li>➢ New equipment/technology to be considered?</li> <li>➢ How to deal with situations where planning levels are exceeded?</li> <li>➢ Impact of flicker from DG in networks with a high source impedance and different planning limits?</li> </ul> </li> </ul> <p>NOTE: Detailed discussion of issues, adequacy of current scope/requirements and proposed changes to ER P28 arising from the above - including availability of information/data to support proposed change and impact on stakeholders.</p>	<b>GJE/ALL</b>	
<b>6.</b>	System study aspects of P28 <ul style="list-style-type: none"> <li>• Presentations from invited consultants</li> <li>• Discussion</li> </ul>	<b>GJE/MH</b>	
<b>7.</b>	Project plan	<b>GJE</b>	
<b>8.</b>	General management/administration <ul style="list-style-type: none"> <li>• On-line repository requirements</li> <li>• Consultation process</li> <li>• Support requirements</li> </ul>	<b>GJE</b>	
<b>9.</b>	AOB <ul style="list-style-type: none"> <li>• GC0076 Update and Alignment with DCODE/GCODE</li> <li>• Proposed changes in membership (GE)</li> <li>• Draft Review Report</li> <li>• Findings and results from Trench Farm</li> </ul>	<b>ALL</b>  <b>KL/MH</b>	
<b>10.</b>	Future meetings <ul style="list-style-type: none"> <li>• Dates</li> <li>• Agenda items</li> </ul>		<b>15:30</b>