

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

3rd September 2015

Held at the EIC, 10th Floor, 89 Albert Embankment, London, SE1 7TP

1. Welcome, Introductions

GE welcomed everybody to the fifth 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).

2. Address by the Chair

GE thanked the WG members for their responses and contributions and presented the agenda (see Appendix C for Agenda)
[Document reference: P28 WG_Paper_5_1_Agenda_P28 WG_Meeting 5_030915_v0.1]

The purpose of the meeting was twofold:

- To commence Phase 3 Revision
 - Phase 2 Review report for ER P28 has been drafted and summarises the proposed changes. The WG will be given another opportunity for comment before it is issued to the DCRP and GCRP for final approval
- To identify sub WGs for the proposed structure of P28
 - Clarify membership nominations from the WG

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 subject to the following amendments:

[Document Reference: P28 WG_Paper_5_2_ P28 Meeting Minutes and Actions_18 06 15_v0.1]

- Page 11 section 9 AOB change last bullet point initials from PT to PTh
- Page 12 action 4.13 change initials from PT to PTh
- Page 13 Appendix A update actions outstanding from previous meeting

Note: see Appendix B for confirmation of P28 WG member initials

ACTION 5.1: Subject to the agreed amendments publish the approved minutes from P28 meeting no. 4 18.06.15 on the DCode website (GE)

GE presented an update on the actions from the last meeting.

[Document Reference: P28 Meeting Actions_18 06 15_v0.1_Issued_Update]

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

| Action | Description | Decision |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.5 | <p>See P28 WG_Paper_5_11_P28 WG Response to Comments-FG</p> <ul style="list-style-type: none"> - FG gave a summary of his paper - Discussed reactive power & confirmed it applies to Stage 3 assessment only - PF (Power Factor) changes for different voltage levels - Discussed Headroom: <ul style="list-style-type: none"> o IEC “global contribution” breaks down o Move to proportional apportionment o Should $\alpha = 3$? o How should generation be dealt with? - Based on load apparent power - Properties of M: <ul style="list-style-type: none"> o Maximum based on Y, load & short circuit level o WG needs to understand K_m & Y – these factors can be refined - G5/5 Methodology <ul style="list-style-type: none"> o P28 should align with G5/5 where possible o Slide 11 – left table shows the process for allocating limits in G5/5 and the right table in P28 o FG looking at changing E to fit WG requirements o G5/5 gives more allocation to subsequent connections (i.e. tries to allocate based on same value of load) - Which philosophy should WG follow? <ul style="list-style-type: none"> o G5/5 need to adjust the multiplier M or o P28 where the load and M stay the same & headroom is reducing - Proposal by DV (see slide 13) <ul style="list-style-type: none"> o Node capacity is not clear – needs to be well defined & kept simple o Defining system capacity is not an easy task o Compensator shouldn't come into equation o Embedded generation o Need to apportion headroom to generators (AH/MH) o G5/5 is biased towards polluters (FG/SSc in previous discussion) o Possible weighting factor to give bigger polluters a bigger limit (FG) - Discussion around load customers – large industrial loads are a problem. Flicker in TSOs is becoming a concern (HVDC systems & modern power stations). Fault level is reducing in TSOs & increasing in DSOs. Need to clarify whether allocation is theoretical or practicable <p>In summary a <i>proportional</i> allocation is recommended</p> <ul style="list-style-type: none"> o The IEC 1st come 1st served method has issues o No need to revisit old connections, will apply to new customers only o Flicker apportionment applies to stage 3 only o PTh cited problems in Ireland; however site measurements should alleviate concerns o FG added work on G5/5 has restarted | <p>Reactive power applies to stage 3 assessment only</p> <p>K_m & Y can be refined</p> <p>Draft a set of apportionment principles (noting legal implications) to agree what is in G5/5 & P28, accepting these requirements will need fine tuning</p> |

ACTION 5.2: Review and comment on Paper 5-11 Apportionment proposal and send to GE by 09.10.15 (All)

