



Model documentation: Update
models for DCP 266 and provide
2018-19 & 2019-20 impact
assessments (Requests A18-1& A19-3)

05 April 2019

DCUSA/ElectraLink

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I. INTRODUCTION

This document describes charging models, impact assessments and supporting documentation commissioned by the DCP 266 Working Group on 29th January 2019.

The following sections set out the:

- i. **specifications** for the new files, including the identity of the reference files for the revisions noted here within and the new file names;
- ii. **model** revisions;
- iii. **impacts** of those revisions; and
- iv. **user guide** revisions.

2. SPECIFICATION

The models and supporting documentation described herein were developed in response to a request to produce versions of the PCDM, CDCM and EDCM (LRIC & FCP) models that implement DCP 266 – “*calculation and application of IDNO discounts*”. The reference files noted below were developed in line with the draft DCUSA text first shared with the modelling team on 08/11/18, then in revised form on 29/11/18, and again on 01/04/19. In all other areas, we assumed that the model should implement the 01 April 2020 DCUSA Charging Methodologies Pre-Release (released 09/10/2018).

The modelling team was asked to create two sets of impact assessments for DCP 266 – for 2018/19 and 2019/20 charging years. The Working Group requested that both assessments include the resolution of circularities between the CDCM and PCDM models (but not the EDCM).

2.1. Reference files

The following table sets out the reference versions of the charging models and user guides used as the starting point for the revisions described in this document.

Table 2.1: Reference files

Model	Model file name	User guide file name	Date sent
PCDM	PCDM_v3_20181016.xlsx	PCDM_v3_20181016.pdf	16/10/2018
CDCM	CDCM_v3_20181016.xlsx	CDCM_v3_20181016.pdf	16/10/2018
EDCM (LRIC)	EDCM-LRIC_v3_20181016.xlsx	EDCM-LRIC_v3_20181016.pdf	16/10/2018
EDCM (FCP)	EDCM-FCP_v3_20181016.xlsx	EDCM-FCP_v3_20181016.pdf	16/10/2018

2.2. New files

The following table sets out the versions of the charging models, user guides and impact assessment provided to the DCP 266 Working Group in response to the request described above.

Table 2.2: New files

Model	Model file name	User guide file name	Date sent
PCDM	PCDM_v3(266)_20190405.xlsx	PCDM_v3(266)_20190405.pdf	05/04/2019
CDCM	CDCM_v3(266)_20181207.xlsx	CDCM_v3(266)_20181207.pdf	07/12/2018

Model	Model file name	User guide file name	Date sent
EDCM (LRIC)	EDCM-LRIC_v4(266)_20181207.xlsx	EDCM-LRIC_v4(266)_20181207.pdf	07/12/2018
EDCM (FCP)	EDCM-FCP_v4(266)_20181207.xlsx	EDCM-FCP_v4(266)_20181207.pdf	07/12/2018
Impact assessments	CEPA-TNEI_A18-1_ImpactAssessment_2018-19.xlsx CEPA-TNEI_A19-3_ImpactAssessment_2019-20.xlsx	-	05/04/2019

The EDCM model files are named “v4” to denote that they include a correction for a non-material error brought to our attention on 02/11/18.

The ARP was not commissioned under this service request. If required at a later date (alongside a service 2 request for the other charging models), we would expect it to be commissioned as a service 1 + 2 request.

We understand that the new files listed in Table 2.2 will be considered by the DCP 266 Working Group and may be shared for consultation.

2.3. New modelling specification assumptions

The modelling team shared a model issues log with the Working Group on 20/11/18, raising five issues and seeking advice on the intended interpretation of the draft text. The Working Group returned a copy of the issues log on 29/11/18 which clarified all five issues and amended the draft text accordingly.

Following a Working Group meeting on 29/03/19, the Working Group amended Schedule 20, Paragraph 46 to remove the requirement to divide by “(S + U)”. The modelling team was commissioned to revise the PCDM and update impact assessments accordingly.

