Worked Example of P109

This section provides a worked example of the scheme outlined in the previous section. In this example, we describe how the P109 risk mitigation scheme would apply in a particular case, ie, a single generator located in the northern half of England.

Such a generator currently incurs transmission losses at the same rate as all other generators, ie, 45% of the average rate. The average rate of transmission losses is currently running around 2%, so that generators normally incur losses of about 0.9% of their metered output. For this example, we assume that the average loss factor (ALF) is 1%. At present, the BSC implements this scheme by setting to zero the variables known as Transmission Loss Factors (TLFs).

According to work carried out for P72 and P85, a zonal allocation of transmission losses would reset the TLF for a northern generator to a new value between roughly 2% and 5% of metered output. (TLFs for generators and consumers in other locations would have different values.) For this example, we assume that the generator faces a new TLF of 3%.

P109 offers a way to mitigate the risk of this change, by invoking a fixed volume adjustment when the new method of allocating losses comes into operation.

Triggering P109 and Setting F-Factors

The risk mitigation scheme described in P109 would remain dormant until a modification set different TLFs for different locations. At that "trigger date", any existing BMU would be assigned an "F-Factor" representing its MWh amount of risk mitigation.[1] The definition of an existing BMU need not concern us here, but would require careful specification of a threshold date (which might be earlier than the trigger date).

The formula for a delivery F-Factor (F^D) looks at the generator's output in the twelve months prior to the trigger date. For each month, the formula calculates the generator's average metered output in each of the 48 settlement periods that make up a day.

Suppose the generator concerned has a capacity of 800 MW, giving maximum production in a half-hour settlement period of 400 MWh. The following table shows the BMU's MWh F-Factors associated with "delivery" (ie, production) for each period for *one* of the four "BSC Seasons"(ie, quarters), say the season from January to March. (The Modification Group decided to adopt quarters in preference to months, to smooth out the impact of scheduled outages that might migrate from between months in successive years.) This F-Factor associated with delivery, "F-Factor plus", indicated by F^D below[2].

[1] The following procedure applies for any BMU with CVA metering systems. For BMUs with SVA metering, the calculation is applied at the level of the GSP Group and shared in proportion to output or offtake.
[2] Note that the draft legal text refers to F^+ and F^-, as opposed to F^d and F^o.

Period	F-Factor	Period	F-Factor	Period	F-Factor	Period	F-Factor
1	153	13	377	25	353	37	115
2	199	14	397	26	338	38	68
3	192	15	380	27	301	39	173
4	174	16	365	28	306	40	168
5	199	17	370	29	355	41	52
6	159	18	384	30	371	42	67
7	176	19	358	31	359	43	37
8	199	20	382	32	393	44	146
10	186	22	350	34	349	46	58
11	194	23	377	35	393	47	49
12	188	24	374	36	323	48	93

A similar calculation would be carried out to determine the F-Factor applicable to offtake by the same BMU, indicated below by F^O. For a baseload generator, offtake would normally be zero, but the meter might record a negative quantity (ie, an offtake) during occasional outages. This negative metered quantity would count towards the average offtake in that particular settlement period, giving a (small) negative F-Factor for the BMU's offtake as well. For example, in period 22 (say), the meter might record 0 on 60 days in the quarter and offtake of -30 MW on 30 days in the quarter. The resulting "F-Factor minus" for offtake (F^O) would be the time-weighted average of -10 MW.

Allocation of Losses

To show how losses are allocated to the generator, we consider only one settlement period, ie, a period 22 on a day in the March. For that period, the BMU's delivery F-Factor (F^D) is 350 MWh (See table above.) and the BMU's offtake F-Factor (F^O) for the same period is –10 MWh. Assume also that the following parameters hold:

1. Average transmission losses = 2.22%
2. Generators' share at 45% = ALF^D = 1%
3. Consumers' share at 55% = ALF^O = 1.22%
4. Location-specific TLF (for this generator) = 3%
5. Actual metered output in this period = 380 MWh (=> Offtake = 0)

The first step in allocating losses to the generator is to multiply its metered output by its TLF:

*(1) Location-specific losses = Metered Output * TLF = 380 MWh * 3% = 11.4 MWh*

The next step is to calculate a surcharge (or rebate) associated with the delivery Factor, to ensure that the generator pays for a fixed volume of losses at the prior rate (ALF):

*(2) F-Factor plus Surcharge/Rebate = Delivery F-Factor * (ALF^D-TLF)*

*= 350 MWh * (1%-3%)*

= ***minus*** *7.0 MWh.*

An equivalent surcharge/rebate applies to the offtake F-Factor:

