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Data analysis | Economic regulation | Competition law

Analysis of the impact of DCP 227 on unrestricted tariffs

Report to the **DCP 227 Working Group** on **Wednesday 6 May 2015**

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1. This document seeks to explain the impact on unrestricted tariffs (profile classes 1 and 3) of the DCP 227 solution documented in a specification issued by the DCP 227 working group on 16 March 2015 and implemented by model revision r6837.

2. All data are taken from models populated in accordance with the requirements set down by the working group. The data sources for allowed revenue are the Annual Review Packs downloaded from dcusa.co.uk (not the DCP 066A templates). Where the working group did not specify a data source (e.g. transmission exit charges), the data have been set to the same value as in the DNOs' February 2015 models.

3. References in this document are to the table numbering in model revision r6837, and to the data used in the DCP 227 impact estimate.

Description of CDCM calculations and DCP 227 impact for a domestic tariff

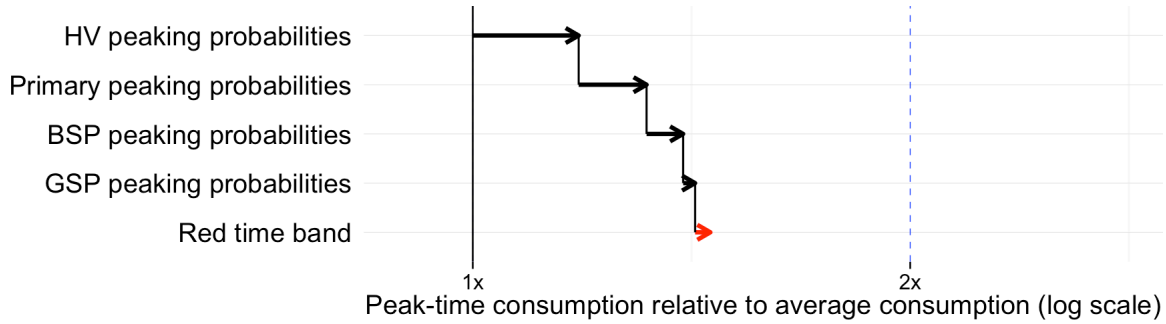
4. The proposed DCP 227 solution changes the way in which consumption (kWh consumed) is converted into use of network capacity (measured as a notional contribution to peak kW at each network level) for unrestricted tariffs.

5. The CDCM model uses the term "load coefficient" as part of these conversions. A load coefficient is the notional contribution to network use (peak kW) attributed, before adjusting for losses, to an amount of consumption that averages 1 kW. In the context of an unrestricted tariff in a leap year, consumption that averages 1 kW is 8,784 kWh in a year.

6. In the illustrations in this section, data are for the domestic unrestricted tariff in the SEPD area. The remainder of the document then examines how things differ for other tariffs and other DNO areas.

7. Figure 1 show how consumption in the red, amber and green time bands (in table 1061 for unrestricted tariffs) matches up with the peaking probabilities in table 1069.

Figure 1 Unadjusted load coefficients for peaking probabilities at each network level (SEPD, Domestic Unrestricted)



8. Only four levels are shown for peaking probabilities, reflecting the way in which peaking probabilities are usually grouped in table 1069:

   (a) HV peaking probabilities apply to HV circuits, HV/LV substations, and LV circuits.

   (b) Primary peaking probabilities apply to EHV/HV substations and EHV circuits.

   (c) BSP peaking probabilities apply to 132kV/EHV substations, 132kV/HV substations, and 132kV circuits.

   (d) GSP peaking probabilities apply for transmission exit charges and revenue matching.

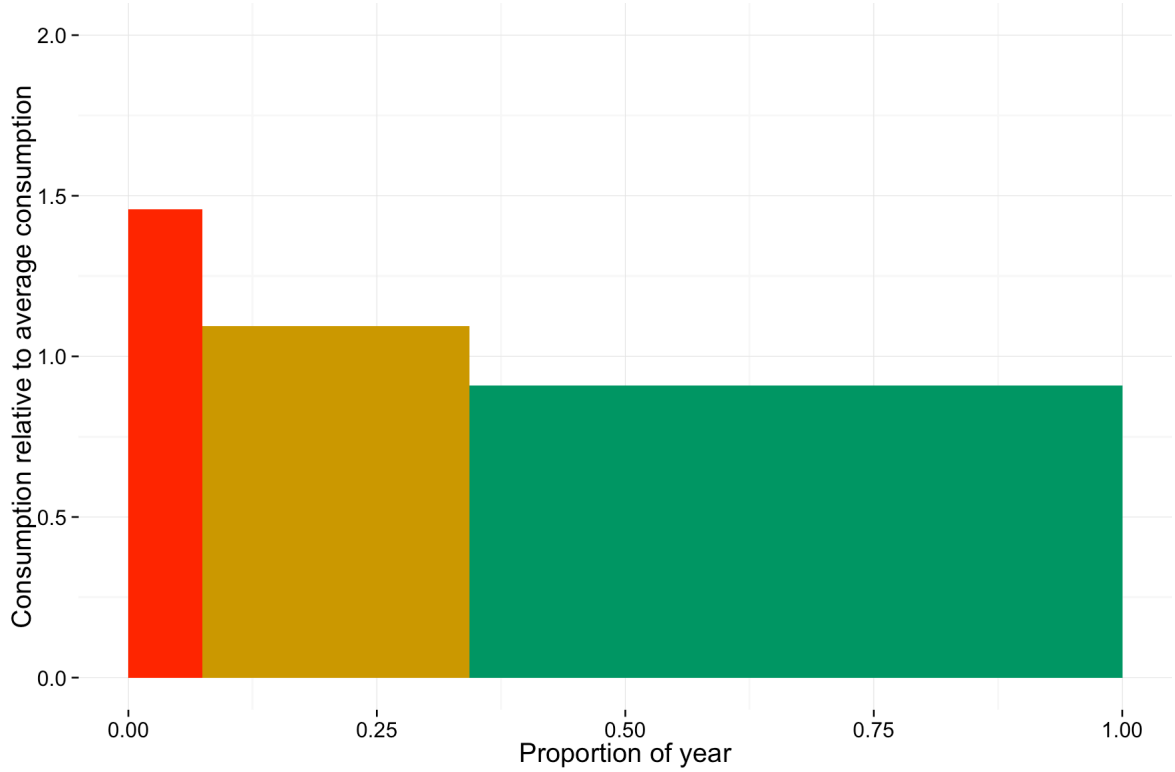
9. The black arrows in figure 1 highlight the change in load coefficient when moving up the network. What figure 1 shows is that, for SEPD and the Domestic Unrestricted tariff, the extent of coincidence of end user consumption to the network peak increases when moving up the network. This results from the combination of two factors:

   (a) The rate of Domestic Unrestricted consumption is highest in the red time band.

   (b) Higher network levels are more likely to peak in the red time band.

10. Figure 2 provides a graphical representation of the first fact, showing consumption in the red, amber and green time bands for the Domestic Unrestricted tariff in SEPD. This chart is based on data from tables 1061 (consumption in each time band) and 1068 (hours in each time band).

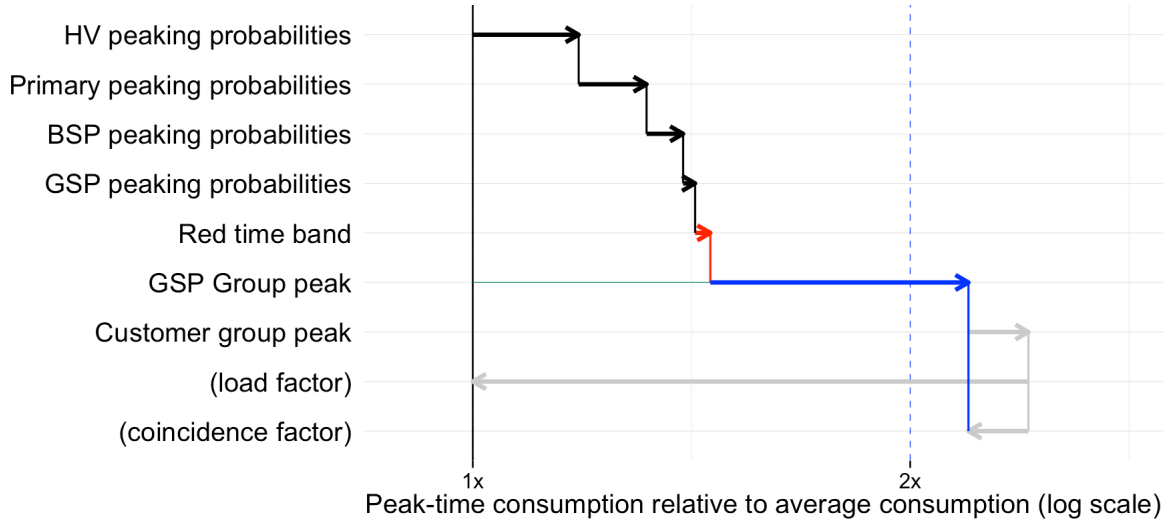
Figure 2 Time band analysis of consumption (SEPD, Domestic Unrestricted)



11. The bottom end of figure 1 also shows the calculation of the coefficient to a hypothetical network level that would peak exclusively in the red time band. The resulting coefficient, 1.457, is the same as the ratio of average consumption in red to average consumption over the year, which is shown as the height of the red bar on figure 2. (As figure 1 is in a logarithmic scale, the tip of the red arrow in figure 1, at a factor of 1.457, is closer to the 2x line than to the 1x line.)

12. The next step in the CDCM calculations is to compare the load coefficient for the hypothetical network level that would peak exclusively in the red time band with the load coefficient to the DNO area system peak implied by the load factor and coincidence factor in table 1041. (All these calculations are on the Multi sheet of the CDCM model, albeit not presented in the same way as in this explanatory document.) Figure 3 extends figure 1 to show these steps for Domestic Unrestricted in SEPD.

Figure 3 Coincidence correction factor calculation (SEPD, Domestic Unrestricted)

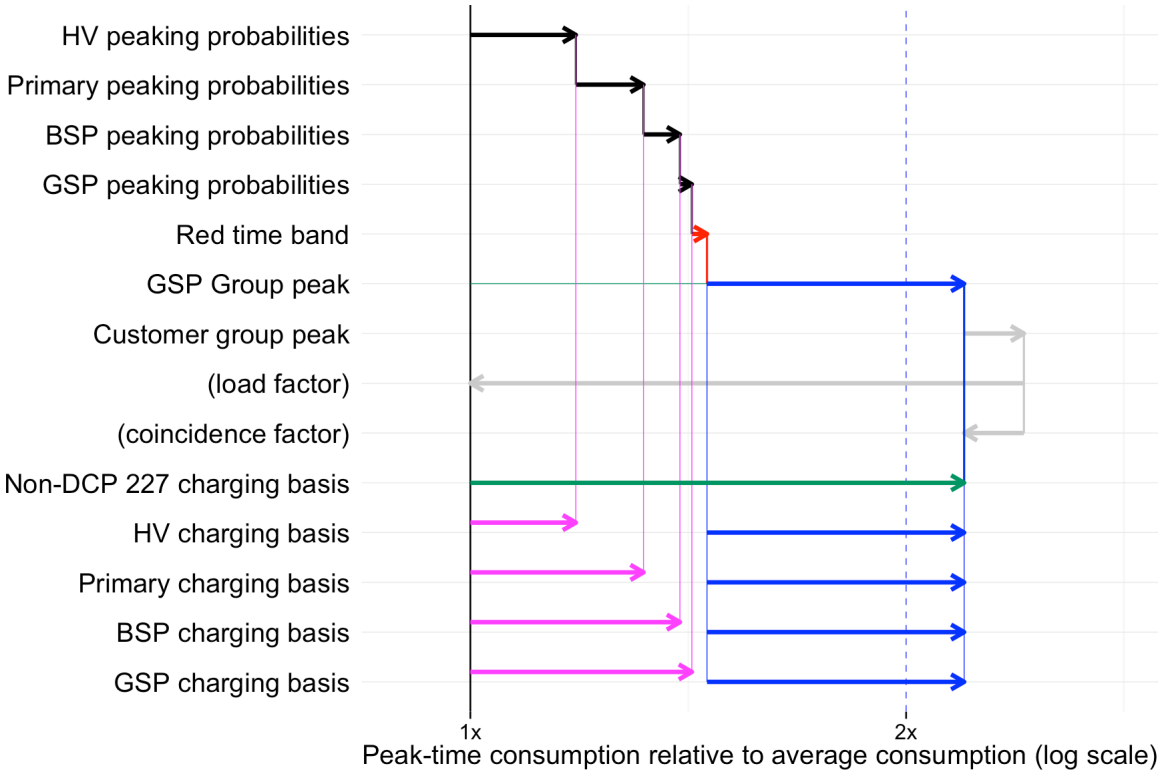


13. The blue arrow in figure 3 represents the coincidence correction factor. In the case of Domestic Unrestricted in SEPD, this factor is large (1.505). This reflects the fact that Domestic Unrestricted consumption at the time of system peak is 50.5 per cent higher than Domestic Unrestricted consumption averaged over the red time band. This difference is explained by the fact that Domestic Unrestricted consumption is seasonal (e.g. because it includes a significant amount of night-only lighting load) whereas the red time band is not.

14. The grey arrows at the bottom of figure 3 show how the load coefficient to the GSP Group peak relates to the load factor and coincidence factors in table 1041. On the logarithmic scale, both the load factor and coincidence factor are shown as leftward arrows. The load factor, 0.415, is a long leftward arrow reflecting the ratio of average consumption to consumption at the time of peak for the Domestic Unrestricted customer group. The coincidence factor, 0.909, is a short leftward arrow reflecting the ratio of consumption at the time of system peak to consumption at the time of peak for the Domestic Unrestricted customer group. Note that the load factor in table 1041 is measured on a diversified basis across all Domestic Unrestricted customers. For each individual domestic customer, both the load and coincidence factor would probably be much less (but their ratio should be similar).

15. Figure 4 extends figure 2 to show the steps in the CDCM model to calculate load coefficients used for charging, before additional adjustments e.g. for loss adjustment factors and DCP 179 equalisation are made (these additional adjustments work in the same way with and without DCP 227).

Figure 4 Load coefficients for CDCM charging (SEPD, Domestic Unrestricted)



16. Under the CDCM without DCP 227, the charge for every network level is based on the green arrow in figure 4, which represents Domestic Unrestricted consumption at the time of system peak relative to Domestic Unrestricted consumption averaged over the year. This assumption effectively implies that every network element peaks at the same time as the aggregate system load.

17. The last four lines in figure 4 represent the underlying charging basis with the DCP 227 solution. For each network level, the charge is in two parts:

    (a) The pink arrow, which differs between network levels, reflects the load coefficient estimated exclusively on the basis of time band loads and peaking probabilities (see figure 1).

    (b) The blue arrow is the coincidence correction factor from figure 3. It captures the fact that there is greater coincidence between network peak and Domestic Unrestricted consumption than what the red time band usage would imply.

18. In the case of Domestic Unrestricted in the SEPD area, the post-DCP 227 charging basis is always less than the pre-DCP 227 charging basis. This is because peaking probabilities indicate that network elements, particularly at the lower network levels, sometimes peak in the amber and green time bands, when Domestic Unrestricted consumption is typically less than in the red time band.