3. MODEL REVISIONS

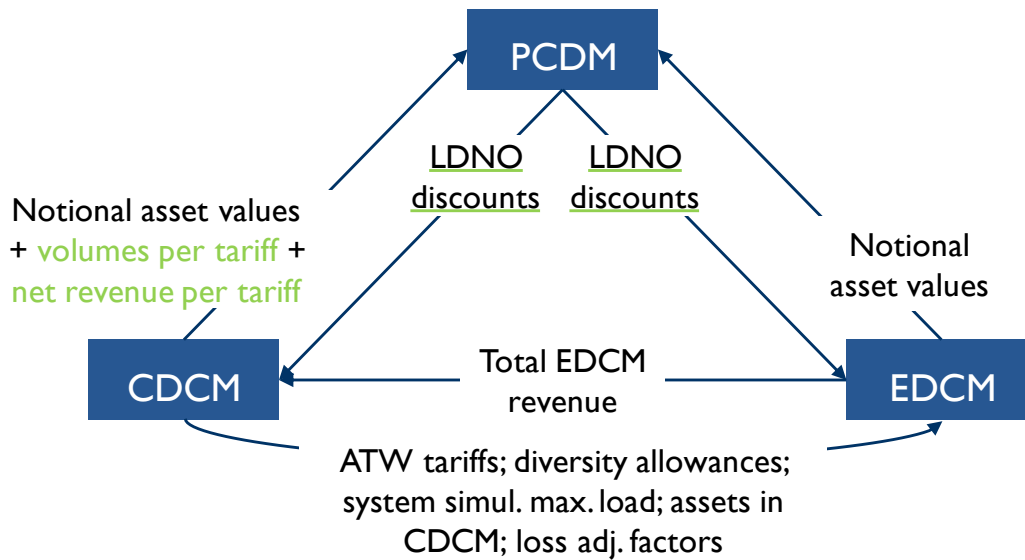
3.1. Structural changes

The following structural changes were made to implement DCP 266:

1. revenue (£) per all-the-way tariff is exported from the CDCM to the PCDM;
2. volumes (MWh) per all-the-way tariff are exported from the CDCM to the PCDM;
3. LDNO discounts are exported from the PCDM to the CDCM / EDCM on a per tariff basis, rather than by LDNO boundary / end-user connection level. Discount mapping tables have therefore been moved from the CDCM / EDCM to the PCDM; and
4. a new sheet (‘Discount mapping’) was added to the PCDM to convert LDNO discounts to percentages per customer category, rather than per LDNO boundary / end-user connection level.

These additions have an impact on how model interactions should work because they introduce a new output table to be passed from the CDCM to the PCDM. Figure 3.1 illustrates the interactions between the three charging models, with changes brought about by DCP 266 highlighted in green. LDNO discounts are underlined in green because their dimensions and values have changed. This can have a knock-on effect on CDCM outputs, which will feed through to other models in turn.

Figure 3.1: Changes to model interactions arising from DCP 266



We discuss the impact of the new circularity introduced between the CDCM and PCDM in sub-section 4.

3.2. Additional or modified information sections

The following revisions were made in the PCDM:

1. **‘Cover’**. Subtitle updated.
2. **‘Version control’**. Version control updated (including model date, DCUSA text version, and description of changes).
3. **‘Model map’**. Updated to account for new sheet (‘Discount mapping’).
4. **‘Index’**. Updated to account for revised section structure.

The following revisions were made in the CDCM:

5. **‘Cover’**. Subtitle updated.
6. **‘Version control’**. Version control updated (including model date, DCUSA text version, and description of changes).
7. **‘Index’**. Updated to account for revised section structure.

The following revisions were made in the EDCM:

8. **‘Cover’**. Subtitle updated.
9. **‘Version control’**. Version control updated (including model date, DCUSA text version, and description of changes).
10. **‘Index’**. Updated to account for revised section structure.

3.3. Additional or modified input sections

The following revisions were made in the PCDM:

11. **‘Fixed inputs’**. Discount mapping tables transferred from CDCM / EDCM; universal values added for conversions from pounds to pence / GWh to kWh; and Input 401-J (previously Input 401-K) renamed to remove reference to “S”. Now named “*network levels included in all-the-way tariffs, by user type and network level*”.

12. **'DNO inputs'**. New inputs added for DCP 266 – net revenue per tariff from CDCM; volumes per tariff from CDCM; charging year units distributed; charging year network losses; and charging year total allowed revenue.

The following revisions were made in the CDCM:

13. **'Fixed inputs'**. LDNO discount mapping table removed.
14. **'Inputs by customer type'**. LDNO discounts table added (relocated from 'General inputs' sheet due to altered dimensions).
15. **'General inputs'**. LDNO discounts table removed (relocated to 'Inputs by customer type' sheet due to altered dimensions).