ACTION 5.3: Produce a set of principles for proportional allocation of rights and circulate to P28 WG (FG)

| Action | Description | Decision |
|--------|-----------------------------------------------------------------|------------|
| 4.10 | See P28 WG_Papers_5_12_Planning Level Allocation Options 009-DV | No comment |

| Action | Description | Decision |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| 4.11 | See P28 WG_Paper_5_13_International Flicker Practice-DV <ul style="list-style-type: none"> - DV recommends proportional allocation - Would be interesting to know how South/North America & Canada deal with flicker (MH) - DC to ask how other European countries allocate rights at Eurelectric PQ WG meeting 21.10.15 (action 4.12) | There is a real mix of flicker apportionment across countries |

| Action | Description | Decision |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 4.13 | See P28 WG_Paper_5_10_Wind Turbine Transformer Energisation <ul style="list-style-type: none"> - PTh discussed protection settings; for RVC where the rate of change is less than 2% readings can be ignored due to rubbish data that will be picked up (tap changers) - The downside of modern windfarms moving towards dry type transformers gives the worst characteristic for inrush & the first energisation causes the biggest dip - Subsequent dips tend to reduce during re-energisation. As you go further down the line the dip reduces (PTh) MH stated this is due to higher impedance - Subsequent energisations result in a reduced flux (FG) - PTh thought very rapid changes were much less than manufacturer states - MH more concerned about Eco Design Directive (see section 9 AOB for detail) | P28 requires a clear definition of what a voltage dip is and how to record the dip. Feed data into RVC sub WG |

| Action | Description | Decision |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 4.15 | See P28 WG_Action_4_15 In summary no conclusions were drawn about permitted voltage changes in P28 & limits in BS EN 61000-3-3 and 3-11 Note IEC standards are product standards (KL) | No conclusions drawn |

4. Terms of Reference (ToR)

GE presented the latest version of ToR
[Document Reference: P28 WG_Paper_5_3_ER P28 WG_ToR_v2.2_Issued]

There were no further comments on the ToR.

GE confirmed the intention is for P28 to align with the GCode and DCode documents however P28 would remain a customer facing document with a set of limits.

It was noted some of the limits quoted in the GCode and DCode documents would be removed (for example voltage change limits) and referenced in the P28 document.

5. Review Phase 2 Review Report for ER P28 – Recommendations for Revision

GE presented the draft Phase 2 Review Report for ER P28 – Recommendations for Revision

[Document Reference: P28 WG_Paper_5_4_ENA_EREC_P28_Ph2_Report_v1_Draft]

The document is a summary of the decisions and key changes considered necessary in the revision of P28. It should contain clear definitions and align with IEC and BS EN standards wherever possible.

A key consideration in P28 is the methodology and validity of limits. Looking at the Stage 2 assessment methodology, it is appropriate to check the validity of the limit and the number of connections – currently 8 connections giving $P_{st} = 1$ (AH).

Electric vehicle (EV) chargers are not always an unconditional connection; BS EN 61000-3-11 defaults to a conditional connection - section 8.1.13 needs rewording (KL). It would be useful to contact LCT Group to understand how it treats flicker (GE).

SM suggested 5.1 General Limits should have a clear definition of what an abnormal condition is.

It was thought the draft report did not explicitly refer to the shift in focus from traditional industries to new technologies/generation (MT). It was agreed to set the background and context in the Introduction of the report.

MH raised the issue of voltage fluctuation produced by heat pumps and storage interacting together. There should be a cautionary note in P28 about frequency of switching - section 8.1.2. It should be amended such there is not a problem with BS EN 61000-3-3 and reworded to state multiple instructions under BS EN 61000-3-11 may cause a problem under network connection (KL). The increasing use of air conditioning in the hotter summer months could cause significant load issues (MH).

There are differences in recording PV (solar) inverters and wind turbine generators (WTG) due to software programming. There is no agreement across the industry which methodology should be adopted. MH suggested looking at recent inverter data sheets from windfarms and comparing it to what has been previously recorded. KL added few differences had been found for solar farms. It was agreed to review these in the proposed Measurements & Specific Applications sub WG (see section 6 of the minutes).