Description of CDCM calculations and DCP 227 impact for a non-domestic tariff

19. Figures 5 and 6 shows the equivalent of figures 2 and 3 for the Small Non Domestic Unrestricted tariff in SEPD.

Figure 5 Time band analysis of consumption (SEPD, Small Non Domestic Unrestricted)

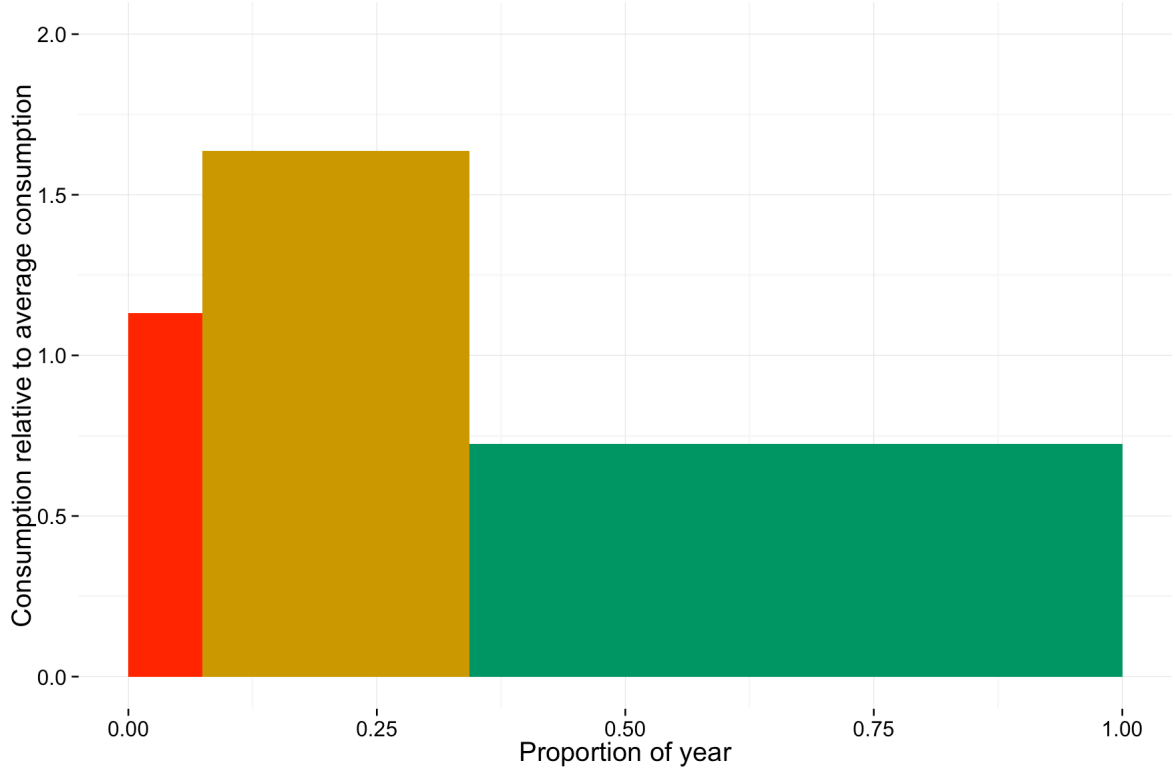
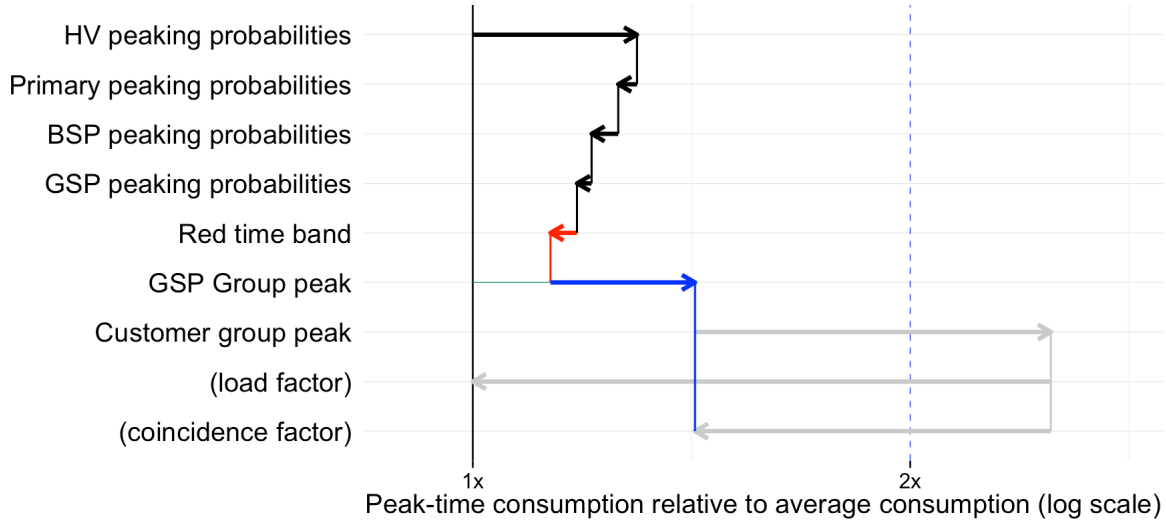


Figure 6 Coincidence correction factor calculation (SEPD, Small Non Domestic Unrestricted)



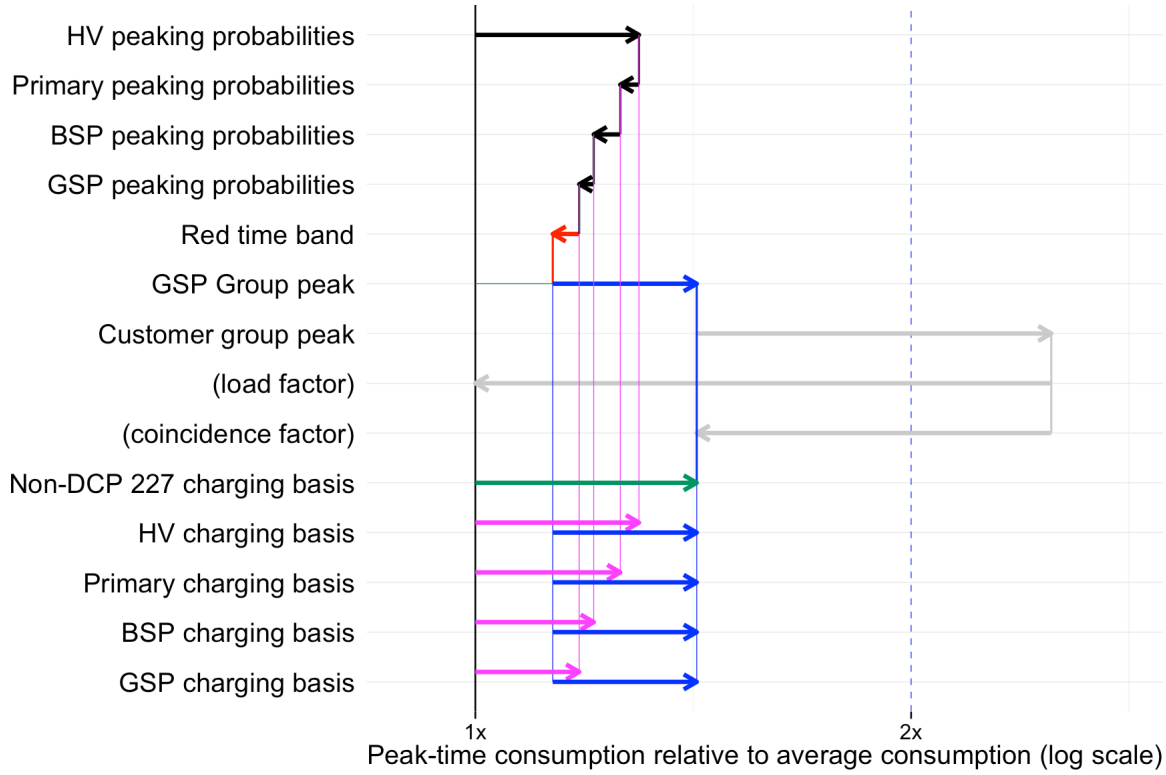
20. As Small Non Domestic consumption is higher in amber than red, and lower network levels have higher amber peaking probabilities than higher ones, the coincidence to network peak now decreases when moving up the network.

21. For the same reason, the coefficient for the hypothetical network level which only peaks in red is lower than the coefficient for actual network levels.

22. The coincidence correction factor (blue arrow in figure 6) is still significant. In this case, it is unlikely to be attributable mainly to seasonal effects. Instead, what probably happens is that the time of system peak tends to occur early within the red time band (which, in SEPD, lasts from 4:30 pm to 7 pm), before business load falls in the evening. Therefore, business consumption at the time of system peak is more than business consumption averaged over the red time band.

23. The CDCM with DCP 227 charges on the basis of a combination of network level load coefficients with the coincidence correction factor. As shown in figure 7, this leads to Small Non Domestic Unrestricted customers being charged for more capacity than in a model without DCP 227, as the pink and blue arrows now overlap (instead of having a gap between them as in figure 4).

Figure 7 Load coefficients for CDCM charging (SEPD, Small Non Domestic Unrestricted)



24. As in the case of Domestic Unrestricted, the model uplifts load coefficients for each network level, by the ratio of customer group load at the time of system peak to customer group load averaged over the red time band as a whole. However, the base

load coefficient that is being uplifted reflects, as well as consumption in red, consumption in the amber band. If consumption in the amber band is higher than consumption in the red band, the rationale for uplifting the coefficients, and therefore implicitly uplifting the amber consumption, by the ratio of load at the time of system peak to load averaged over the red time band, seems weaker than in the case of Domestic Unrestricted. Insofar as there is a non-zero peaking probability in amber, Small Non Domestic Unrestricted customers are being charged *more* in respect of amber consumption because their average red consumption is *lower*.

25. It is arguable that the CDCM methodology outlined above might be overcharging business users in some cases. This would be the result of an interaction between the estimation methodology based on coincidence correction factors and a red time band which includes both the time of system peak (when business load is high) and an hour or two afterwards when network load is still high, but business load is much lower.

26. The following points should be kept in mind in relation to the possible defect outlined above:

    (a) DCP 227 would merely extend to the Small Non Domestic Unrestricted the method used in the CDCM for other business tariffs except Small Non Domestic Off Peak (related MPAN). Insofar as the analysis above reveals a defect, this is a defect in the CDCM's use of coincidence and load factors, not a defect specific to DCP 227.

    (b) There might be other defects, unrelated to DCP 227, in the CDCM's use of coincidence and load factors for business tariffs, for example the undue discrimination between LV and LV Sub tariffs which can arise if the mix of customers in these two tariffs leads to materially different coincidence correction factors.

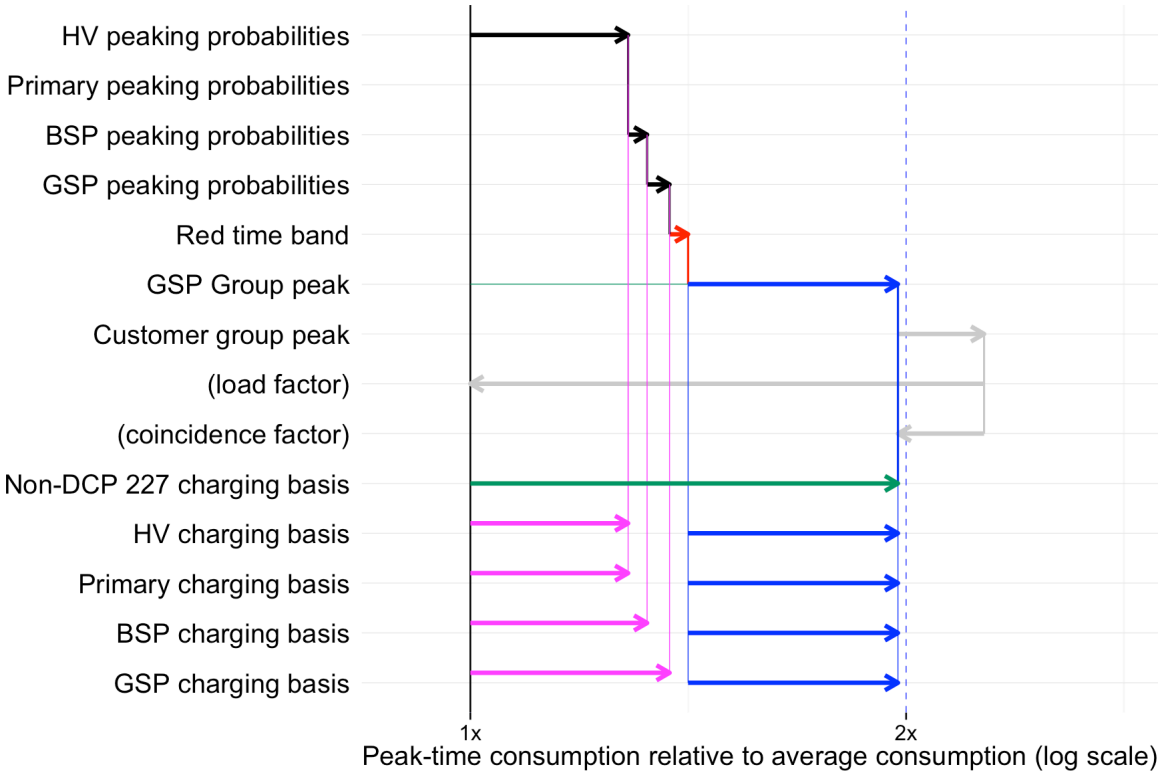
    (c) The potential issue identified above would probably not be alleviated by a move to seasonal time bands. The issue, if there is one, is a lack of time focus of the red time band on the peak in each day, not a lack of seasonal focus.

Impact of DCP 227 for each DNO area and each unrestricted tariff

27. The following pages show figures similar to figure 7 for each DNO area and unrestricted tariff, with a short commentary on DNO-specific features.

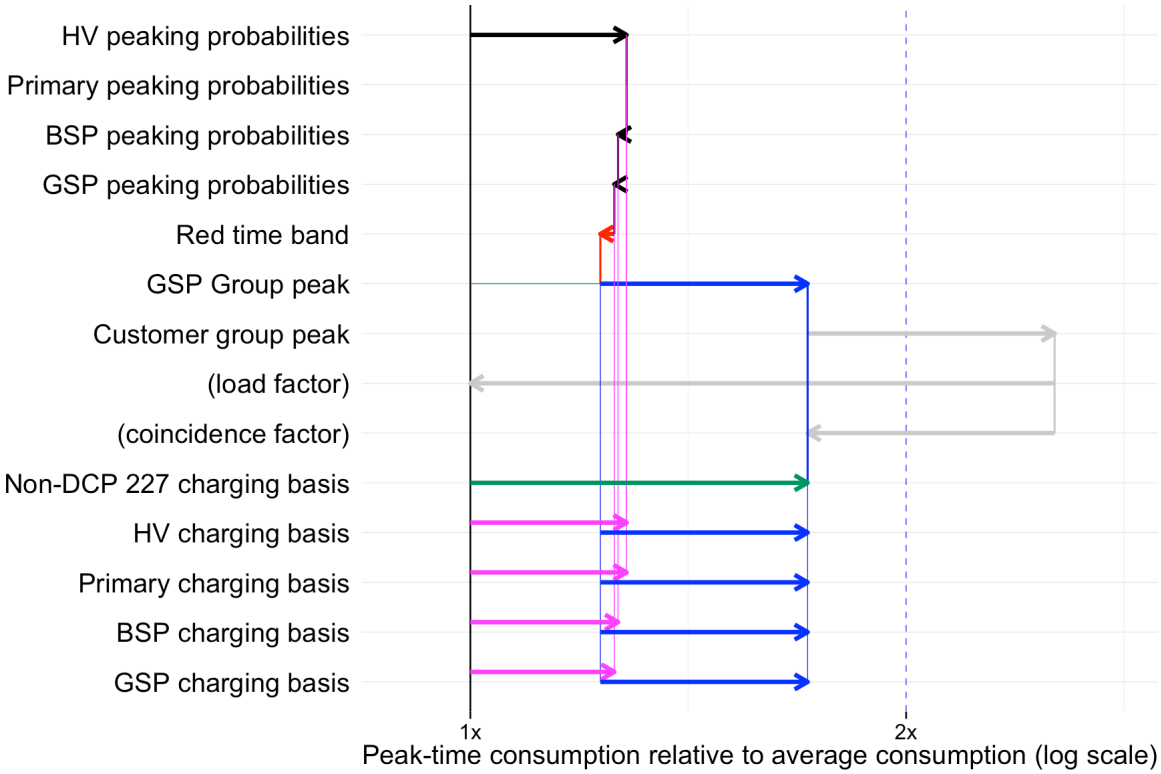
Electricity North West

Figure 8 Load coefficients for CDCM charging (Electricity North West, Domestic Unrestricted)