The following revisions were made in the EDCM:

16. **'General inputs'**. LDNO discounts table removed (relocated to 'LDNO inputs' sheet due to altered dimensions).
17. **'LDNO inputs'**. LDNO discounts table added (relocated from 'General inputs' sheet due to altered dimensions).

3.4. Additional or modified calculation sections

The following revisions were made in the PCDM:

18. **'Rev allocation'**. Revised from Section G onwards to implement DCP 266 – namely the application of revenue and unit scalars; calculation of revenue to share in p/kWh rather than as percentages; and calculation of "U" (previously in Section 405-J) removed.
19. **'EDCM discounts'**. Revised to express discounts in p/kWh. Division by "(S + U)" removed in the calculation of EDCM discounts (previously Section 407-F).
20. **'CDCM discounts'**. Revised to express discounts in p/kWh.
21. **'Discount mapping' [new sheet]**. Added to map discounts from the LDNO boundary / end-user connection level to the tariff level; to calculate average all-the-way tariffs in p/kWh (including adjustment for dual tariffs described in Schedule 29, Paragraph 46A); and then to express discounts as a percentage of average all-the-way tariffs.

The following revisions were made in the CDCM:

22. **'Volume adjustments'**. Dimensions of initial discounts table altered, and first discount mapping stage removed.
23. **'Net revenue summary'**. Rows added to express net revenue and combined volumes per all-the-way tariff for export to the PCDM.

The following revisions were made in the EDCM:

24. **'LDNO calculations'**. Dimensions of initial discounts table altered, and discount mapping stage removed.

3.5. Additional or modified output sections

The following revisions were made in the PCDM:

25. **'Outputs to other models'**. Table dimensions altered to export discounts by customer category.

The following revisions were made in the CDCM:

26. **‘Outputs to other models’**. Table added to export net revenue and combined volumes per all-the-way tariff to the PCDM.

No revisions were made to outputs in the EDCM.

4. IMPACT STATEMENT

4.1. Background

The impact assessments submitted under this service request set out the impact of DCP 266 on:

- i. **‘Discounts %’**. % LDNO discounts produced by the PCDM;
- ii. **‘Discounts per kWh’**. LDNO discounts per kWh of all-the-way load;
- iii. **‘Discounts £’**. Aggregate £ value of LDNO discounts at CDCM boundary levels;
- iv. **‘CDCM tariffs’**. Tariffs produced by the CDCM;
- v. **‘CDCM net rev’**. Net revenue for each CDCM tariff;
- vi. **‘CDCM per kWh’**. Net revenue per kWh for each CDCM tariff;
- vii. **‘CDCM per MPAN’**. Net revenue per MPAN for each CDCM tariff; and
- viii. **‘CDCM other outputs’**. Other CDCM outputs not shown elsewhere (e.g. notional EHV asset values, system simultaneous maximum load, assets in CDCM model, and breakdown of total net revenue).

In each case the impact assessment presents values before DCP 266, after DCP 266, absolute difference, and percentage change.

Impact assessments were generated using inputs from the 2018/19 and 2019/20 published models, except where the Working Group had provided new or alternative inputs for network losses, units distributed and non-zero volumes.¹

The model versions used for impact assessments include changes implemented under DCP306. For the purposes of the impact assessments presented here, “non-activity costs and reconciling amounts” were fully allocated to “Other costs” as opposed to allocating part of that amount to “Ofgem licence fees”. This assumption removes the impact of DCP 306, as per the published models for those years.

DCP 266 introduces a new output table to be passed from the CDCM to the PCDM, as illustrated in Figure 3.1 above.

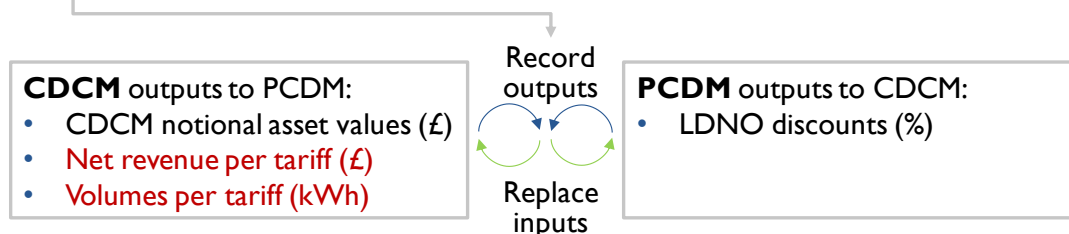
4.2. Approach

Figure 4.1 summarises the approach taken to producing impact assessments, which was run for each DNO both pre and post-DCP 266, using both 2018/19 and 2019/20 data. The items in red only apply to the post-DCP 266 models.