*(3) F-Factor minus Surcharge/Rebate = Offtake F-Factor * (ALF^O-TLF)*

*= -10 MWh * (1.22%-3%)*

*= **plus** 0.2 MWh*

At this stage, the generator's liability for losses is item (1) plus item (2) plus item (3), ie, 11.4 MWh – 7.0 MWh + 0.2 MWh = 4.6 MWh. This formula is equivalent to allocating losses at the ALF for the F-Factors and at the TLF for additional output above the F-Factor plus (and the shortfall in offtake below F-Factor minus):

$=(F^D * ALF^D) + [(\text{Metered Output} - F^D) * TLF]$

$+ (F^O * ALF^O) + [\text{Metered Offtake} – F^O) * TLF]$

= (350*1%) + (380-350)*3%

+ (-10*1.22%) + (0-(-10)*3%)

= 3.5 + 0.9 – 0.1 + 0.3 = 4.6 MWh

The sum of all losses allocated in this way may add up to more or less than total actual transmission losses. Suppose that total generation in this period is 20,000 MWh. Transmission losses (at 2.22%) are 444 MWh, of which generators are liable in total for 45% = 200 MWh. If items (1) and (2) allocate only 180 MWh in total to generators, there remain 20 MWh to be recovered. The term $TLMO^+$ is intended to perform this reconciliation, by spreading the shortfall (or over-recovery) over all generation at a flat rate[3]. (Variable $TLMO^-$ performs a similar role for offtake.) In this case, each delivered MWh is allocated an additional 0.001 MWh (=20/20,000), giving our case study generator a further allocation of losses as follows:

*(4) Metered output * shortfall/(total generation)*	*= 380 * 20/20,000 MWh*
	= 0.38 MWh
	= 0.4 MWh (to 1 decimal place).

Total losses allocated to the generator are the sum of items (1), (2), (3) and (4):

(1) Location-specific losses	11.4 MWh
(2) F-Factor plus surcharge/(rebate)	-7.0 MWh
(3) F-Factor minus surchase/(rebate)	0.2 MWh
(4) Allocated shortfall/(over-recovery)	0.4 MWh
Total	**5.0 MWh**

Diagrammatic Explanation

The following diagrams may help readers to understand how the formulae work for items (1) and (2). (Item (3) works similarly on the demand side and item (4) represents an additional allocation in proportion to metered output.)

In the top diagram, metered output exceeds the F-Factor. Item (1) is the product of Metered Output and the TLF, ie the rectangle consisting of three blocks: A (white), B (shaded) and C (cross-hatched). Item (2), the F-Factor rebate, is the product of the F-Factor and the *difference* between the TLF and the ALF, ie block B. Hence, the generator's remaining allocation of losses is:

[3] 'Tranmission Loss Adjustment' (i.e. $TLMO^{+/-}$) terms are used to ensure that the overall allocation of transmission losses is such that 45% is allocated to generation and 55% to demand. These terms already exist within the Code, and P109 would not alter their function.

block A = F-Factor volume at ALF

plus block C = output *above* F-Factor at TLF.

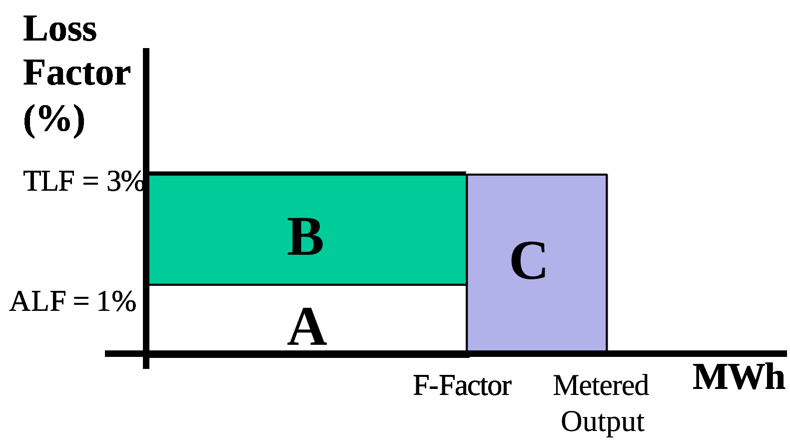
In the bottom diagram, metered output is less than the F-Factor. The F-Factor rebate is exactly the same as before, ie, blocks W and X, which add up to shaded block B. However, metered output incurs losses at the TLF for the smaller blocks marked W and Y. The generator's allocation of losses is therefore the difference between these two areas. One way to view this difference is as:

blocks Y and Z = block A = F-Factor volume at ALF

less blocks X and Z = block C = output *below* F-Factor at TLF.

For clarity, block A is marked in dots, whilst the shortfall in output equivalent to block C is ringed in dashes. Note that *in both cases* the allocation of losses at ALF for F-Factors is block A (ie, it is independent of output), whilst any variation in output results in a further variation in allocated losses at the rate of TLF.

Metered Output > F-Factor



Metered Output < F-Factor