28. This is similar to the situation described in detail for SEPD Domestic Unrestricted.

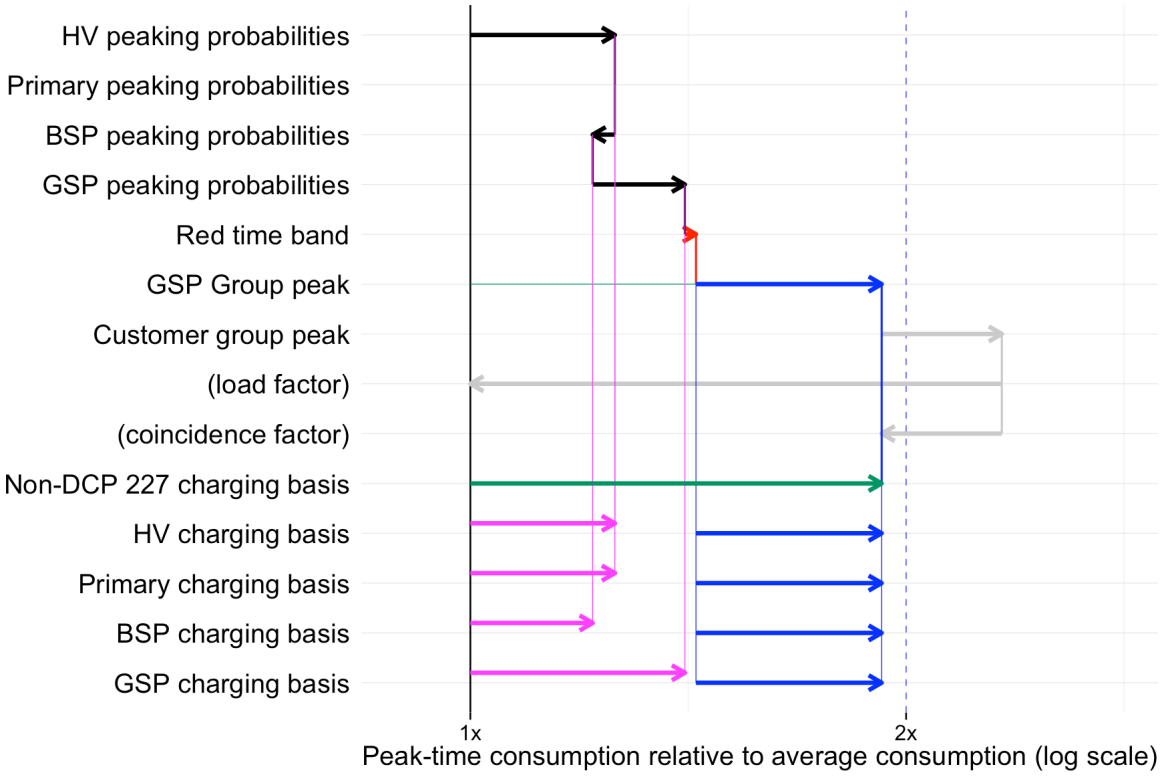
Figure 9 Load coefficients for CDCM charging (Electricity North West, Small Non Domestic Unrestricted)



29. This is similar to the situation described in detail for SEPD Small Non Domestic Unrestricted.

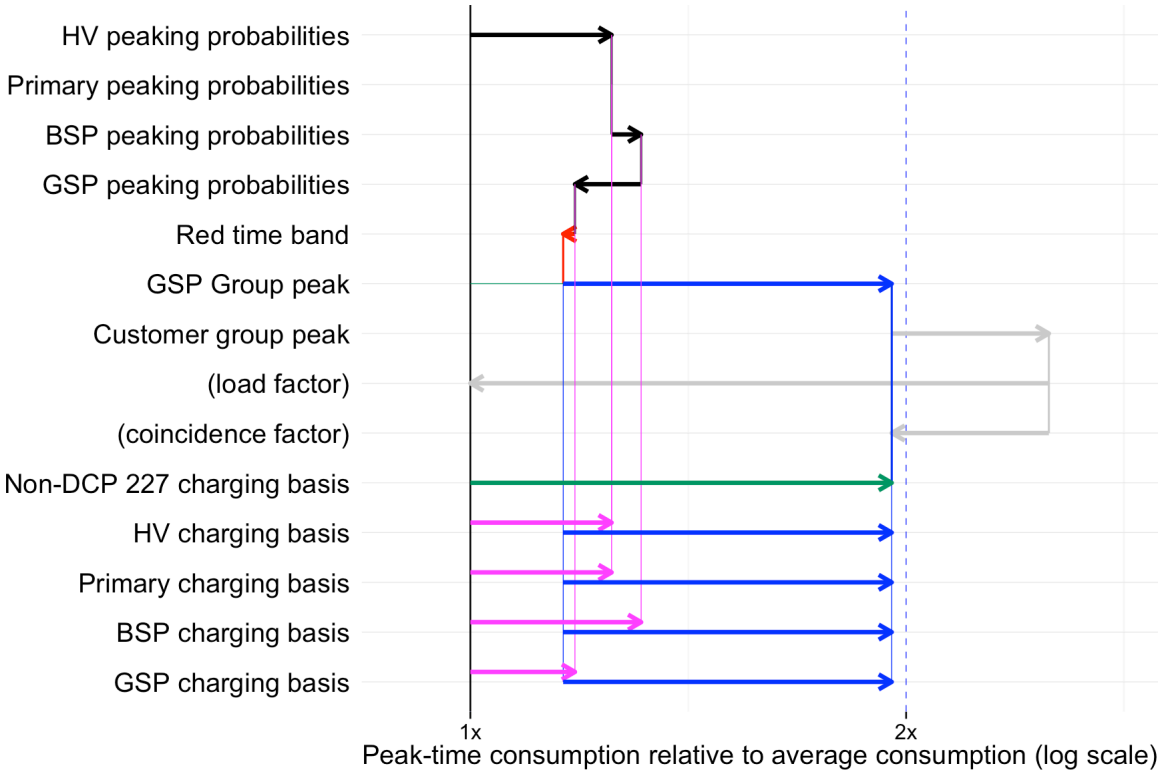
Northern Powergrid

Figure 10 Load coefficients for CDCM charging (Northern Powergrid Northeast, Domestic Unrestricted)



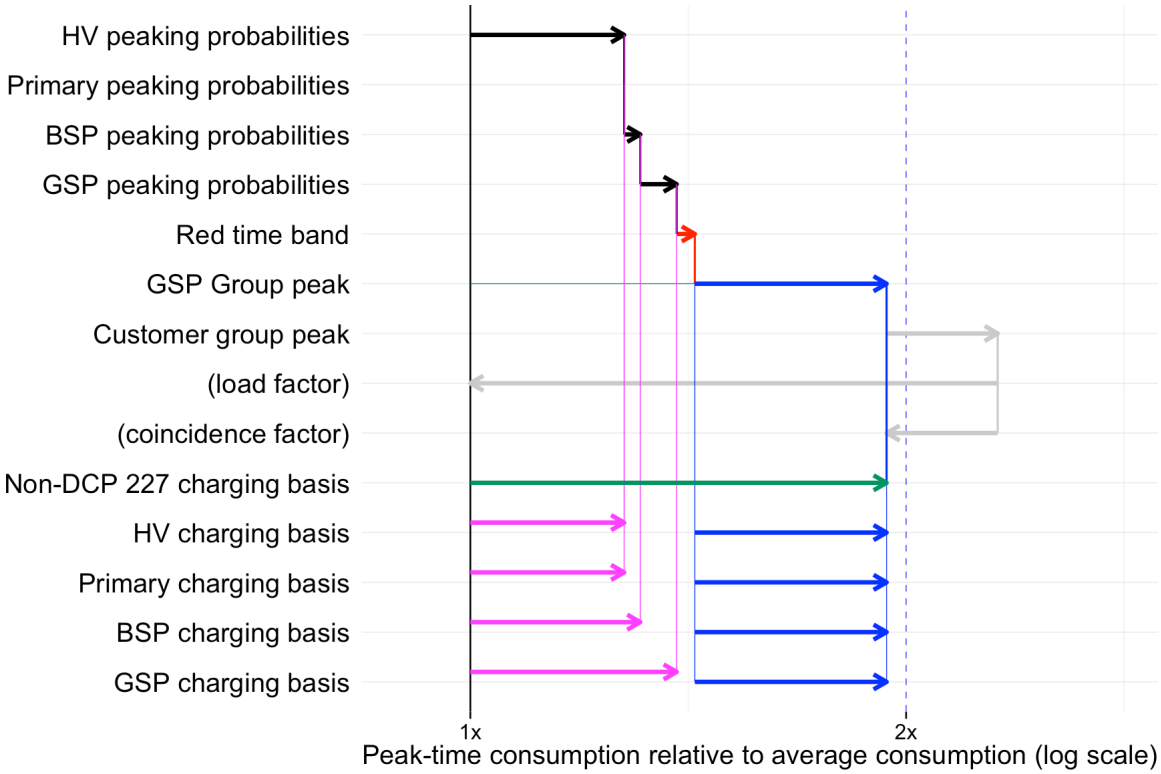
30. This is essentially similar to the situation described in detail for SEPD Domestic Unrestricted, although a low proportion of BSPs is assumed to peak in the red time band (39 per cent, compared to 93 per cent of GSPs and 54 per cent of primaries).

Figure 11 Load coefficients for CDCM charging (Northern Powergrid Northeast, Small Non Domestic Unrestricted)



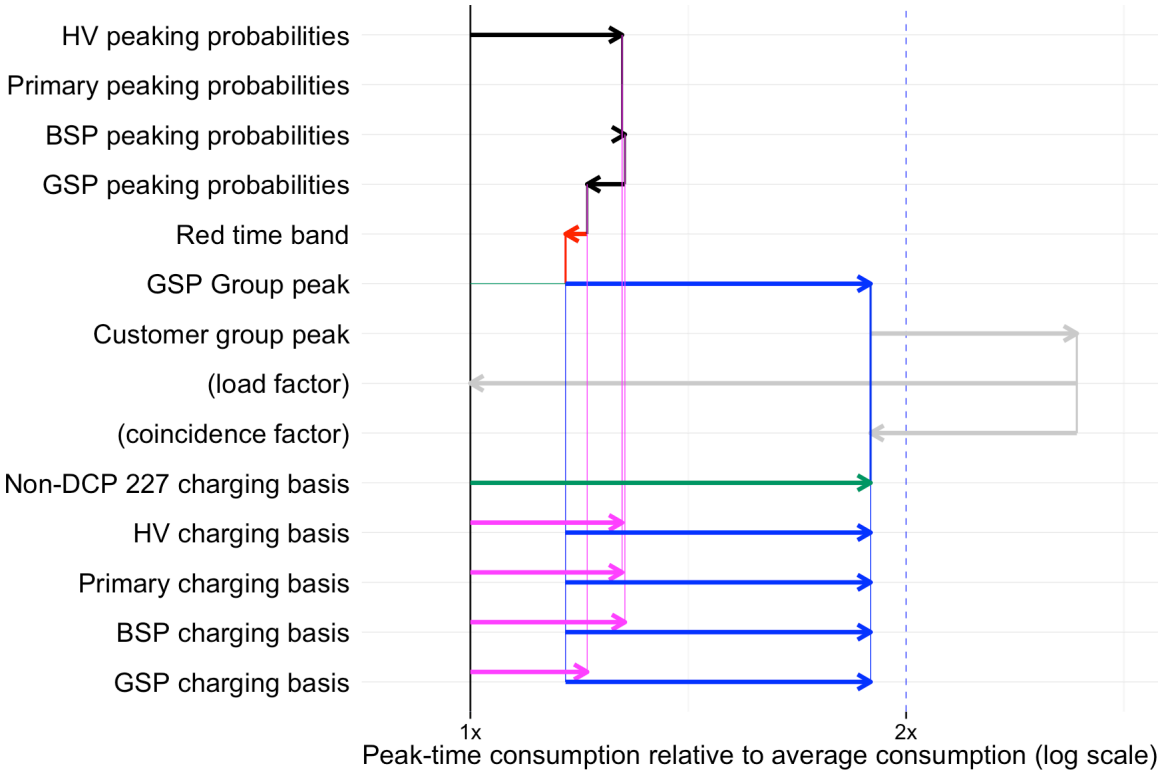
31. This is essentially similar to the situation described in detail for SEPD Small Non Domestic Unrestricted, although a low proportion of BSPs is assumed to peak in the red time band (39 per cent, compared to 93 per cent of GSPs and 54 per cent of primaries).

Figure 12 Load coefficients for CDCM charging (Northern Powergrid Yorkshire, Domestic Unrestricted)



32. This is similar to the situation described in detail for SEPD Domestic Unrestricted.

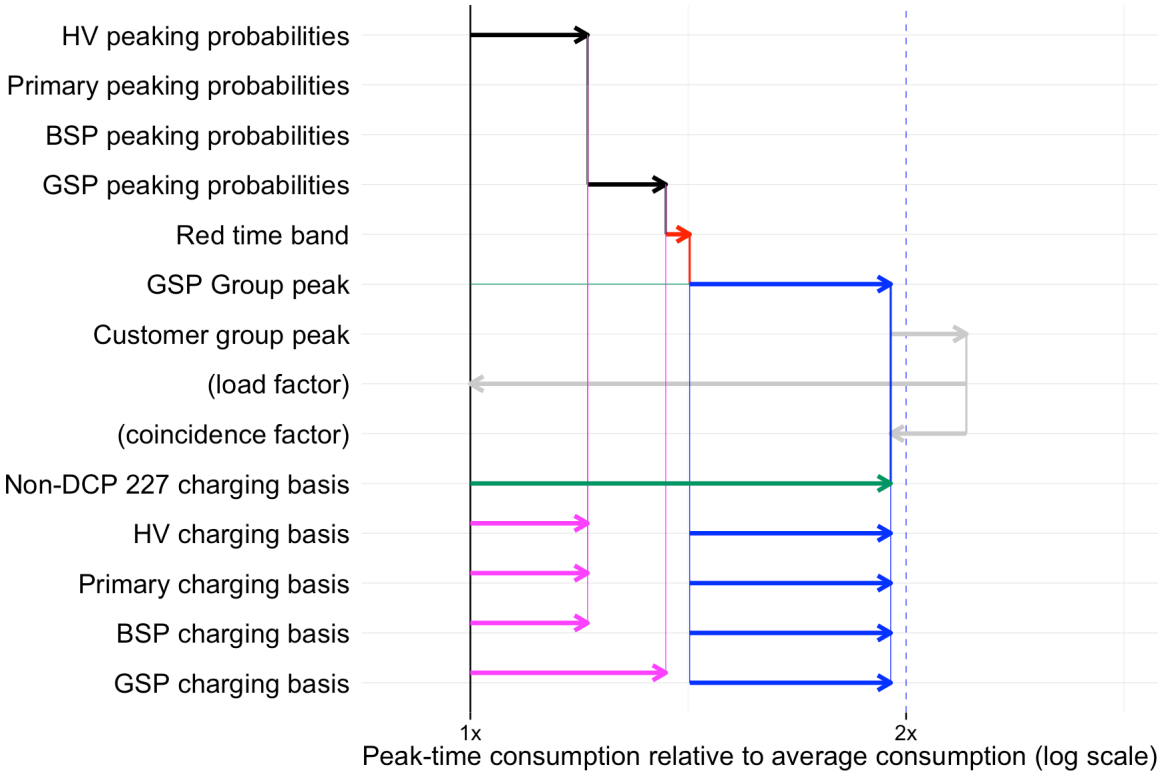
Figure 13 Load coefficients for CDCM charging (Northern Powergrid Yorkshire, Small Non Domestic Unrestricted)