¹ Attachment B_DCP 266 Input Data 2018_19 and 2019_20.xlsx; Attachment C_DCP 266 2018_19 Non Zero Adjusted Volumes.xlsx; Attachment D_DCP 266 2019_20 Non-Zero Adjusted Volumes.xlsx – received from Working Group on 01/04/2019.

Figure 4.1: Approach to impact assessments for DCP 266 (items in red only apply for post-266 models)

- Step 1: Populate with published inputs
- Step 2: Replace CDCM volumes with non-zero values
- Step 3: Add new PCDM inputs required by DCP 266 (network losses & units distributed)
- Step 4: Allocate all “non-activity costs and reconciling amounts” to “other costs”
- Step 5: Resolve CDCM/PCDM interaction



The Working Group requested impact assessments where the circularity between the CDCM and PCDM is resolved. Resolution is defined as when “CDCM table 102-A and PCDM table 402-C, CDCM table 102-F and PCDM table 402-R, and PCDM table 401-A and CDCM table 102-E remain aligned”. The values in these tables can differ slightly even after many iterations, without having any impact on tariffs. Since precise interpretation of “aligned” was not defined, the modelling team have chosen to provide impact assessments after 7 iterations – by which point all LDNO discounts are resolved to at least 9 significant figures.

In practice, extra iterations made very little difference relative to the impact assessment submitted on 12/12/2018 using 2018/19 data because that version effectively included one iteration already. That is, revenue and volumes per tariff were passed from the CDCM to the PCDM and LDNO discounts were passed back into the CDCM.

The Working Group requested that impact assessments should not attempt to resolve interactions with the EDCM model, which were considered “to be immaterial in comparison with the CDCM circularity”.

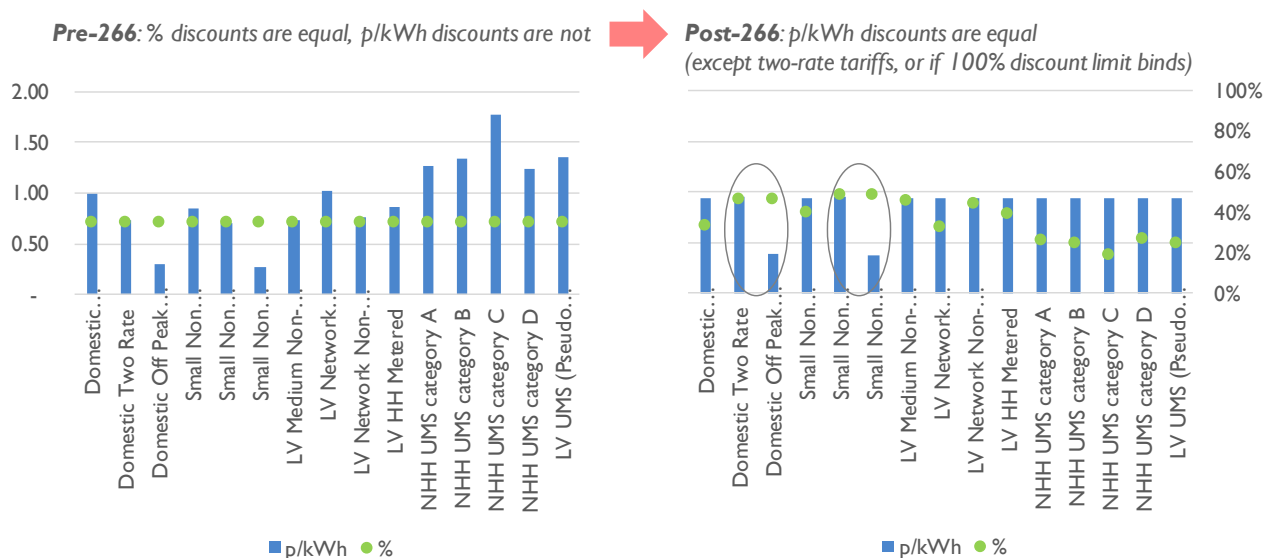
4.3. Impacts

Overall effect

The overall effect of DCP 266 is to cause discounts to diverge in percentage terms, but to converge to the same p/kWh value for the same boundary level.