Generally changes are not retrospective however ESQCR (Electricity Safety, Quality and Continuity Regulations) is an overriding factor (AH).

MB from Ofgem asked if the DNOs had any problems with heat pumps and flicker. It was thought there were no issues if product standards were complied with (KL).

From Ofgem's point of view it is important to consider what the impact would be on customers of moving to a proportional allocation charging regime (MB). Although the WG had looked at the technical issues it had not considered the *impact* of such changes. Therefore it was agreed that a more robust investigation should be carried out on the impact/consequences of such changes and these should be identified as early as possible (GE/MB).

Future technologies were discussed and the impact these would have on the market, for example battery storage in homes. It is important P28 incorporates both existing and new technologies (PTh/KL). In light of this point, the validity of page 16 of the draft report should be reviewed in context of these changes (PTh).

RB discussed G81 and the right to determine the POC (Point of Connection). It was agreed in principal that a DNO should seek to comply with P28, where appropriate.

GE also presented a summary of comments received prior to the meeting [Presentation_P28 WG_Meeting 5_03.09.15_v1.1 slides 14 & 15]

In summary the WG agreed operating conditions must be clearly defined and properly modelled. It should contain minimum and maximum fault levels under credible fault conditions. P28 should not have discretionary limits and as such this should be the focus of a sub WG (DC).

A round the table discussion resulted in the following amendments to the current draft summarised below:

ACTION 5.4: Review and amend the wording in the following sections of P28 WG_Paper_5_4_ENA_EREC_P28_Ph2_Report_v1_Draft (GE):

a. section 8.1.13 Electric Vehicles 61000-3-11 reword paragraph as follows (KL)

“IEC 61000-3-3 is applicable to electrical and electronic equipment having an input current equal to or less than 16 A per phase, intended to be connected to public low-voltage distribution systems of between 220 V and 250 V line to neutral at 50 Hz, and not subject to conditional connection. Equipment which does not comply with the limits of this part of IEC 61000-3-3 when tested with the reference impedance Z_{ref} and which therefore cannot be declared compliant with IEC 61000-3-3 may be retested or evaluated to show conformity with IEC 61000-3-11. IEC 61000-3-11 is applicable to electrical and electronic equipment with rated current < 75 A but is primarily applicable to electrical and electronic equipment having a rated input current from 16 A up to and including 75 A and is subject to a conditional connection. It should be noted that equipment tested under IEC 61000-3-11 can connect via the unconditional connection route if the equipment meets the technical requirements of IEC 61000-3-3.”

b. section 5.1 General Limits remove ambiguity – should be credible operating conditions (SM)

c. Introduction add background context statement outlining the shift away from traditional industries to new technologies/generation (MT)

d. Review page 16 of P28 report in context of the proposed changes (PTh)

e. Reword section 8.1.2 of P28 report (MH)

f. Give consideration to the *impact* of changing those technical issues identified in the Phase 2 Review Report (MB)

ACTION 5.5: Contact LCT Group to understand how it treats flicker (xref 5.4a) (GE)

ACTION 5.6: Circulate a tracked changes version of draft P28 report for comment (see action 5.4) (GE)

6. Phase 3 Revision

GE presented the proposed key headings and structure for P28 Revision.

[Document reference: P28 WG_Paper_5_6_Proposed Structure & Headings for P28 Issue 2_Draft_v1]

6.1 Revised Structure of P28 Document

The proposed structure and key headings are:

1. Scope
 2. Normative References
 3. Terms & Definitions
 4. General
 5. Flicker Severity Assessment & Limits
 6. Rapid Voltage Change Assessment & Limits
 7. Measurements
 8. Guidance on Specific Applications
- Annexes
Bibliography

A key change in this review is that flicker will be split into traditional flicker (section 5) and short term RVC (section 6). Section 5 will contain a different methodology for LV, HV and EHV.