33. This is similar to the situation described in detail for SEPD Small Non Domestic Unrestricted.

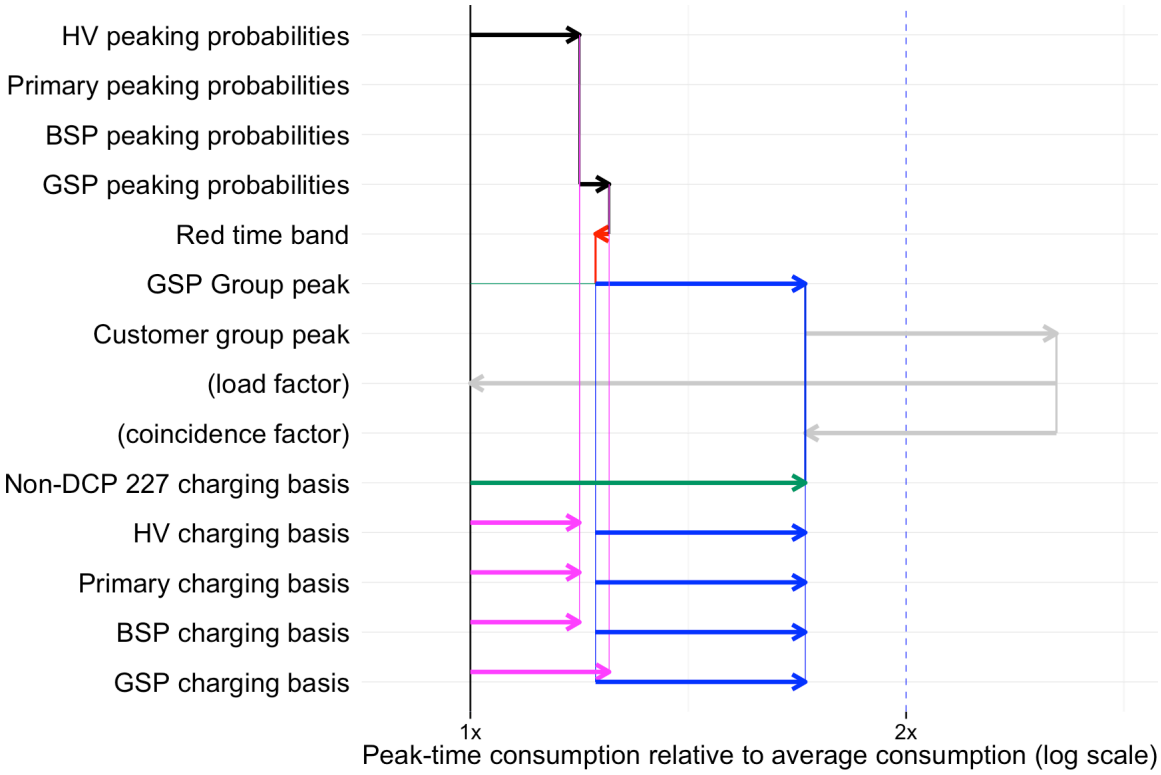
SP Energy Networks

Figure 14 Load coefficients for CDCM charging (SP Distribution, Domestic Unrestricted)



34. This is similar to the situation described in detail for SEPD Domestic Unrestricted. The BSP network level is not relevant in Scotland.

Figure 15 Load coefficients for CDCM charging (SP Distribution, Small Non Domestic Unrestricted)

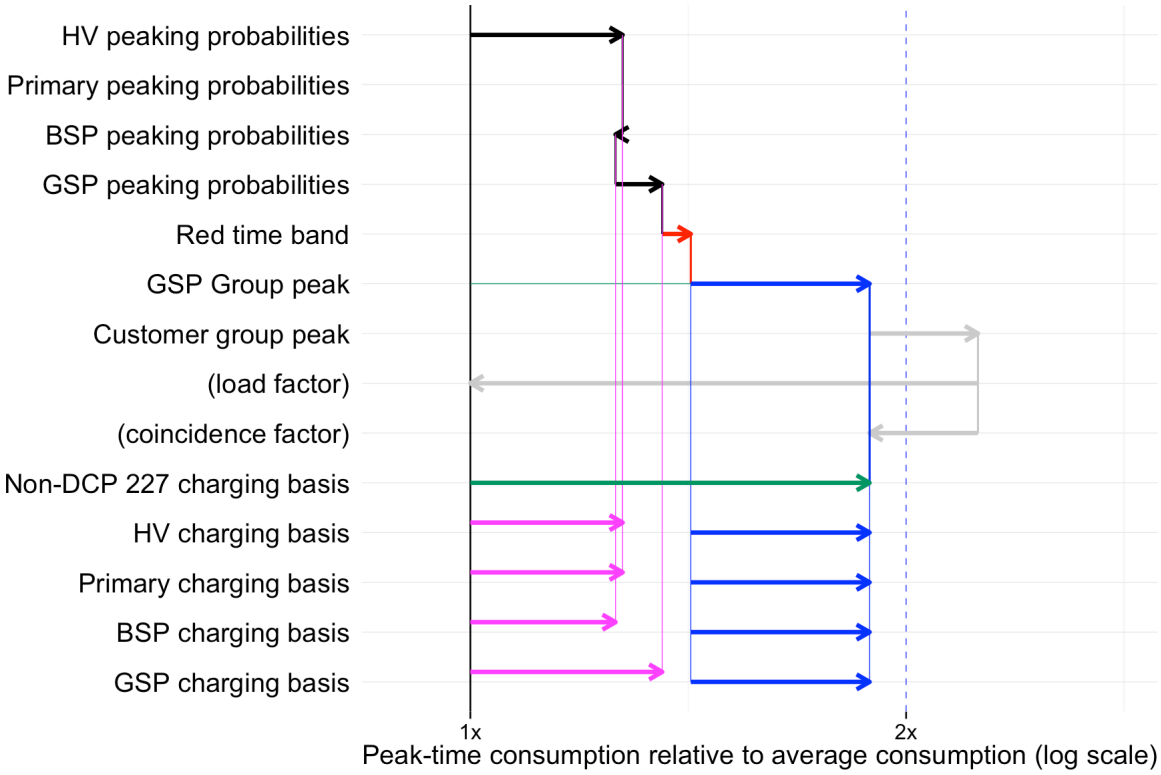


35. The BSP network level is not relevant in Scotland. Unusually for a business tariff, the load coefficient based on peaking probabilities is higher at the GSP and pure-red-time-band levels than at the primary substation level. This is because a fairly high proportions of primary substations are assumed to peak in the green time band (18 per cent, compared to 1 per cent of GSPs), and business load is low in the green time band. This might reflect the prevalence of night-time electric heating in parts in the network.

36. As a result, DCP 227 would reduce the network assets and costs attributed to Small Non Domestic Unrestricted consumption, effectively recognising that some of these assets are sized to serve night-time load and therefore should not be charged to consumption during business hours.

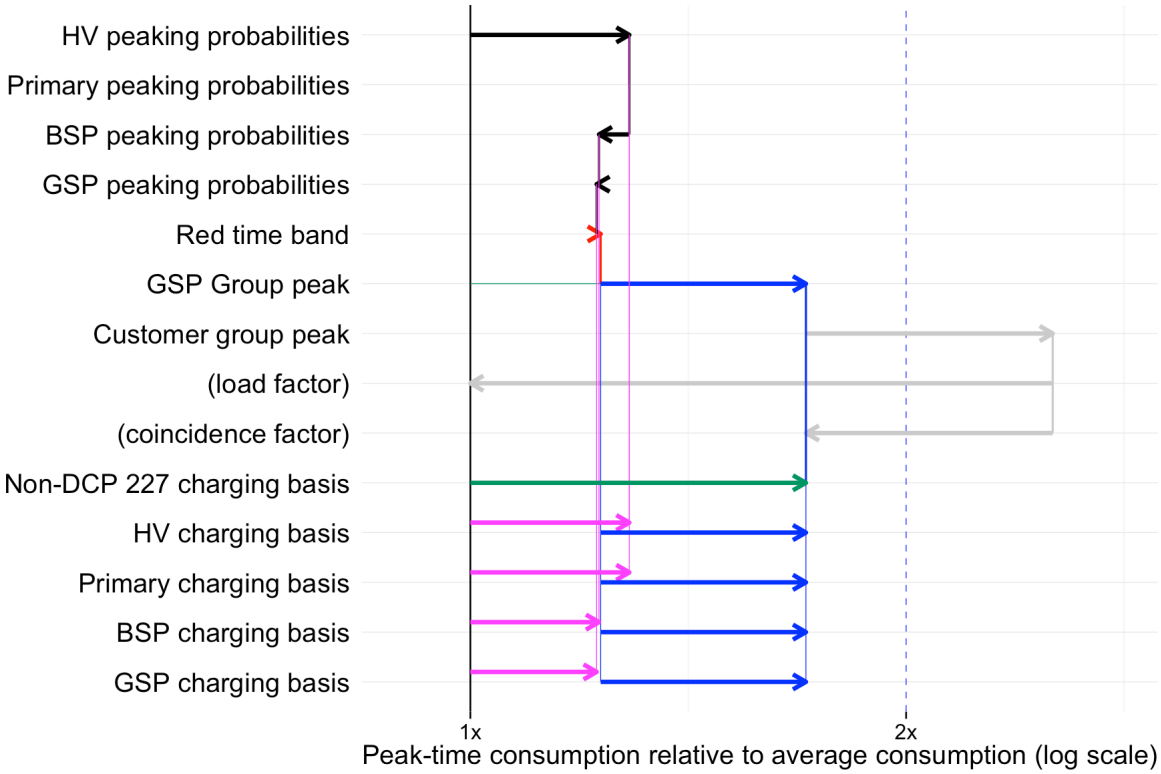
37. However, DCP 227 would still lead to an increase in charges at the GSP level. Furthermore, charges are pushed up by the increase in revenue matching charges resulting from the changes to Domestic Unrestricted load coefficients.

Figure 16 Load coefficients for CDCM charging (SP Manweb, Domestic Unrestricted)



38. This is essentially similar to the situation described in detail for SEPD Domestic Unrestricted, although a relatively high proportion of BSPs is assumed to peak in the green time band (11 per cent, compared to 5 per cent of GSPs and 4 per cent of primaries).

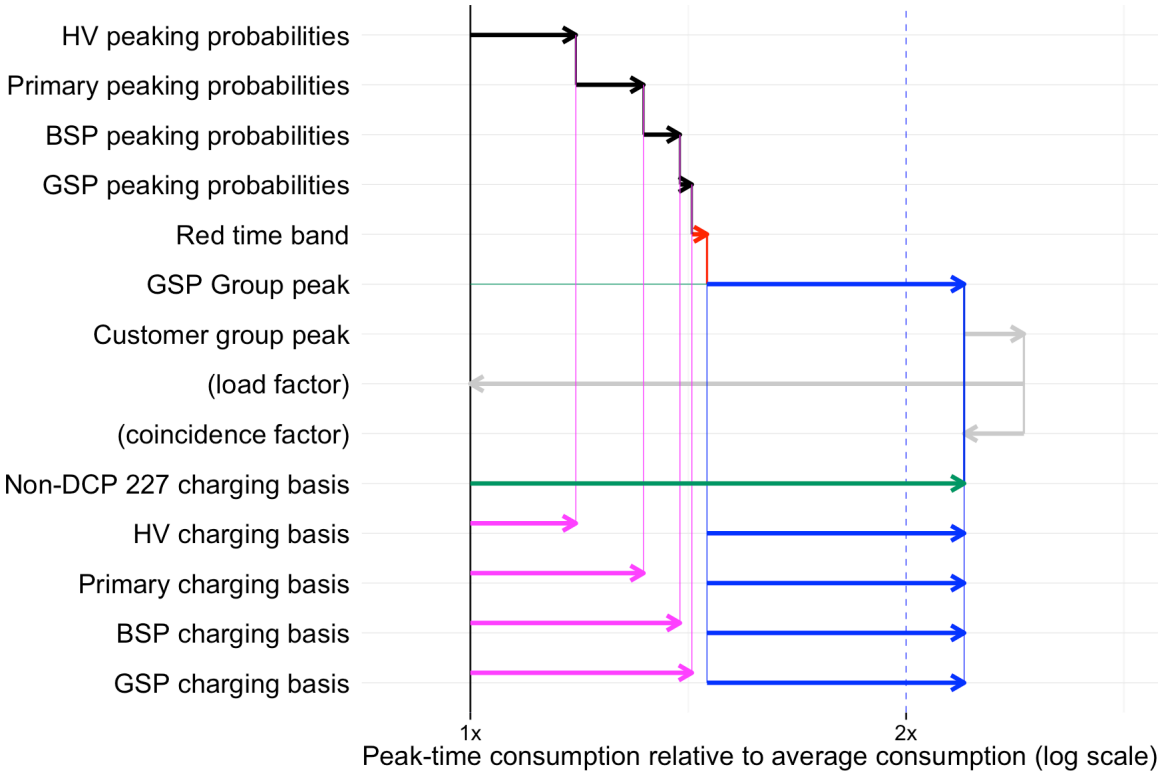
Figure 17 Load coefficients for CDCM charging (SP Manweb, Small Non Domestic Unrestricted)



39. This is essentially similar to the situation described in detail for SEPD Small Non Domestic Unrestricted.

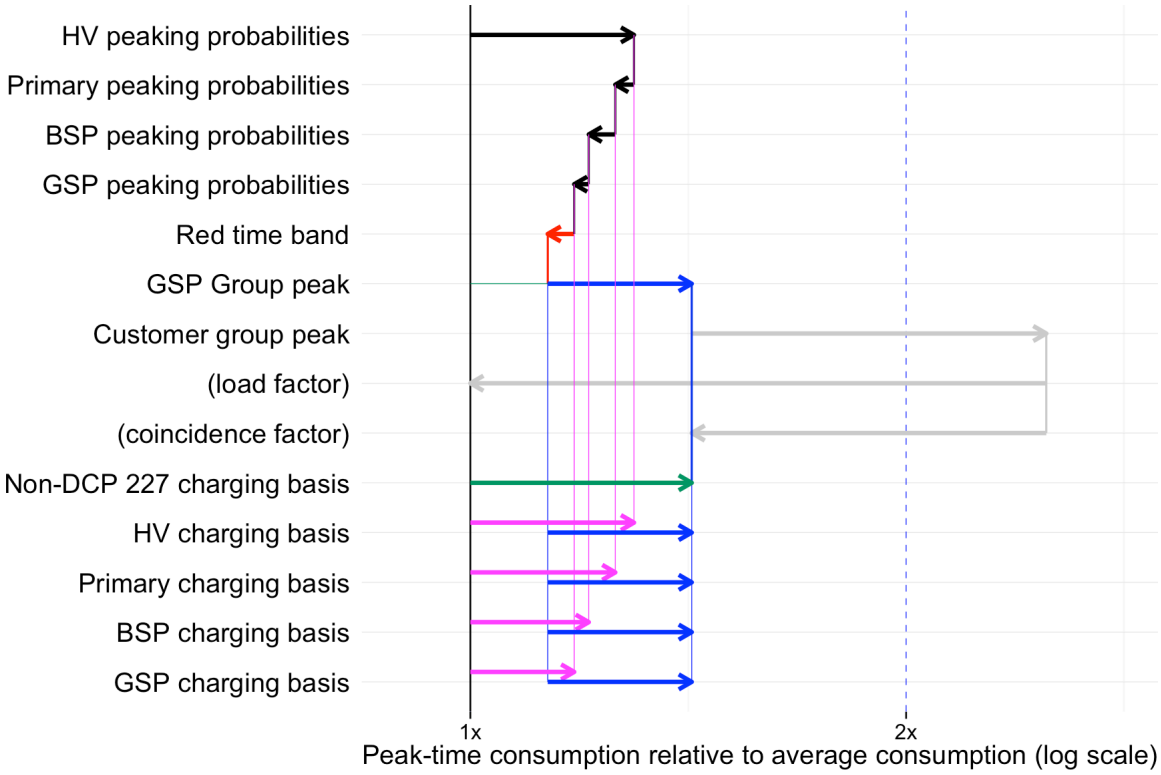
Scottish and Southern Energy Power Distribution

Figure 18 Load coefficients for CDCM charging (SEPD, Domestic Unrestricted)