Figure 4.2 illustrates the basic effect for one DNO (ENWL) for one boundary level (LV). Whereas before DCP 266, percentage discounts were consistent across tariffs – leading to inconsistent discounts per kWh, after DCP 266 each tariff receives a different % discount – leading to a consistent discount per kWh.

Figure 4.2: LDNO discounts for LV boundaries, ENWL 2019/20 – p/kWh (left axis), % (right axis)



This outcome is not achieved in two instances:

- for “two rate” and “off peak (related MPAN)” tariffs, which must have equal % discounts; and
- for tariffs where the 100% discount limit binds.

Discounts will also diverge per kWh for tariffs which cover different network levels. For instance, demand users connected at the HV level will receive a lower LDNO discount than those connected at the LV level, other things being equal.

Direction of impacts

The impact of DCP 266 on LDNO discounts differs by tariff, by DNO-LDNO boundary level, and by DNO area. For most tariffs, in most DNO areas, and at most boundary levels, DCP 266 would *raise* percentage discounts. But for some high-volume tariffs, notably ‘Domestic Unrestricted’, DCP 266 would *lower* discounts in most cases.

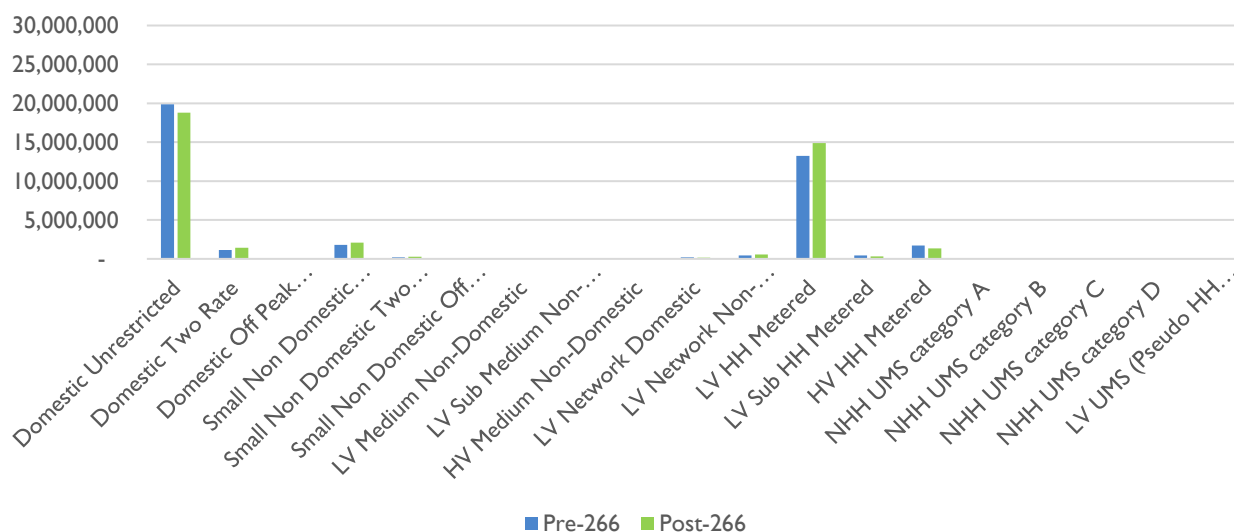
Taking all DNO areas together, these impact assessments suggest that DCP 266 would *raise* the aggregate value of LDNO discounts at CDCM boundary levels² by £897,568 (+2.29%) in 2018/19, and £800,125 (+1.55%) in 2019/20. The impact for individual LDNOs will differ according to the profile of their customer bases.

Figure 4.3 presents the value of LDNO discounts at CDCM boundary levels³ across GB DNOs in the 2018/19 charging year.

² i.e. Not including discounts applied within the EDCM model, for which input data was not available to the modelling team.

³ Discounts are not shown at EDCM boundary levels (HVplus, EHV, 132kV/EHV, 132kV, 0000) as these would require EDCM volume data, which are not in the public domain. The pattern of impacts will differ at higher boundary levels. For instance, generation tariffs only receive LDNO discounts from the HVplus boundary level upwards.

Figure 4.3: Impact of DCP 266 on aggregate LDNO margins at CDCM boundaries, all DNOs (£) – 2018/19



This picture changes for individual DNO areas. For some DNOs, DCP 266 may reduce the overall value of LDNO discounts or have an impact on specific tariffs in the opposite direction.