There was a round the table discussion resulting in the following considerations:

- Section 5 - G5/4 does not follow the structure outlined above instead it uses a voltage range with set limits (MH)
- Section 6 – a number of omissions were identified:
 - Motors (MH)
 - Cable energisation (FG)
 - Point on wave energisation (a subset of transformers and motors) with a given limit (MH)
 - Energisation should align with GC0076 (FG)
- P28 has an assessment of limits section which is hard and fast and an application section – should there be a mitigation section (GE)?
- What voltage is measured over one cycle i.e. the RMS value? What about the flux angle? Look at motors starting after 30ms? Half cycle measurements?
- P28 must give clear definitions of characteristics and be in alignment with IEC standards

6.2 Measurement Requirements

P28 parameters should align with IEC and the terminology with BS EN standards wherever possible. Parameters should be defined with a methodology of how they should be measured including the instruments to use for setting limits (FG).

It was agreed the Flicker sub WG should examine whether the $P_{st} = 1$ curve definition aligns with the current P28.

Section 8 Guidance on Specific Applications should include motors and welders (AH).

It was agreed Figure 4 in the original P28 would be covered in section 5 Limits (THw)

6.3 Data Requirements

It was agreed to include the following to the list of specialist data requirements:

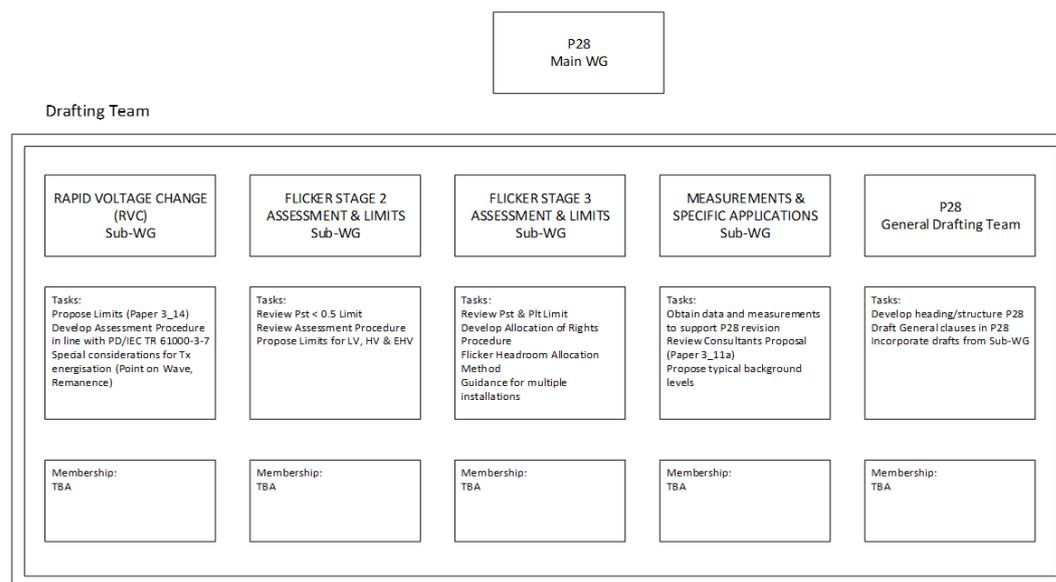
- Monitoring actual flicker levels for windfarms could provide data (PTh)

- Step voltage change occurs with windfarms as they are energised – this real time data could be useful (MH)
- National Grid has specific power quality measurements for 132 kV windfarms (FG) as does Electricity North West (PTw). It is possible that Western Power Distribution and Scottish & Sothern Electricity has data too (AH/AE)
- Export limiting devices (KL)

6.4 Proposed sub WGs and Membership

GE presented the proposed sub WG structure and associated tasks summarised below:
 [Document reference: P28 WG_Paper_5_7_Proposed Working Groups and Presentation_P28 WG_Meeting 5_03.09.15_v1.1 slides 20 &21]

P28 Sub-Working Groups & Drafting



Page 1

It was agreed Flicker Stages 2 & 3 should be amalgamated into one sub WG given their commonalities.