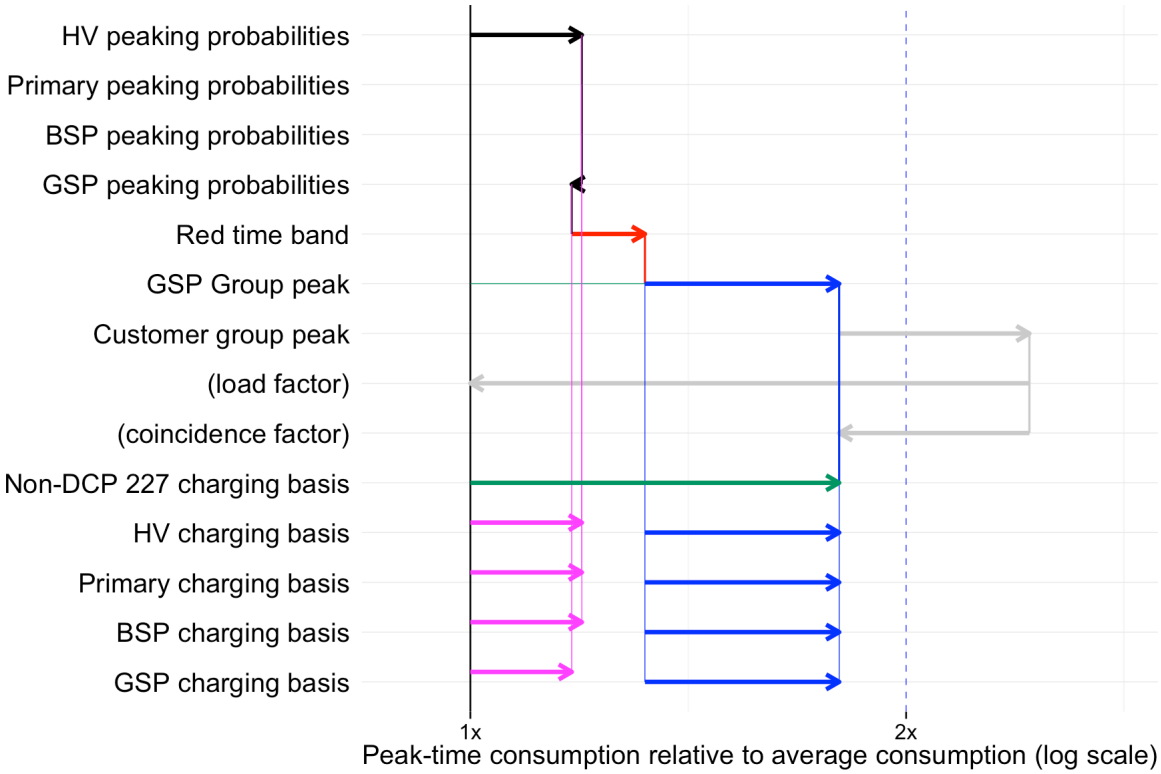
40. This is the situation described in detail above.

Figure 19 Load coefficients for CDCM charging (SEPD, Small Non Domestic Unrestricted)



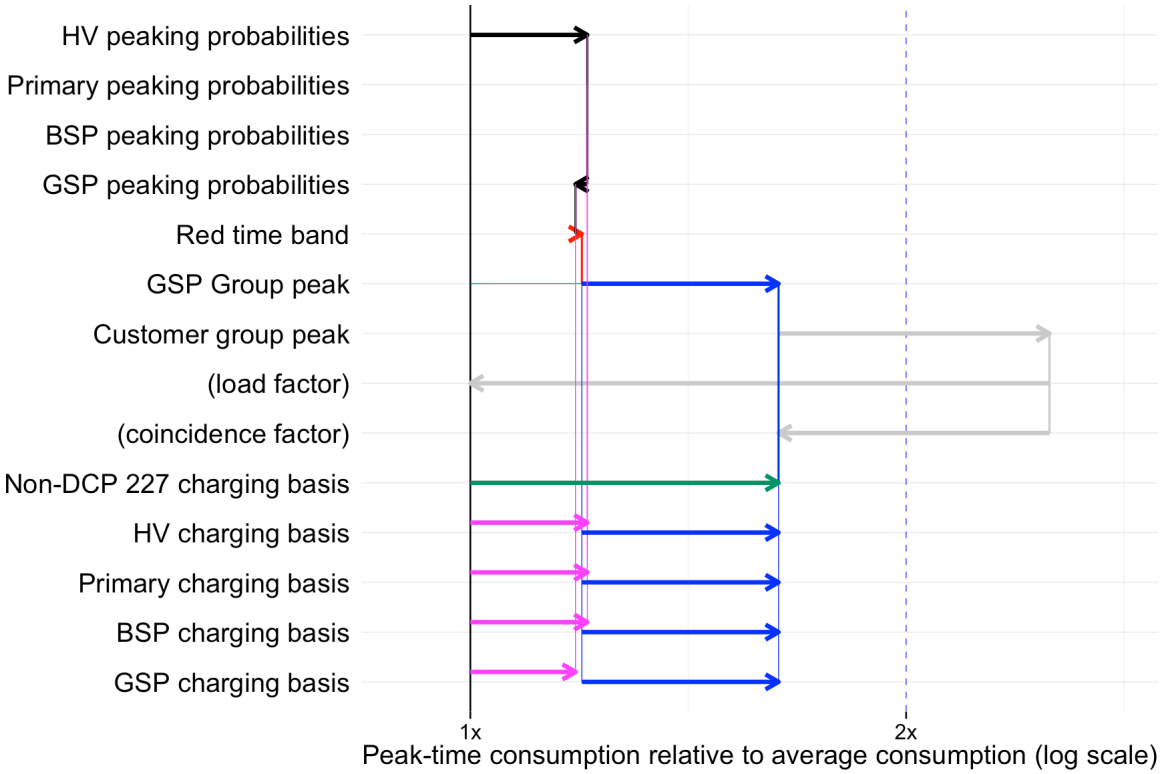
41. This is the situation described in detail above.

Figure 20 Load coefficients for CDCM charging (SHEPD, Domestic Unrestricted)



42. This is essentially similar to the situation described in detail for SEPD Domestic Unrestricted. The BSP network level is not relevant in Scotland. The GSP level load coefficient is slightly lower than the primary level load coefficient because a high proportion of GSPs is deemed to peak in green (17 per cent) than primaries (13 per cent). These relatively high green peaking probabilities might reflect the prevalence of night-time electric heating in parts in the network. Load patterns, particularly at the GSP level, might also be affected by the prevalence of embedded generation.

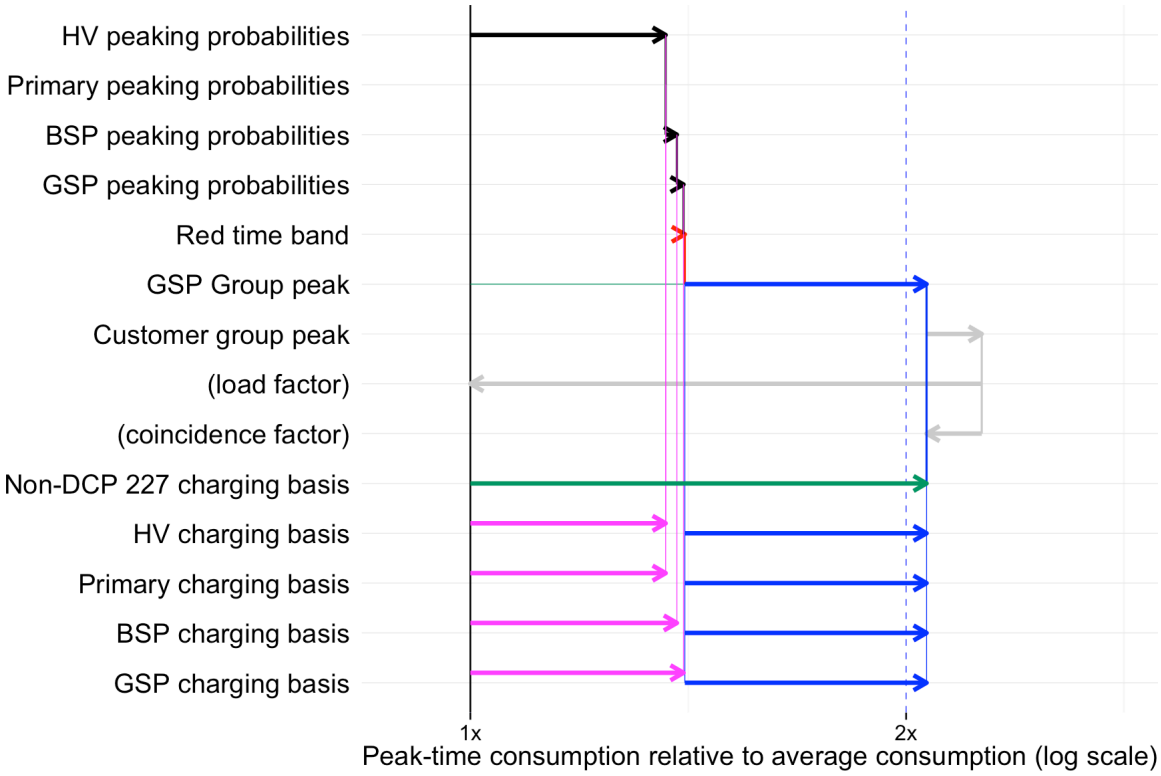
Figure 21 Load coefficients for CDCM charging (SHEPD, Small Non Domestic Unrestricted)



43. This is essentially similar to the situation described in detail for SEPD Small Non Domestic Unrestricted. The BSP network level is not relevant in Scotland.

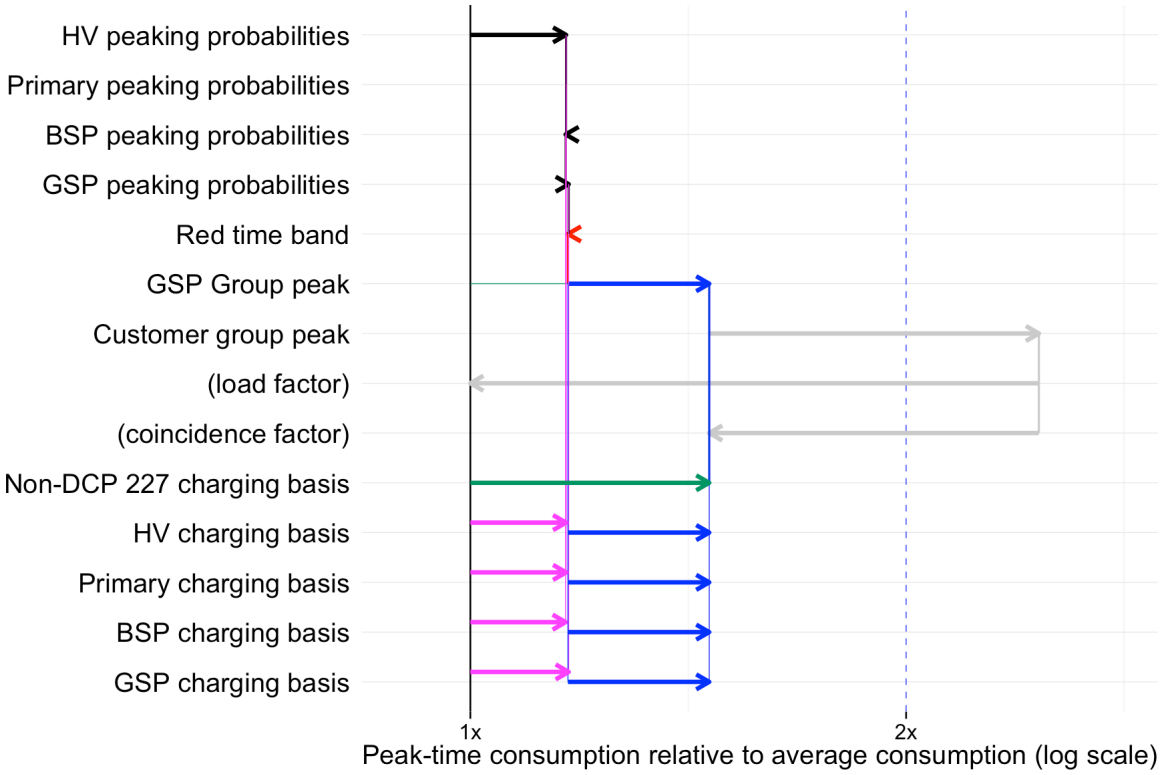
UK Power Networks

Figure 22 Load coefficients for CDCM charging (Eastern Power Networks, Domestic Unrestricted)



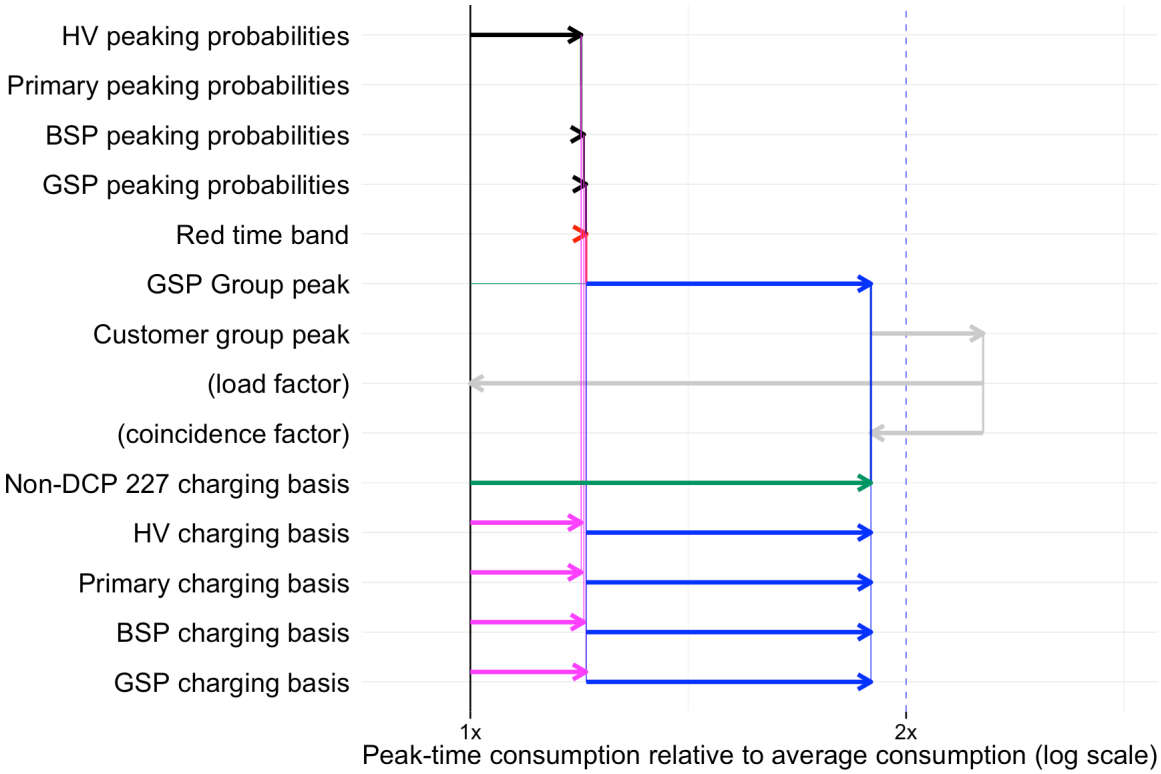
44. This is similar to the situation described in detail for SEPD Domestic Unrestricted. The effects are smaller because peaking probabilities at all network levels are at least 89 per cent in red.