Figure 4.4 presents the same chart for the 2019/20 charging year. The pattern of results is similar, though the value of discounts is greater due to increases in LDNO volumes and DNO allowed revenues.

Figure 4.4: Impact of DCP 266 on aggregate LDNO margins at CDCM boundaries, all DNOs (£) – 2019/20

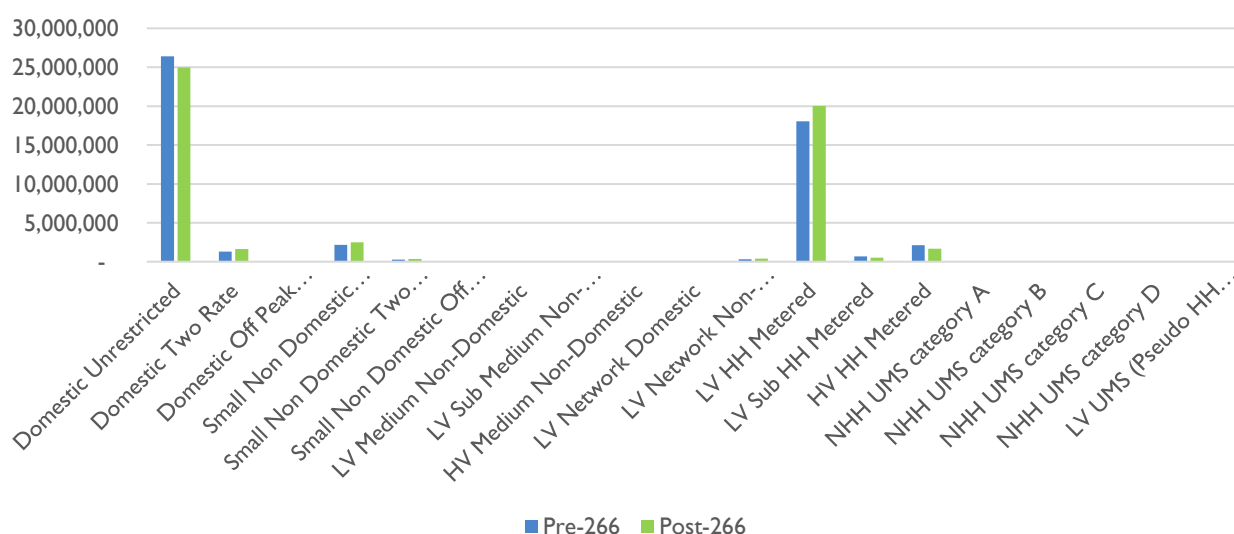


Figure 4.5Error! Reference source not found. and Figure 4.6 present the range of impacts across all discounts produced by the PDCM as ‘box and whisker’ plots.

Figure 4.5Error! Reference source not found. shows an increase in median and mean discounts for every DNO in 2018/19. Mean increases are modest in some cases (e.g. EPN, 2.4 percentage points) and large in others (e.g. WMID, 13.5 percentage points). Some individual discounts fall by up to 61 percentage points, and others increase by up to 77 percentage points.

Figure 4.5: Impact of DCP 266 on LDNO discounts (percentage point change) – 2018/19