A new Step Voltage Change sub WG was agreed (MH/RB) and consideration should be given to adding it as a key heading in the P28 report although it would be a very short section.

ACTION 5.7: Add a new sub WG Step Voltage Change (GE)

ACTION 5.7a: Amalgamate the two Flicker sub WGs covering Stages 2 & 3 into one sub WG (GE)

Consideration should be given to having an Apportionment sub WG under the Flicker WG (FG).

There was a discussion about the best way of obtaining data. In the absence of relevant university contacts it was suggested GE should approach ENA.

ACTION 5.8: Ask ENA what the formal mechanism is for obtaining access to data that has been gathered (GE)

Registration of interest for sub WG memberships was discussed, with each group having a Chair /Expert and members from a mixture of DNOs and independent representatives.

The ToR would be agreed with the main P28 WG in line with the Stage 2 report. The principles would be set by the General Drafting team and would follow EREC G0.

A drafting and review process would be set up to assist and finalise the agreed output.

Facilitation of meetings could include conference calls, the possible use of ENA meeting rooms or at members own offices.

The proposed sub WG memberships is summarised below *noting* these are not confirmed yet as some members were not in attendance at the meeting but it is within their areas of expertise*:

| | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Rapid Voltage Change (RVC) Peter Thomas Roshan Bhattarai Mark Horrocks Forooz Ghassemi Davor Vujatovic* Simon Scarbro* | Flicker Assessment & Limits Forooz Ghassemi Andrew Hood Peter Thomas (data provider only) Davor Vujatovic* Joe Duddy* | Step Voltage Change Roshan Bhattarai |
| Measurements & Specific Applications Peter Thomas Mark Horrocks Steve Mould Ken Lennon Andrew Hood (data provider only) Joe Duddy* | P28 General Drafting Gary Eastwood David Crawley Mark Kilcullen Joe Duddy* | |

ACTION 5.8a: Contact individual WG members to request registration of interest for sub WGs (GE)

7. Project Plan

GE presented the unchanged project plan stating this current Phase 3 Revision Plan is probably a little optimistic in issuing the final draft of P28 Phase 3 Revision Report in July 2016.

[Document reference: ENA_EREC_P28_Ph1_PID_v1_Issued]

ACTION 5.9: Review the timescales for Review of P28 Phase 3 (GE)

8. General Management/Administration

Arrangements for general management and administration have not changed since the previous meeting except to note the WG secure access area on the ENA website is now operational. 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.

8.1 On-line Repository Requirements

- Public access
 - Hosted by ENA on the DCRP website
 - Administered on behalf of the WG by the ENA Secretariat
 - Access to all approved outputs from WG (see <http://www.dcode.org.uk/areas-of-work/>)
- Working Group secure access
 - Propose to use the ENA website (see <http://www.energynetworks.org/electricity/engineering/engineering-documents/engineering-documents-overview.html>)
 - Click on ER P28 Working Group
 - Enter Username and Password supplied
 - If there are any issues with this proposal or problems accessing files let GE know

**ACTION 5.10: Circulate ENA website link with username and password
Let GE know whether or not P28 WG members were able to download test document (GE/All)**

GE confirmed the ENA Secretariat would upload all documents onto the ENA website.

Due to time constraints the following two sections 8.2 and 8.3 were omitted from the meeting as nothing had changed since the last meeting.

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

- As previously documented 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
- GC0076 has been published and implemented (FG)
- Transformer Mag Inrush Modelling (MH email 02.09.15 software differences for inrush) - it was found that different software packages (Digsilent and PSCAD) produce the same results for transformer energisation, which is reassuring. A discussion followed on how the voltage drop compares with the fault level 40 MVA and whether the illustrated models were too optimistic (KL)

ACTION 5.11: Sanity check mag inrush modelling with actual data (xref MH email 02.09.15) (MH/KL)

- There is a new European Eco Design Directive for Transformers which looks at lower resistances in new transformers (MH). The concern is what the impact will be on the grid, DNOs and customers alike. Has any modelling been done? How does resistance effect inrush? What is the impact of transformer losses? There will be a bigger effect for 1-3 MVA and what happens when the limit is close to 3%? It was agreed the Measurements sub WG could use the data based on current transformer designs and substitute the new values for low loss transformers and compare the two. It is possible the Transformer Assessment Panel (TAP) could provide data. KL to try and obtain measurements when changing a transformer.