Figure 23 Load coefficients for CDCM charging (Eastern Power Networks, Small Non Domestic Unrestricted)



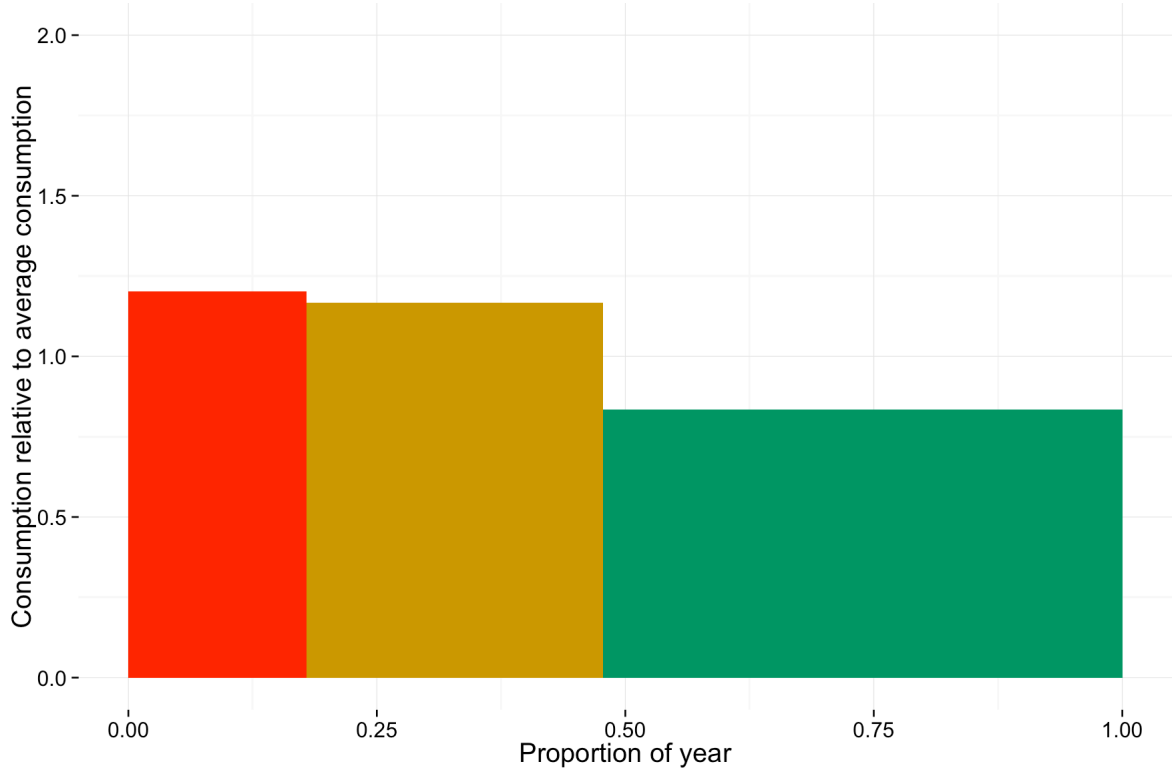
45. The effects are small because peaking probabilities at all network levels are at least 89 per cent in red, with the balance split between amber and green which have countervailing effects in the case of a Small Non Domestic Unrestricted load.

Figure 24 Load coefficients for CDCM charging (London Power Networks, Domestic Unrestricted)



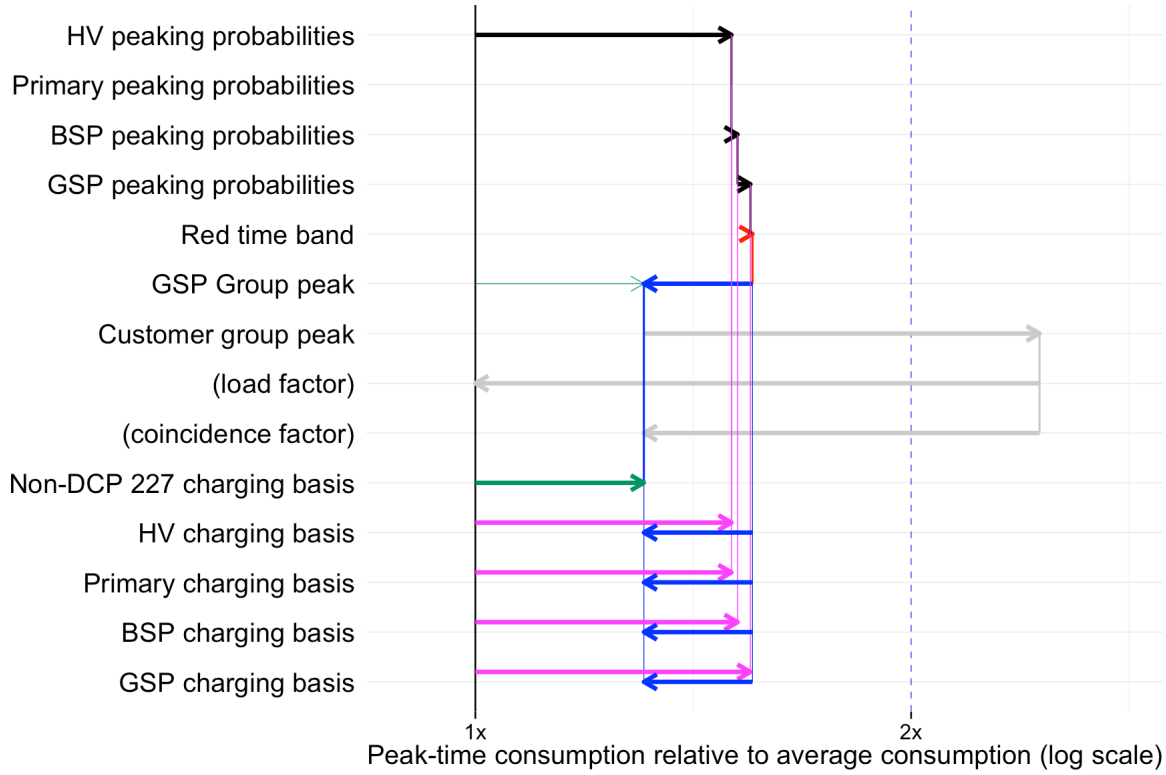
46. The effects are small, primarily because the domestic load is not much higher in red than amber, as shown in figure 25 below.

Figure 25 Time band analysis of consumption (London Power Networks, Domestic Unrestricted)



47. The pattern in figure 25 probably reflects that fact that a significant part of the red time in London is at lunchtime, when domestic load is lower.

Figure 26 Load coefficients for CDCM charging (London Power Networks, Small Non Domestic Unrestricted)

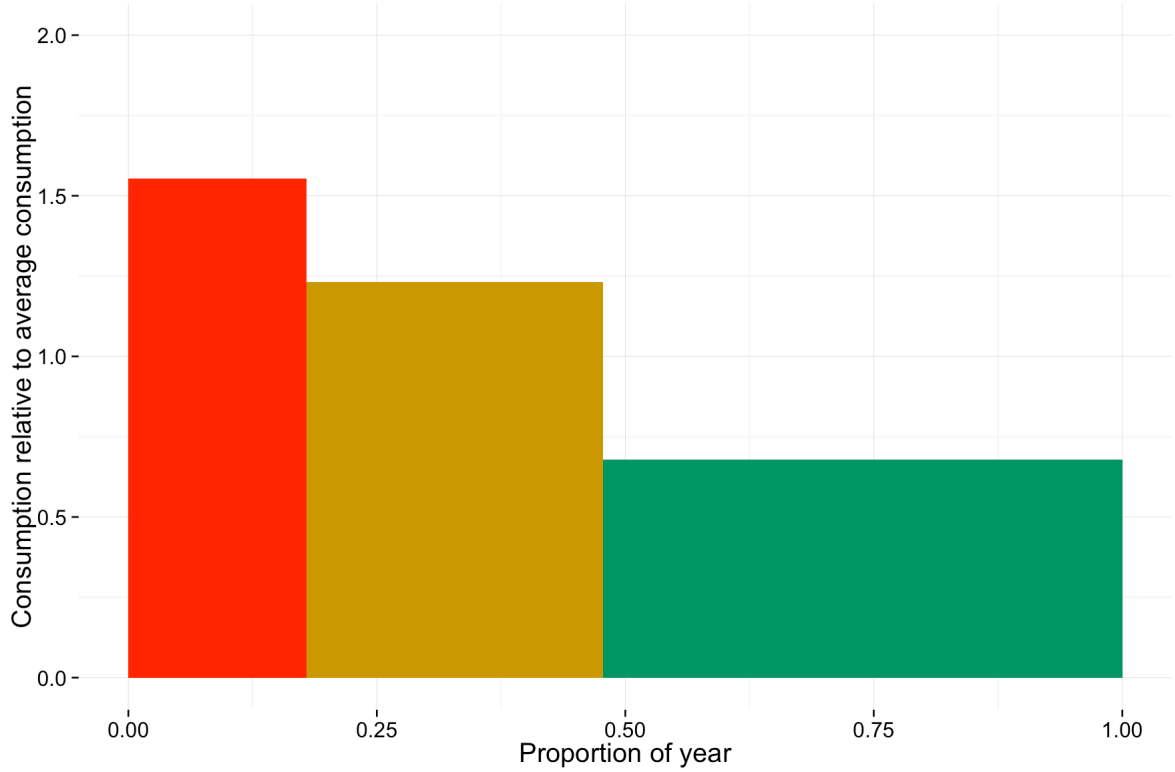


48. Most of the effects are reversed compared with the situation described in detail for SEPD Domestic Unrestricted.

49. The fact that load coefficient increases when moving higher into the network is because the non-domestic load is, unusually, higher in red than in amber, as shown in figure 27 below. This means that DCP 227 tends to reduce the amount of network capacity charged to Small Non Domestic Unrestricted consumption. These effects are small because peaking probabilities at all network levels are at least 86 per cent in red.

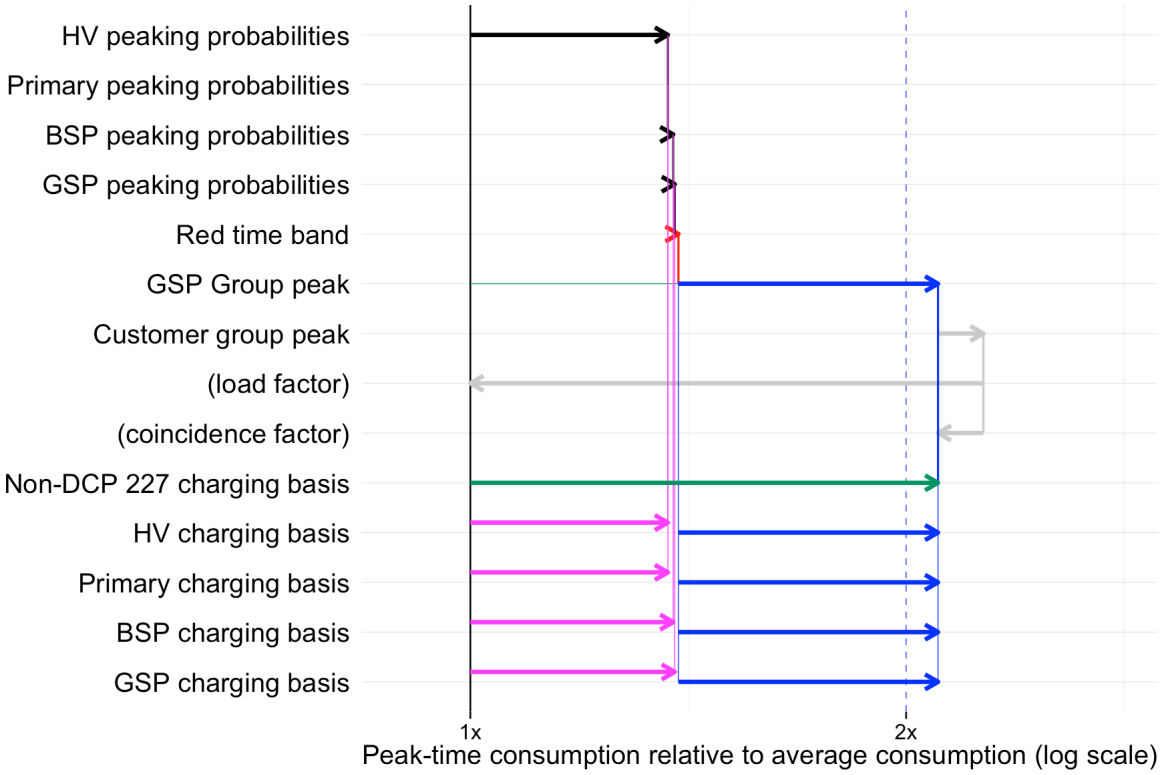
50. Additionally, the coincidence correction factor (the blue arrows in figure 26) is unusually reversed: Small Non Domestic Unrestricted consumption at the time of system peak is less than Small Non Domestic Unrestricted consumption averaged over the red time band. This probably reflects the fact that the red time band Small Non Domestic Unrestricted consumption is pushed up by the lunchtime element of the red time band, whereas Small Non Domestic Unrestricted consumption at the time of system peak is relatively low — presumably because the time of system peak is relatively late, as system load is dominated by domestic and street-lighting loads. This feature has the same effect on the models with and without DCP 227.

Figure 27 Time band analysis of consumption (London Power Networks, Small Non Domestic Unrestricted)



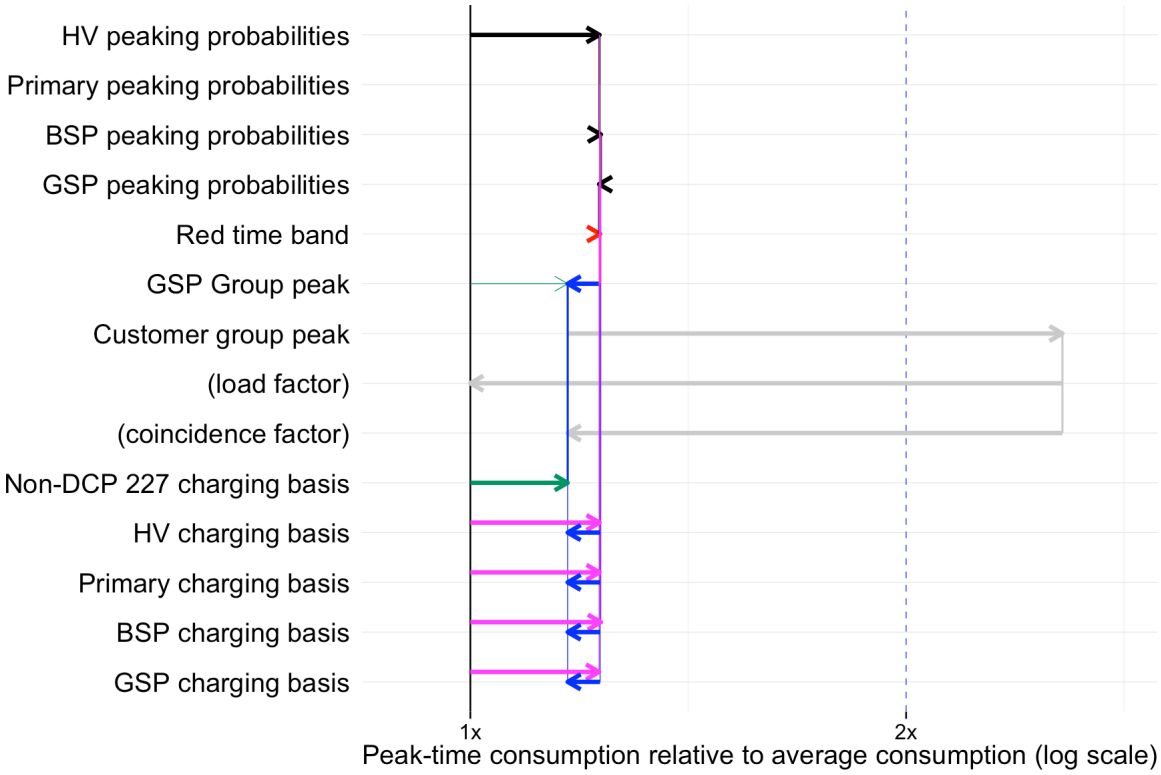
51. The pattern in figure 27 probably reflects that fact that a significant part of the red time in London is at lunchtime, when business load is higher.

Figure 28 Load coefficients for CDCM charging (South Eastern Power Networks, Domestic Unrestricted)



52. This is similar to the situation described in detail for SEPD Domestic Unrestricted. The effects are smaller because peaking probabilities at all network levels are at least 93 per cent in red.