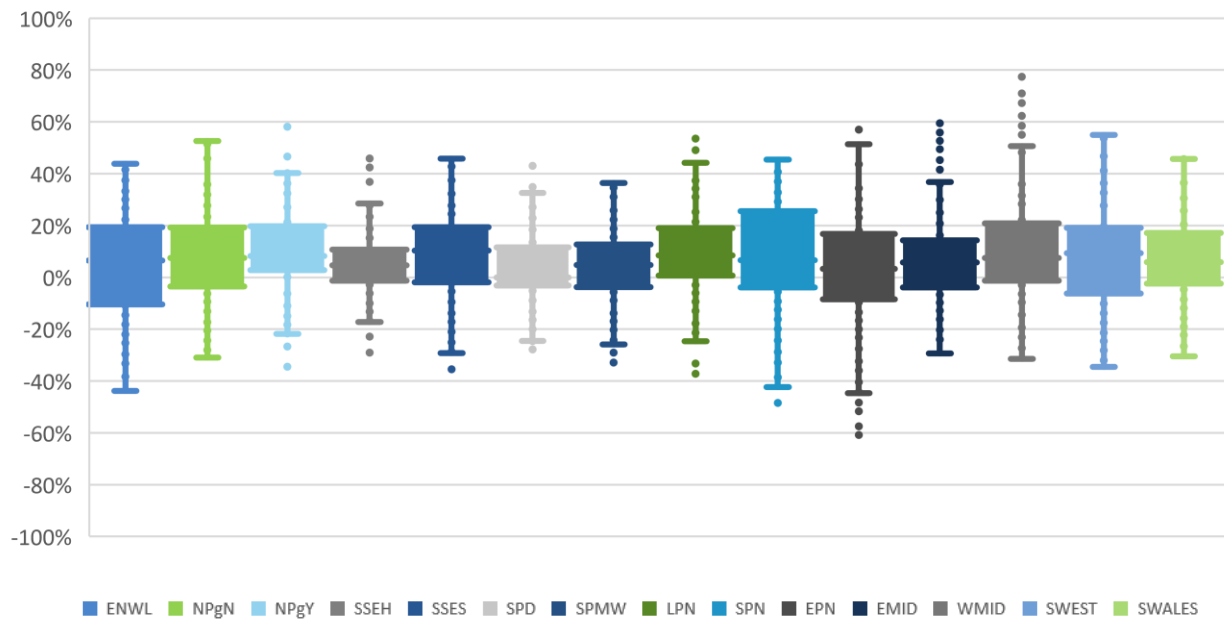
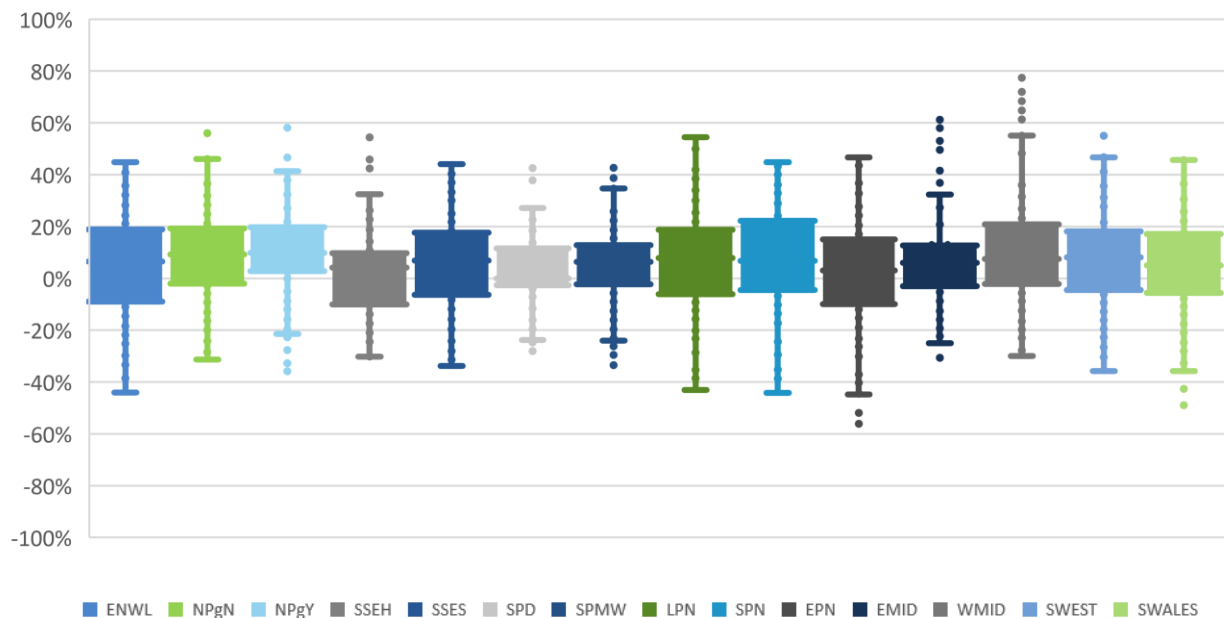


Figure 4.6 shows very similar impacts for 2019/20. There are small differences in every case, though overall the two charts look almost identical. The largest difference between the two impact assessments appears to be for the two DNO areas owned by Scottish and Southern Electricity Networks – SSEH and SSES. This difference relates to SSEH's and SSES's unmetered supply customers, whose average p/kWh charges rose by about a third between 2018/19 and 2019/20 – causing percentage discounts to fall but leaving the value of discounts in p/kWh unchanged.