ACTION 5.11a: Look at changing transformers and differences in flicker data before and after (KL)

- It was agreed to add a standard agenda item for all sub WGs to report back to main P28 WG

ACTION 5.12: Add a standard agenda item for all sub WGs to report back to main P28 WG (GE)

- 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 (xref action 4.18)

10. Date for Future Meetings

The following dates have been proposed for future meetings:

- 4th November 2015 (previously agreed)
- 12th January 2016
- 3rd March 2016
- 21st April 2016
- 9th June 2016
- 28th July 2016

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.5

Summary of Actions from Current Meeting

| Item | Action | Who | Due by |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|
| 5.1 | Subject to the agreed amendments publish the approved minutes from P28 meeting no. 4 18.06.15 on the website | GE | 25.09.15 |
| 5.2 | Review and comment on Paper 5-11 Apportionment proposal and send to GE by 09.10.15 | All | 09.10.15 |
| 5.3 | Produce a set of principles for proportional allocation of rights and circulate to P28 WG | FG | 09.10.15 |
| 5.4 | Review and amend the wording in the following sections of P28 WG_Paper_5_4_ENA_ERECP28_Ph2_Report_v1_Draft <ul style="list-style-type: none"> a. section 8.1.13 Electric Vehicles 61000-3-11 can be unconditional connection b. section 5.1 General Limits remove ambiguity – should be credible operating conditions c. Introduction add background context statement outlining the shift away from traditional industries to new technologies/generation d. Review page 16 of P28 report in context of the proposed changes e. Reword section 8.1.2 of P28 report f. Give consideration to the <i>impact</i> of changing those technical issues identified in the Phase 2 Review Report | GE | 25.09.15 |
| 5.5 | Contact LCT Group to understand how it treats flicker (xref action 5.4a) | GE | 09.10.15 |
| 5.6 | Circulate a tracked changes version of draft P28 report for comment (see action 5.4) | GE | 25.09.15 |
| 5.7 | Add a new sub WG Step Voltage Change | GE | 09.10.15 |
| 5.7a | Amalgamate the two Flicker sub WGs covering Stages 2 & 3 into one sub WG | GE | 09.10.15 |
| 5.8 | Ask ENA what the formal mechanism is for obtaining access to data that has been gathered | GE | Next meeting |
| 5.8a | Contact individual WG members to request registration of interest for sub WGs | GE | Next meeting |
| 5.9 | Review the timescales for Review of P28 Phase 3 | GE | Next meeting |
| 5.10 | Circulate ENA website link with username and password Let GE know whether or not P28 WG members were able to download test document | GE All | 25.09.15 |
| 5.11 | Sanity check mag inrush modelling with actual data (xref MH email 02.09.15) | KL/MH | 09.10.15 |
| 5.11a | Look at changing transformers and differences in flicker data before and after | KL | 09.10.15 |
| 5.12 | Add a standard agenda item for all sub WGs to report back to main P28 WG | GE | Next meeting |

Summary of Outstanding Actions from Previous Meetings

| Item | Action | Who | Due by |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------|
| 4.7 | Summarise an alternative method of scaling a user's flicker emission to the available headroom (xref paper 4.9) | PJ | 09.10.15 |
| 4.8 | Review Stage 2 assessment methodology in P28 to see if it is still applicable to the revision in its current form | All | GJE Comments |
| 4.12 | Ask Eurelectric PQ WG about their knowledge of how other countries allocate rights | DC | 09.10.15 |
| 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 | 09.10.15 |
| 4.18 | Circulate paper 4.11 "P28 WG_Paper_4_11_Trench Farm pre mag tests 1" to the WG for comments | GE All | 09.10.15 |
| 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 |
| 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 | |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------------|
| 2.28 | 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 | Complete |
| 4.0 | Publish the approved minutes from P28 meeting no. 3 23.04.15 on the DCode website | GE | Complete |
| 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 | Complete |
| 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 | Complete - Proposed sub-WG |
| 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 | Complete - Proposed sub-WG |
| 4.4 | Publish the approved Terms of Reference v2.2 on the DCode website | GE | Complete |