Figure 29 Load coefficients for CDCM charging (South Eastern Power Networks, Small Non Domestic Unrestricted)

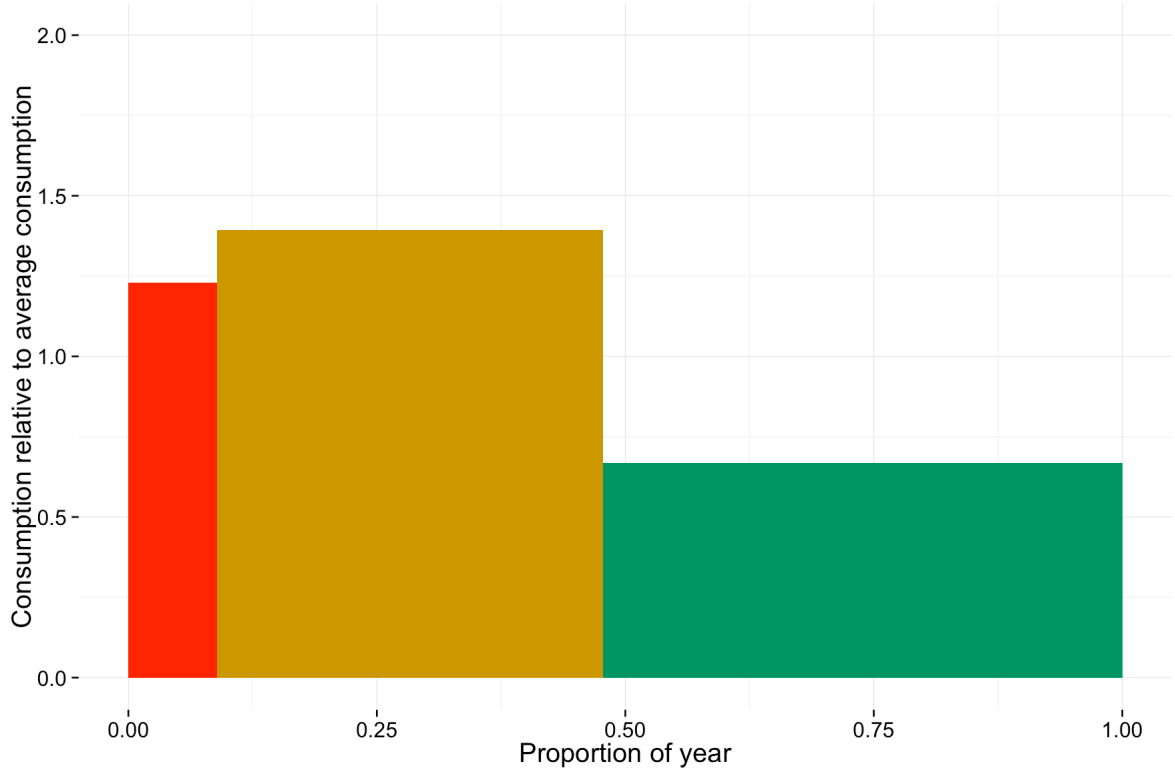


53. The effect of DCP 227 is small because peaking probabilities at all network levels are at least 93 per cent in red.

54. The coincidence correction factor is reversed, as for Small Non Domestic Unrestricted in London. But the reasons are not the same, since there is no lunchtime element in the red time band in South Eastern Power Networks.

55. Figure 30 below shows the red/amber/green pattern of consumption.

Figure 30 Time band analysis of consumption (South Eastern Power Networks, Small Non Domestic Unrestricted)



56. Whilst this is qualitatively similar to the usual situation, the difference between average red consumption and average amber consumption is smaller than usual. The coincidence factor to load factor ratio is particularly low (1.167, compared to figures ranging from 1.307to 1.955 for Small Non Domestic Unrestricted in other DNO areas). These two features combine to reverse the coincidence correction factor. This has the same effect on the models with and without DCP 227.

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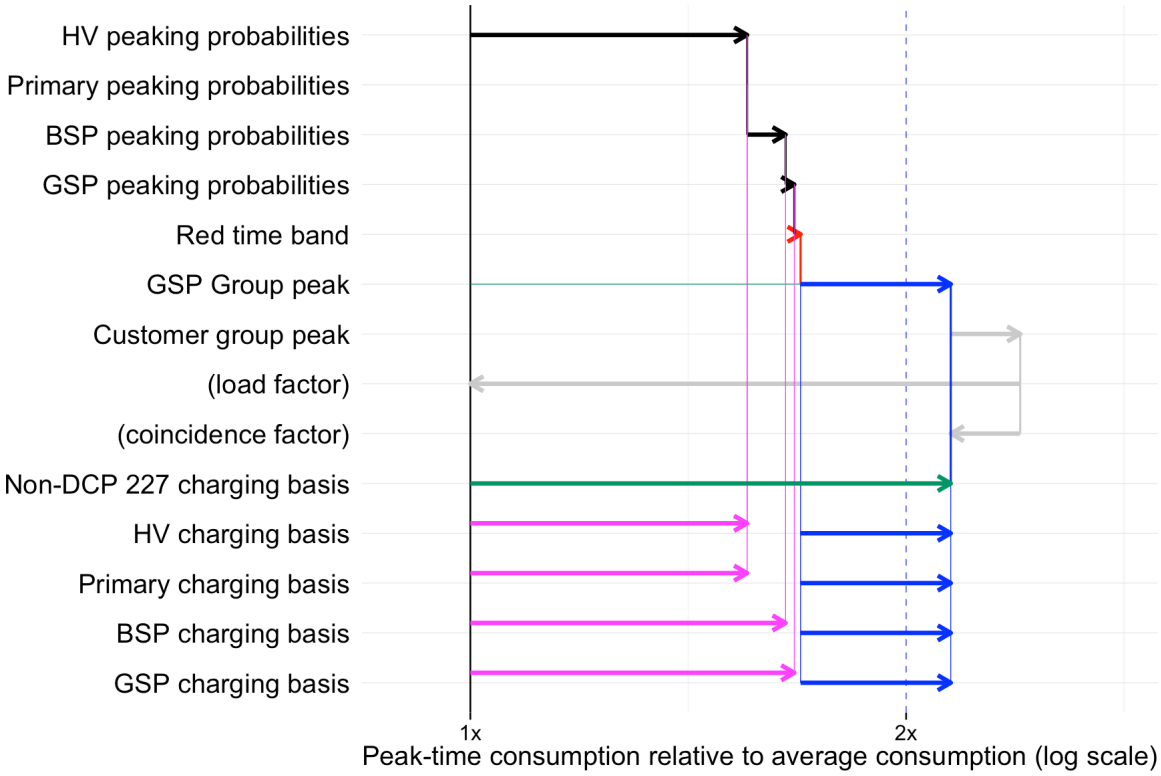
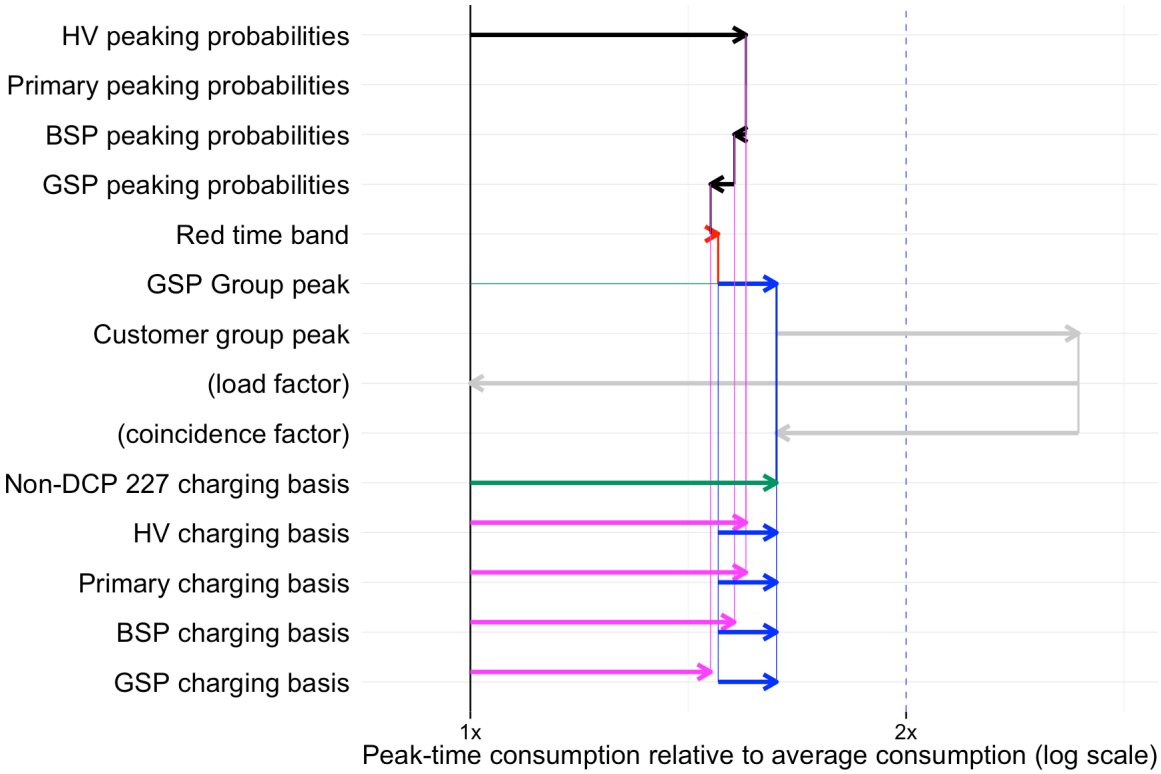
Figure 31 Load coefficients for CDCM charging (WPD East Midlands, Domestic Unrestricted)



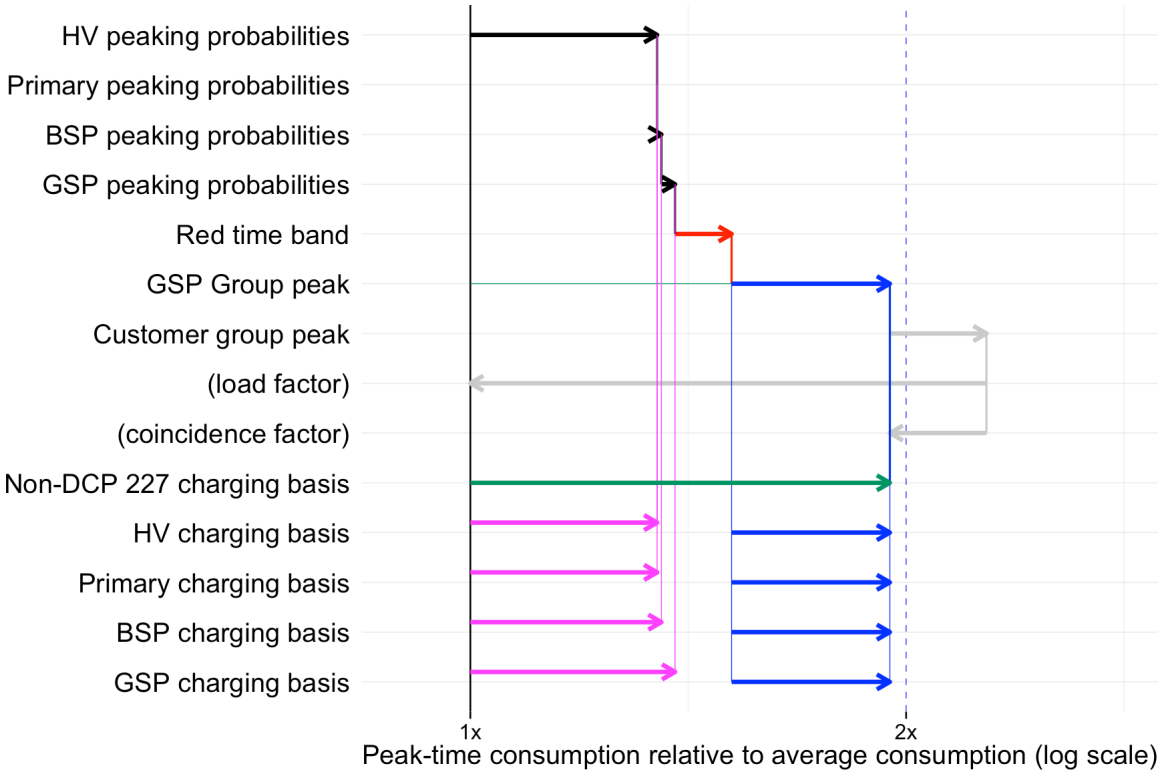
57. This is similar to the situation described in detail for SEPD Domestic Unrestricted.

Figure 32 Load coefficients for CDCM charging (WPD East Midlands, Small Non Domestic Unrestricted)



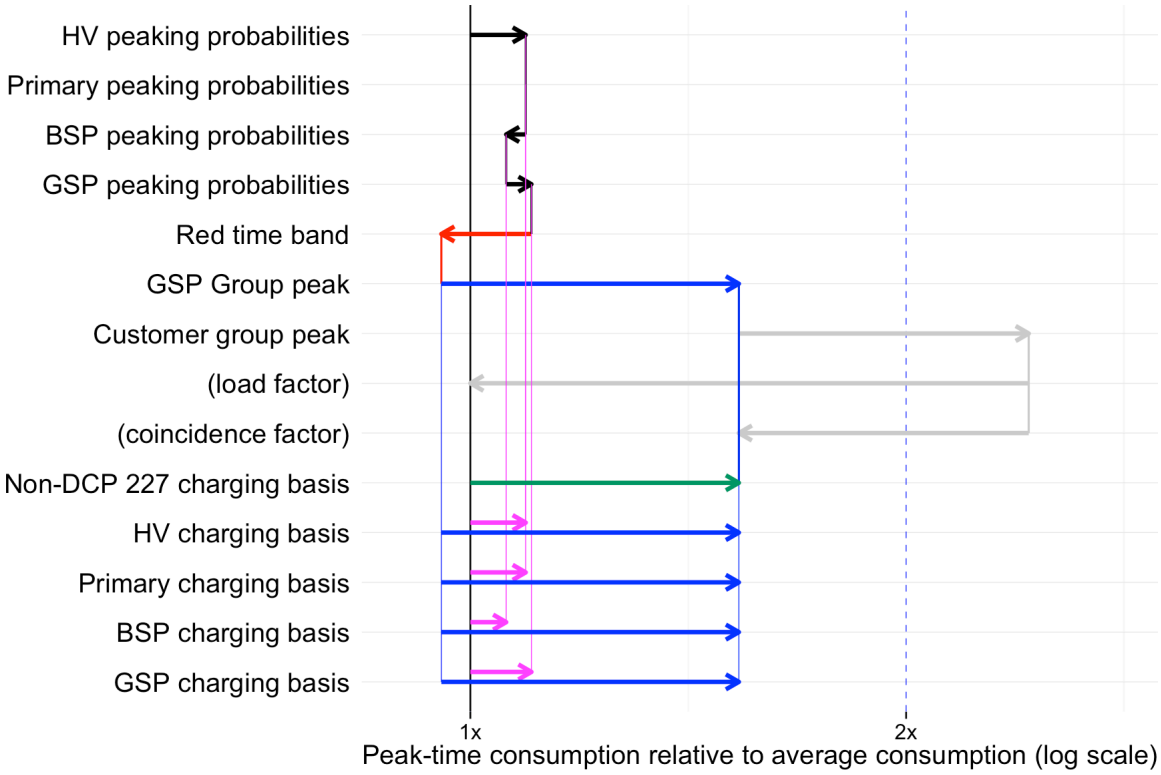
58. This is essentially similar to the situation described in detail for SEPD Small Non Domestic Unrestricted.