Figure 4.6: Impact of DCP 266 on LDNO discounts (percentage point change) – 2019/20



Impact of extra iterations

The modelling team submitted an earlier impact assessment on 12th December 2018 using 2018/19 data. The previous assessment did not include steps to resolve the circularity between the PCDM and CDCM but is equivalent to the current 2018/19 assessment in all other ways.

The difference introduced by extra iterations is very small. Extra loops changed discounts by 0.013 percentage points on average in absolute terms (max: 0.096%; min: -0.201%). This is partly because the previous assessment effectively included one round of interactions already. That is, net revenue per kWh was exported from the CDCM to PCDM – as required by DCP 266, and LDNO discounts were sent back from the PCDM to the CDCM. After this first loop, the impact of additional loops diminishes.

Impact of removing “(S + U)”

The initial set of draft text shared with the modelling team included the requirement to divide by “(S + U)” when calculating LDNO discounts for EDCM boundary levels. This step was subsequently considered to be inappropriate if PCDM discounts are expressed as a proportion of all-the-way typical bills calculated in the CDCM. The Working Group therefore reissued the draft text for DCP266 with the “S” and “U” terms removed.

Removing the “S” and “U” terms has no direct effect on discounts for LDNOs with boundaries at CDCM network levels (LV or HV), which are calculated separately. There could, however, be some indirect impact if interactions between the EDCM and CDCM are taken into account.

The impact on EDCM-level discounts was large in some instances. Removing “S” and “U” raised discounts for most LV-connected customers by a small amount (max. 7.9 percentage points) because “(S + U)” was slightly above 100% in the previous model version for most DNOs, but slightly below 100% for SEPD and SHEPD. For HV-connected customers (with EDCM boundary levels), discounts fell significantly (max. 67.7 percentage points). In some cases, removing “(S + U)” brought discounts back under the 100% cap – though most instances of 100% discounts remained in place.

4.4. Interpretation

The impact analysis performed as part of this modelling request demonstrates that:

- i. DCP 266 introduces **more consistent discounts per kWh**. An implication of this is that it also introduces more variation in *percentage* discounts. Additional percentage variation corresponds to differences in average tariffs between customer categories, which is the denominator in the percentage discount formula.
- ii. Although the impact of DCP 266 on LDNO discounts can be large, the knock-on **effect on all-the-way tariffs is generally small**. Using 2018/19 data, the range of impacts on net revenue per all-the-way tariff lies between +0.3% and -0.1%.
- iii. The **100% upper limit** on LDNO tariffs is binding for many tariffs at the higher boundary levels.
- iv. DCP 266 **exposes LDNOs to new risks** from year-to-year changes in average all-the-way tariffs.

Understanding the impact of DCP 266 on a certain discount can be complex. As a simplification, it can help to focus on the following three terms:

- i. All discounts for a DNO are affected by the **revenue / unit scaler** used to bring 2007/08 volumes and revenues into line with the charging year. For example, SPN has a larger scaler than EPN or

LPN so, other things being equal, DCP 266 will increase LDNO discounts for SPN more than for EPN or LPN.

- ii. The **average p/kWh tariff** for a customer category, which is the denominator of the percentage discount post-DCP 266. Since this is the only term which varies by customer category within the same charging model, the direction of impact is consistent across LDNO boundary levels within the CDCM and EDCM. For example, if DCP 266 lowers the discount received by LDNOs with a boundary at the 0000 level serving a Domestic Unrestricted end-user, then it will also lower discounts at the 132kV, 132kV/EHV, and EHV levels for that customer category (but not necessarily for HV or LV boundary levels, which fall under the CDCM).
- iii. **Revenue to share per unit for all network levels**, which was the denominator of the discount percentage formula before DCP 266. The PCDM calculates one value per charging model per DNO, which can explain some of the pattern of impacts between charging models. For instance, the average increase in LDNO discounts is greater in the EDCM than the CDCM (7.9% and 5.8% respectively, using 2018/19 data).

5. USER GUIDE REVISIONS

The following sections of the user guides were updated to reflect DCP 266.

Table 5.1: Updated user guide sections

CDCM-ARP	PCDM	EDCM-FCP	EDCM-LRIC
Section 1	Section 1	Section 1	Section 1
Section 2	Section 2	Section 2	Section 2
Section 6	Section 3	Section 6	Section 6
Section 7	Section 4	Section 7	Section 7
Section 8	Section 7		
	Section 8		



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