| Item | Action | Who | |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------------------------|
| 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 | Complete - See P28 WG Paper_5_11 & 12 |
| 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 | Complete |
| 4.9 | Circulate ENA ER G5 current draft to WG | DC | Complete - 10/08/15 |
| 4.10 | Write a paper highlighting the principles behind flicker allocation in ER G5 latest draft on whether these translate to P28 | DV | Complete See P28 WG Paper_5_12 |
| 4.11 | Ask Cigre WG about their knowledge of how other countries allocate rights and headroom for flicker | DV | Complete See P28 WG Paper_5_13 |
| 4.13 | Review transformer energisation data from wind farm connections and feedback data to the WG for revision stage | PT | Complete See P28 WG Paper_5_10 |
| 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 | Complete |
| 4.16 | Review presentation by Jose Ribbecca Lightsource and summarise the important parameters for modelling (as per the brief) | MH | Complete |
| 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 | Complete |

Appendix B

ER P28 Joint GCRP & DCRP Working Group Meeting No.5

Attendance List

3rd September 2015 EIC Office, London

Attendees:

| Name | Initials | Company |
|-------------------|----------|---------------------------------------|
| Peter Twomey | PTw | 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 |
| Roshan Bhattarai | RB | Northern Powergrid |
| Forooz Ghassemi | FG | National Grid |
| Matthew Ball | MB | OFGEM |
| Mark Thomas | MT | TataSteel |
| Mark Kilcullen | MK | Department of Energy & Climate Change |
| Peter Thomas | PTh | Nordex |
| David Crawley | DC | ENA |
| Gary Eastwood | GE | Threepwood Consulting Ltd |
| Michelle Chambers | MJC | Threepwood Consulting Ltd |

Apologies:

| | | |
|-----------------|-----|------------------------------|
| Joe Duddy | JD | RES Group |
| James Hoare | JH | Renewable Energy Association |
| Gareth Evans | GE | OFGEM |
| Davor Vujatovic | DV | VandA Engineering Services |
| Tony Headley | THE | BEAMA |

Absences:

| | | |
|------------------|----|-----------|
| Sridhar Sahukari | SS | Energy UK |
|------------------|----|-----------|

Appendix C

ER P28 Joint GCRP & DCRP Working Group Meeting No.5

Thursday 3rd September 2015, 10:30 – 15:30

Agenda

| | | | |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------|
| 1. | Welcome, introductions | DC/GJE | 10:30 |
| 2. | Address by the Chair | GJE | |
| 3. | Update/actions from last meeting <ul style="list-style-type: none"> • Review/approval of meeting notes • Update on actions • Findings and results from Trench Farm • Correspondence on Paper 4_9 | GJE/ALL KL/MH FG | |
| 4. | Terms of Reference (ToR) | GJE/ALL | |
| 5. | Review Phase 2 Review Report for ER P28 - Recommendations for Revision | GJE/ALL | |
| 6. | Revision Phase 3 <ul style="list-style-type: none"> • Revised structure for P28 document • Data & measurement requirements • Proposed sub-WGs & membership | GJE/ALL | |
| 7. | Project plan | GJE | |
| 8. | General management/administration <ul style="list-style-type: none"> • On-line repository requirements • Consultation process • Support requirements | GJE | |
| 9. | AOB <ul style="list-style-type: none"> • Proposed changes in membership (GE) | ALL GJE | |
| 10. | Future meetings <ul style="list-style-type: none"> • Dates • Agenda items | | 15:30 |