Figure 33 Load coefficients for CDCM charging (WPD South Wales, Domestic Unrestricted)



59. This is similar to the situation described in detail for SEPD Domestic Unrestricted.

Figure 34 Load coefficients for CDCM charging (WPD South Wales, Small Non Domestic Unrestricted)



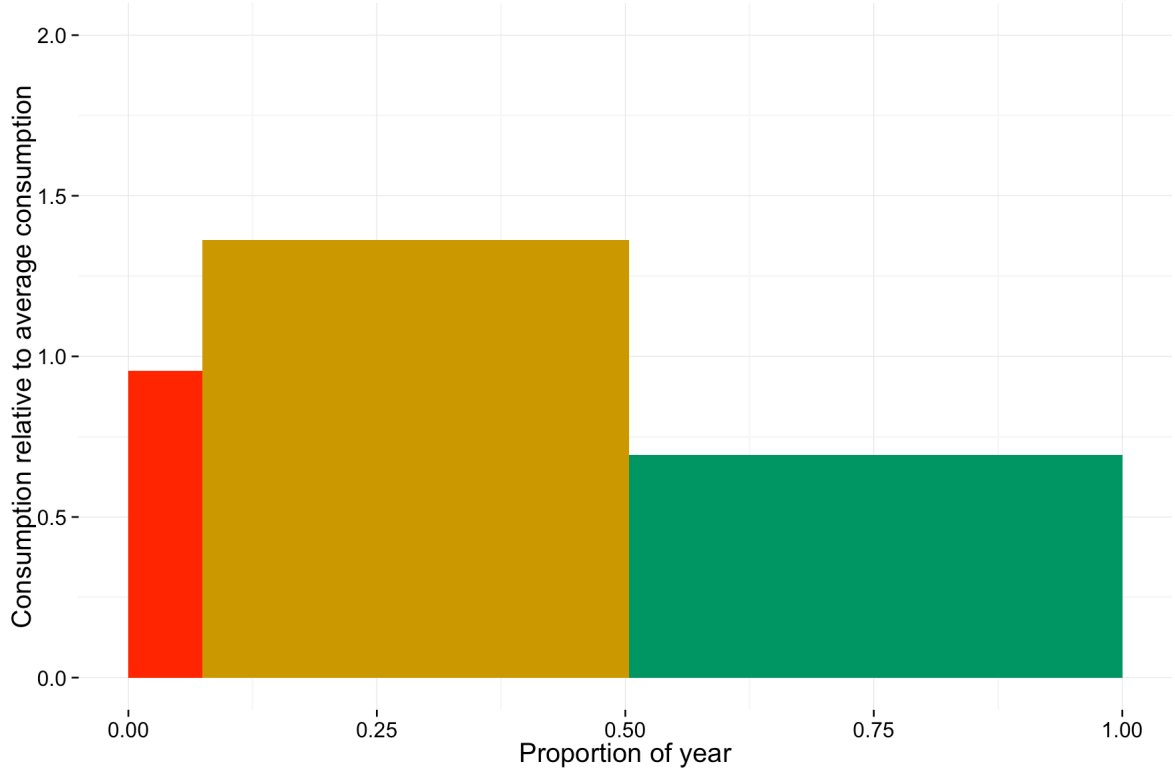
60. As far as the effect of DCP 227 is concerned, this is essentially similar to the situation described in detail for SEPD Small Non Domestic Unrestricted.

61. The following features are unusual in figure 34:

(a) The load coefficient at the BSP level is lower than both the load coefficients at the GSP and primary levels. This is because of peaking probabilities: BSPs are less likely to peak in amber (30 per cent) than either GSPs (36 per cent) or primaries (37 per cent).

(b) Average Small Non Domestic Unrestricted consumption in the red time band is less than average Small Non Domestic Unrestricted consumption across the year. This is because of the allocation of Small Non Domestic Unrestricted consumption between time bands (see figure 35).

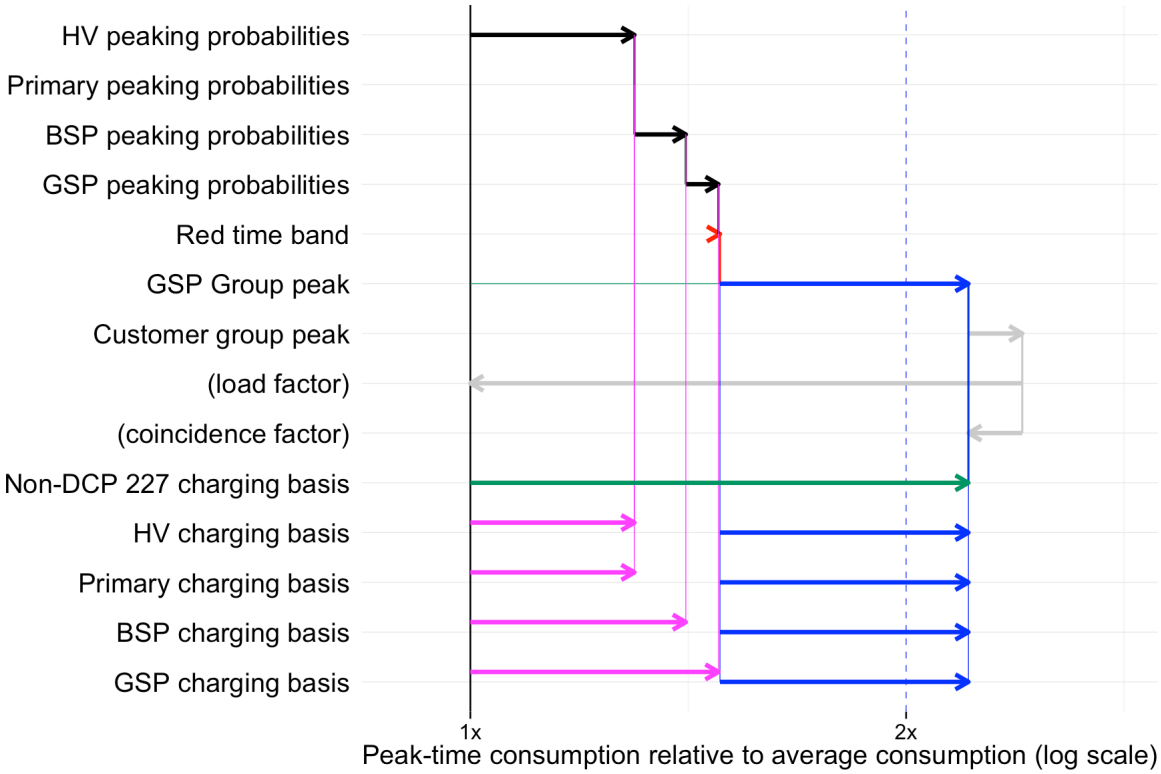
Figure 35 Time band analysis of consumption (WPD South Wales, Small Non Domestic Unrestricted)



62. The overall pattern of figure 35 is normal. What is unusual is that the ratio of average consumption in red to average consumption overall is lower than 1.0. This might be related to the fact that the red time band is relatively late in the day (5 pm to 7:30 pm).

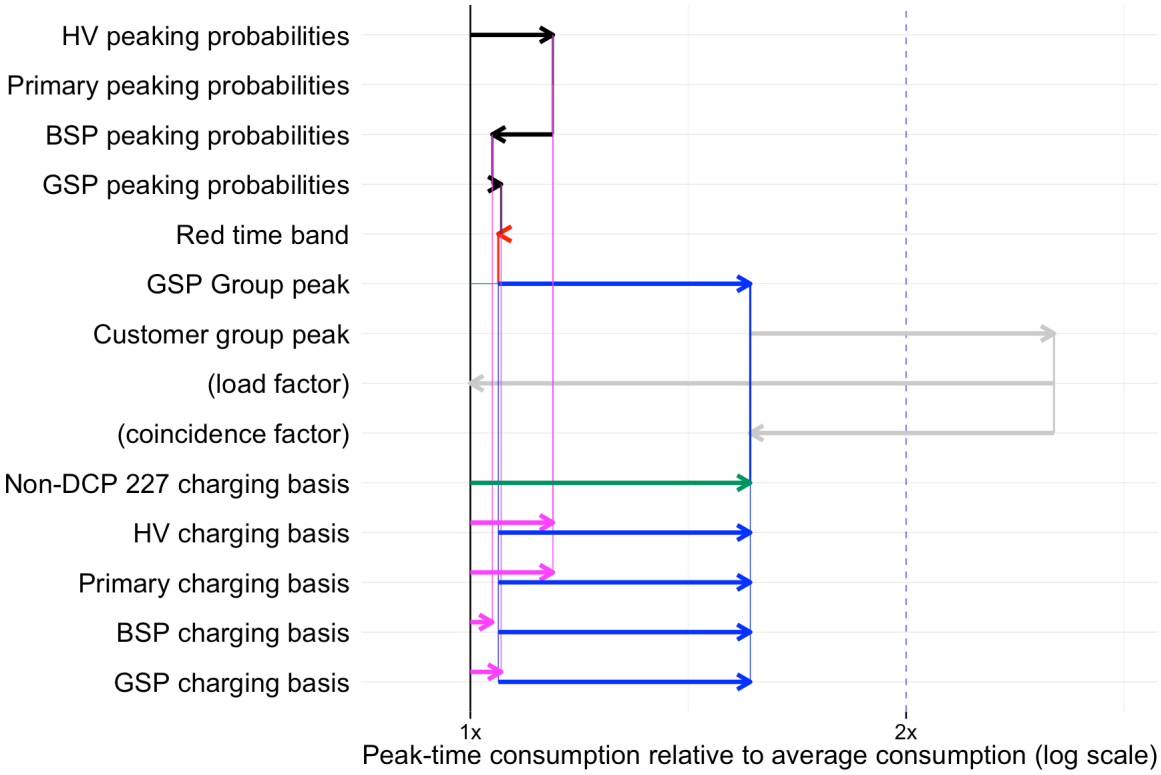
63. The only significance of this feature for DCP 227 is that the effect of DCP 227 is particularly marked, because the ratio of average amber consumption to average red consumption, at 1.427, is relatively large for a Small Non Domestic Unrestricted tariff (only SEPD's is higher, at 1.448).

Figure 36 Load coefficients for CDCM charging (WPD South West, Domestic Unrestricted)



64. This is similar to the situation described in detail for SEPD Domestic Unrestricted.

Figure 37 Load coefficients for CDCM charging (WPD South West, Small Non Domestic Unrestricted)

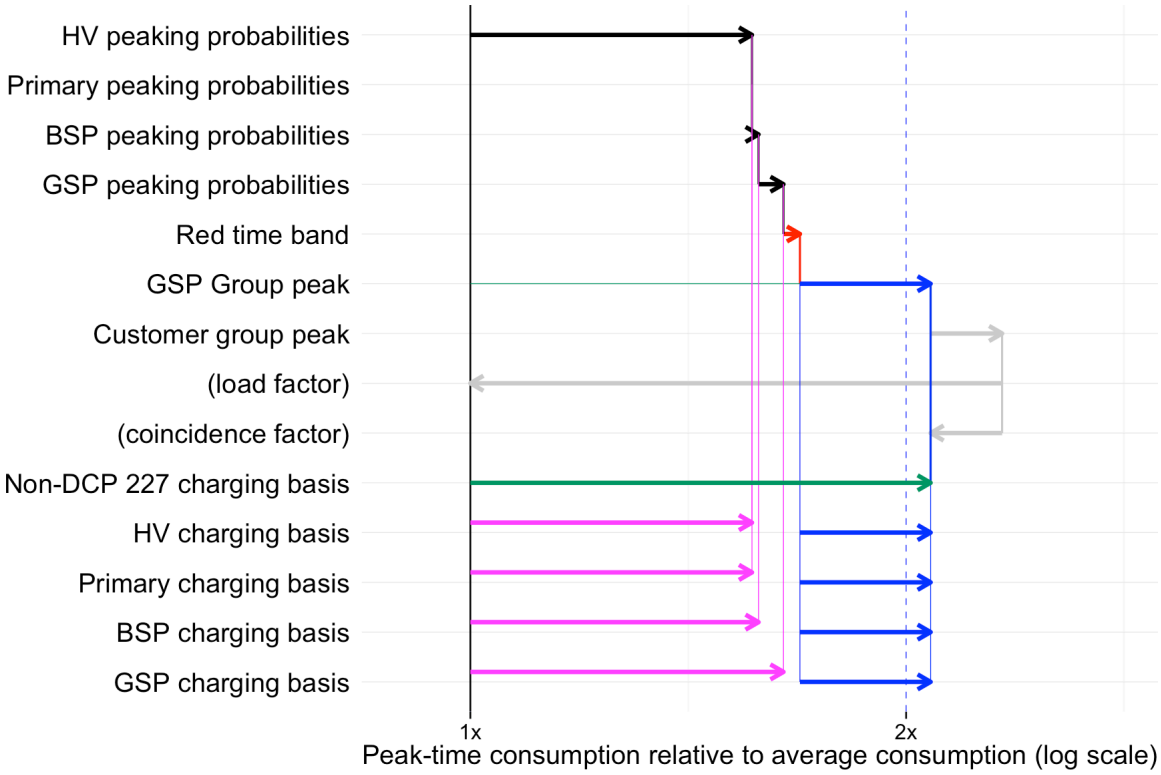


65. In respect of the HV and primary network levels, this is essentially similar to the situation described in detail for SEPD Small Non Domestic Unrestricted.

66. In respect of the BSP network level, the effect of DCP 227 is in the opposite direction. This is probably due to the fact that the BSP peaking probability is higher in green (9 per cent) than in amber (6 per cent). This might reflect the prevalence of night-time electric heating in parts in the network.

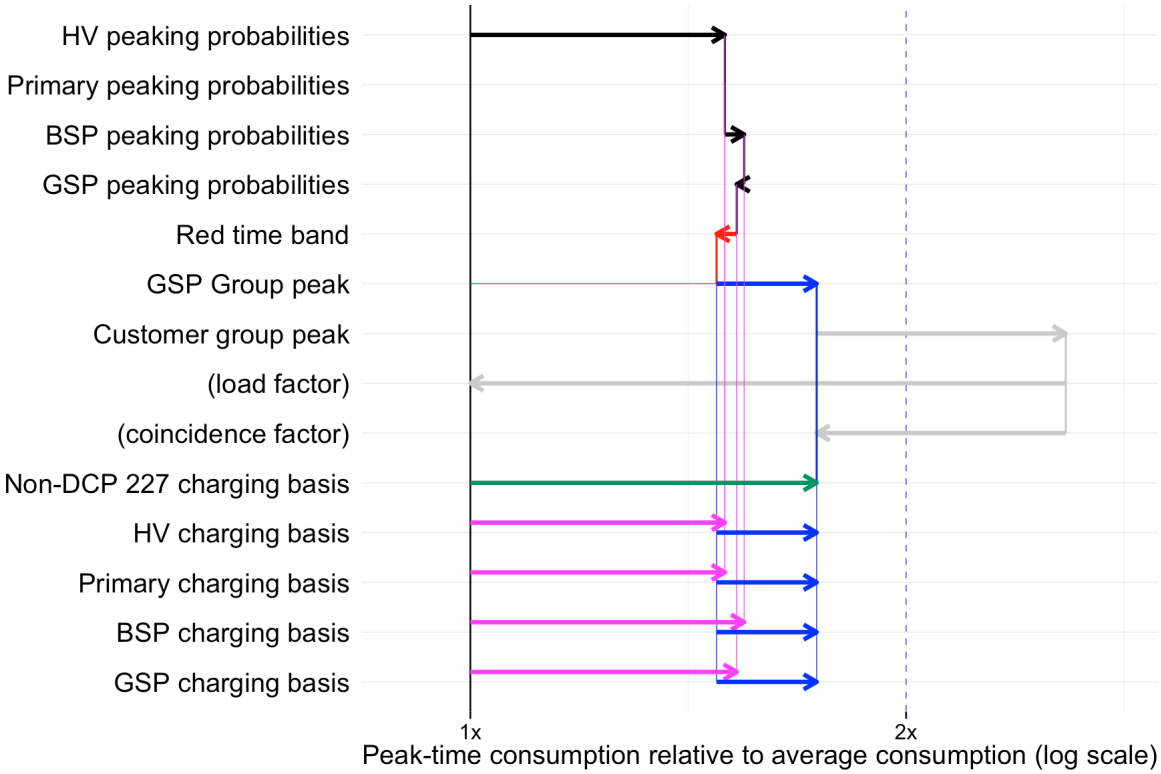
67. In respect of the GSP network level, the effect of DCP 227 is small. This reflects the fact that 99 per cent of the GSP peaking probability is in red.

Figure 38 Load coefficients for CDCM charging (WPD West Midlands, Domestic Unrestricted)



68. This is similar to the situation described in detail for SEPD Domestic Unrestricted.

Figure 39 Load coefficients for CDCM charging (WPD West Midlands, Small Non Domestic Unrestricted)



69. This is essentially similar to the situation described in detail for SEPD Small Non Domestic Unrestricted. The load coefficient for the primary network level is lower than for the BSP network level because the amber peaking probability for primaries (19 per cent) is lower than the amber peaking probability for BSPs (23 per cent).